External imbalances from a GVAR perspective*

Mariam Camarero†[1], Josep Lluís Carrion-i-Silvestre[2] and Cecilio Tamarit[3]

[1]Department of Economics, University Jaume I and INTECO
[2]Department of Econometrics, Statistics and Spanish Economy, University of Barcelona
[3]Department of Applied Economics II, University of Valencia and INTECO

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Abstract

In this paper we study the drivers governing external disequilibria through a Global VAR (GVAR) analysis applied to a group of 24 countries during the period 1972-2017. The GVAR methodology is particularly well suited for our research question. First, it permits to measure the effects of both, domestic and foreign country-specific shocks. Second, it allows to analyze not only the long-run relationships, but also the dynamics through generalized impulse-response functions. Third, it enables to test many hypotheses from a macroeconomic perspective and the existence of spillovers. Our results show evidence of international financial integration in terms of the fulfillment of the real interest rate parity. Concerning the Twin Deficit hypothesis, we find no linkages between domestic current account and fiscal deficit. In addition, we show how German fiscal policy has relevant spillover effects on other European countries (such as France, Spain and the Netherlands) as well as on the US and India. Finally, the global shocks have long-lasting effects in most of the countries analyzed, especially through the real oil prices. These results provide some clues about how to implement a more symmetrical external adjustment, especially inside the euro area.

Keywords: Current account, net foreign assets, twin deficit, panel data, Global VAR.

JEL codes: F32, F41, C23

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†Corresponding author: camarero@uji.es

1 Introduction

There is a longstanding debate both on theoretical and empirical grounds about the causes and consequences of external imbalances. This debate has gained new momentum after the Great Recession (GR). During the pre-crisis period the very loose external financing conditions fed the divergences in the current account flows of surplus and deficit countries also contributing to asset price bubbles and credit booms in a number of debtor countries. The GR meant a dramatic reassessment of external credit risk, a tightening of the financing conditions and a sudden stop in capital flows that led to an important correction in flow imbalances. However, these corrections in flow terms have not been big enough to change the accumulated imbalances in stock terms, that is, the Net Foreign Asset (NFA) position. Although the current account (that is, the flow) has adjusted around the world after the crisis, many of the countries that experienced imbalances still accumulate important external debt stocks (either as creditors or debtors). This entails financial stability risks not only for borrowers in deficit countries but also for savers in surplus countries. There is an increasing number of studies made by policy institutions (IMF, 2014) and academics (Catão and Milesi-Ferretti, 2014) stressing the destabilizing importance of these external imbalances and their consequences for a proper design of macroprudential policies. Indeed, increasing external imbalances in stock terms may leave debtor economies more exposed to market sentiments, rising its fragility and building up a possible thread to future financial stability that is worth to monitor. Having a proper understanding of countries' external positions both in current accounts and stock terms, is critical to highlight policymakers' shared responsibility to tackle external imbalances before they become too risky.

The gist of our investigation is to assess the relative importance of the role played in the above-mentioned external disequilibria by financial and real factors. Depending on the period considered – Bretton-Woods system (60's), (dirty) floating system (70's up to mid-80's), and the "saving glut"/"saving drought" phenomena (90's) – the emphasis on the different type of variables has varied over time. In order to assess the relative importance of the various factors driving global external imbalances we need more conclusive empirical evidence. This debate has recently gained even more interest for those countries inside a monetary union, where nominal exchange rate adjustments are no longer possible. The 2008 crisis reflected a deep divide between the external surpluses of the North and external deficits of the South.[1]

At present, the Eurosystem generates real resource transfers, in the form of subsidized credit, from the creditor to the debtor countries. But this arrangement does not seem stable. Country-specific macroeconomic imbalances which before the crisis were underestimated by policy-makers and financial markets alike have now come to light as destabilizing factors. Only very recently academics and policy makers have expressed the need to reinforce a system of explicit surveillance for these macro imbalances where the external ones are especially relevant – see Camarero et al. (2013) and European Commission (2009). There was a lack of surveillance of competitiveness and macroeconomic imbalances (trade, international investment, labour cost, private and public debt, house prices and unemployment). Only from 2011, the EU introduced a new framework for the timely correction of macroeconomic imbalances. The 2011 reforms of the

[1] See Barnes et al. (2010), Mayer (2011) and Sinn and Wollmershäuser (2012) for different approaches to explain this crisis.

Stability and Growth Pact referred to as the "six-pack" together with the European Semester, the Fiscal Compact and, some months later, the "two pack" entered into force, that established a comprehensive surveillance framework and a system to secure correction of excessive deficits and macroeconomic imbalances.

In this paper we seek to assess the relative importance of the determinants of the current account for a group of countries that include the Euro area to obtain clear economic policy orientation about external adjustment strategies. We use the global vector autoregressive (GVAR) methodology proposed by Pesaran et al. (2004), further estimated for the Euro area by Dees et al. (2007) and recently updated by Smith and Galesi (2014). The analysis makes use of an econometric framework in which current account balances are linked to their main macroeconomic national fundamentals and, separately, to external shocks, namely, competitiveness and oil price shocks. We specify a vector autoregressive (VAR) model that is aimed at analyzing multiple channels of transmission, including trade and financial linkages. At the same time we try to ascertain cross-country linkages at a world regional level together with the effects of global shocks. To model such complex interactions, high dimensional systems are needed, which can be quickly affected by the so-called *curse of dimensionality*, that is, the existence of too many variables for too few observations, which renders robust empirical estimation unfeasible. In the spirit of the GVAR, the individual specific domestic variables are related to *foreign variables*, which are assumed to be weakly exogenous to reduce the number of parameters for estimation. The result is a model which includes a parsimonious, yet comprehensive, set of linked macroeconomic and financial variables. This study builds on standard empirical models on the determinants of the current account (Lane and Milesi-Ferretti, 2012) and augments these models by considering the role of fiscal deficits for the period 1972-2017.

The remainder of the paper is organized as follows. Section 2 discusses the theoretical framework that guides our empirical investigation. Next, Section 3 displays a revision of the previous empirical literature, emphasizing the main issues related to the relationship between increasing economic integration and the external imbalances. Section 4 presents the econometric methodology, while section 5 reports the results, and finally, Section 6 includes the summary of the main finding and the conclusions.

2 Theoretical approach: a holistic view

During the 90's the increasing and persistent external disequilibria between the US economy and oil exporting and emerging countries, (mainly China) produced two competing explanatory theories (Chinn, 2017): The first one, commonly known as the "saving glut", represents the hegemonic view in the US political arena and has been supported by Bernanke (2005), Clarida (2005) and Hubbard (2006). According to them the US external imbalance is a problem made abroad, driven by the recycling of rising saving in some surplus countries with less developed financial systems unable to efficiently allocate its increasing resources.

In contrast to the former hypothesis, other scholars think that the relative importance of the "savings glut" is residual and that the leading force to explain the US external imbalance is based on internal macroeconomic disequilibria between demand and output, with an especial

emphasis in the public deficit (Chinn and Ito, 2007). However, they also point to the importance of equity and housing market booms since the end of the 1990s as crucial factors to explain industrial countries' current account.

A similar debate exists in the Eurozone concerning the role of surplus-deficit countries in the external imbalances adjustment after the GR. Again, there are two approaches to explain this crisis that are not mutually exclusive. The first one is that the surplus countries, namely Germany, mainly blame peripheral countries for an excessive indebtedness process since the beginning of European Monetary Union (EMU). In their opinion, the Southern countries in the Eurozone have been fiscally irresponsible, and the imbalances are the result of excessive public expenditure (twin deficits) and private consumption (Sinn and Wollmershäuser, 2012), while others think that the excess of saving in the North countries of the Euro area facilitated a misallocation of capital due to weaknesses in financial regulation and expectations that turned out to be too optimistic (Barnes et al., 2010). Note that this debate over the "external"/"internal" origin of the disequilibria lays mainly in financial variables. A second view posited by Mayer (2011), among others, holds that below the surface of the euro area's public debt and banking crisis lies a balance-of-payments crisis caused by a misalignment of internal real exchange rates. At the core of the problem lies an issue of balance of payments adjustment within a monetary union. Said otherwise, because peripheral euro area countries have fixed exchange rates with core countries, the needed real exchange rate adjustments could not occur through nominal exchange rate appreciation, but took place instead through faster domestic price inflation in the periphery than in the core. Furthermore, as prices rose faster in peripheral than in core countries, their real interest rates fell relative to those in the rest of the euro area, encouraging still more borrowing.

Against this backdrop and according to Mann (2002) we can single out up to four representations of the current account:

$$CA_t \equiv S_t - I_t \tag{1}$$

$$CA_t \equiv GDP_t - AB_t \tag{2}$$

$$CA_t \equiv (NFA_t - NFA_{t-1}) \tag{3}$$

$$CA_t \equiv NX_t, \tag{4}$$

where CA_t is the current account (assuming that net foreign income and unilateral transfers are zero) and S_t, I_t and AB_t stand for savings, investment and absorption, respectively; $NFA_t = A_t - L_t$ is the net foreign asset position (with A_t being assets and L_t liabilities) and NX_t is the trade balance. Thus, the above expressions are accounting identities linking the current account and the accumulation of foreign assets, the trade balance, savings, investment, income and absorption. Following Mann (2002), these identities represent, in fact, three perspectives on the current account balance interpreted in terms of the potential adjustment channels when hit by a shock. Identities (1) and (2) correspond to the domestic perspective, based on national income and production. The international perspective, based on flows and stocks of financial assets, is represented by (3), whereas identity (4) refers to the adjustment channel based on trade of goods and services. Although simple identities, they make evident the multiples sources

of linkages among all the macroeconomic variables involved.

The theoretical foundations for the current account determination is a central topic in open macroeconomics. In this Section we start with a general setting based on *the intertemporal approach to the current account* that represents the current workhorse proposed by Obstfeld and Rogoff (1996). If agents are not constrained by borrowing restrictions, and if they have rational expectations, then they should smooth consumption, which implies borrowing and saving accordingly. This framework has been extended more recently by Gourinchas and Rey (2014) proposing a more general approach that does not merely concentrate on the current account, but in the world global imbalances to which they refer as a basis for the analysis, distinguishing between a trade and an asset channel for external adjustment. The existence of these different channels is what makes the empirical analysis very challenging, as the current account is related to many macro-magnitudes. The next subsections disentangle the main approaches involved.

2.1 Domestic perspective

In a closed economy, the current account (the difference between savings and investment) is zero. In open economies, firms, households and even the government, can borrow and lend internationally. In small open economies, the domestic interest rate is exogenously determined as it has to be equal to the world interest rate. In this framework, the current account is a function of the interest rate. However, a highly indebted country may face a country risk premium and may eventually have difficulties to obtain further financing from the rest of the world. An easy way to represent this situation (for net debtors) is that the country risk premium is an increasing function of the stock of foreign debt. This type of situation normally affected developing countries but since the GR it has hit more seriously developed countries and, in particular, these euro area countries.[2]. In this context, it is of particular interest to derive another identity from (1) and (2) that serves to postulate the *"twin deficits"* hypothesis:

$$S_t^{pr} + (-NX)_t = I_t + (G_t - T_t), \tag{5}$$

where S_t^{pr} stands for private savings (households savings plus firms profits), G_t is public expenditure and T_t taxes. Provided that private savings and investment are not affected by an expansionary fiscal policy, it would deteriorate the trade account by a similar magnitude. The most widespread point of view among analysts and scholars is that high public deficits produce greater external deficits. However, the possible relationship between the two deficits is not commonly accepted, either theoretically or empirically. This controversy is known in the macroeconomic literature as the problem of the twin deficits. The emergence and persistence of unprecedented public deficits and external deficits in the US economy generated an increase in theoretical and empirical literature that addresses the analysis of the joint evolution over time of both deficits. From a theoretical point of view, there are two schools that analyze in different ways the possible relationship between public and external deficits. On the one hand, the standard approach of the Mundell-Fleming model suggests that, in an economy with a given

[2]According to De Grauwe (2012) these countries have become more "fragile" as they have lost their capacity to issue debt in a currency over which they have full control

level of taxes, an increase in the government deficit derived from an increase in public spending raises the national disposable income. The relationship between both deficits comes from two ways. First of all, the increase in disposable income increases consumption, which causes a deterioration in the current account deficit, *ceteris paribus*, due to increased consumption of imported goods. Second, the growth of the public deficit can provoke an increase in the real interest rate that, *ceteris paribus*, will attract new external capital flows, with the consequent appreciation of the real exchange rate and a loss of competitiveness, which will ultimately lead to the deterioration of the current account deficit. If so, a direct economic policy implication of this model would be that, for a given level of public spending, taxes should increase with the aim of rebalancing the budget, which ends up reducing private sector spending and external imbalance.

However, if the *Ricardian Equivalence* (RE) holds, decreases in lump-sum taxes do not affect the current account as private agents modify their decisions to adjust to the fiscal policy change. The RE defenders, Barro (1974), Aschauer (1985) and Frenkel et al. (1996) among others, argue that a substitution of government debt for tax increases, without changes in the level of public spending, should not affect the current account balance. The reason for the breakup of the relationship between the two deficits is found in the effects that economic agents' expectations have on future taxes. Thus, agents increase their savings now because they expect higher taxes in the future, offsetting the growth of public sector debt. Therefore, the impact of the public deficit on private sector spending would be nil and would not affect the current account balance either. This model maintains, in short, that the simple alteration of the way of financing public spending (taxes, public debt, seigniorage) does not affect private consumption. In short, provided public expenditure is kept unaltered, a tax increase such as that proposed by the Mundell-Fleming model to reduce the public deficit cannot be used as an economic policy measure to reduce the imbalance in the foreign sector. It would be more appropriate to reinforce the adjustment by reducing current levels of public spending. All in all, RE may fail, for example, if there are credit constraints so that the households and firms cannot borrow and smooth their consumption or investment decisions. Therefore, another relevant variable to account for in the determination of the current account and the existence fulfillment of the twin deficit is capital mobility, as we can see below in Subsection 2.3.[3]

2.2 International perspective: trade channel

Exports and imports of goods and services are the most important components of the current account. This perspective would concentrate in the forces that drive export and import flows, and how foreign and national growth and relative prices affect the current account. The most common measure of relative prices is the real exchange rate (RER). This last variable is especially relevant in our case, as the countries in the euro area have a common currency since 1999 but their competitive position has not moved in the same direction for all of them. Therefore, this variable is crucial to understand the deterioration of the current account in some peripheral countries.

[3]Note, however, that in our particular study a majority of the countries analyzed have complete liberalization of capital movements.

In a complementary way, the theoretical underpinnings in this trade channel analyse the determinants of the RER. If we assume that the purchasing power parity (PPP) holds for the tradable goods, one of the main determinants of the RER is the productivity differential in the non-traded goods sector of the domestic and foreign country (Balassa-Samuelson model). Changes in relative productivity are equivalent to changes in the relative prices, as this is the slope of the production possibility frontier of each country. Fast-growing developing countries may experience a deterioration in their current account as the real exchange rate appreciates as a result of insufficient improvements in non-tradables productivity.

An additional effect to the real exchange rate, causing an appreciation and, therefore, deteriorating its competitive position, is the so-called *"Dutch disease"*.[4] This hypothesis postulates that when countries exploit their natural resources and reallocate their production factors, the currency appreciates and deteriorates the competitive position of other economic sectors, mainly manufacturing, but also agriculture in some cases. A similar effect has been attributed to immigrant remittances in credit constraint countries as in Cerra et al. (2009) and Ball et al. (2017). More importantly, according to Lartey (2011), increasing the degree of financial openness may cause Dutch disease effects, as capital inflows appreciate the exchange rate. Finally, Copeland (1991) stressed that tourism could also lead to de-industrialization.

2.3 International perspective: assets channel

This perspective focuses on the role that differences in rates of return have affecting the financial flows as well as the value of the currency. This would influence the allocation of wealth in different portfolios, either in the domestic or in foreign financial markets. There is an evident relationship between this approach and the previous discussion concerning the existence of the Feldstein-Horioka puzzle and possible home bias effects even in the current high level of international financial integration.

Capital mobility can be assessed using two types of formulations. From identity (1), if capital mobility is high, the correlation between domestic savings and investment should be close to zero. However, Feldstein and Horioka (1980) found the opposite result: a high correlation between the two magnitudes. Since then this is known as the *Feldstein-Horioka puzzle*. One of the explanations given to the puzzle is the existence of a "home bias" towards domestic assets, as argued by Coeurdacier and Rey (2013). Alternatively, a more direct measure of capital mobility is to look at interest rate differentials or parities. In particular, the real interest rate differential is considered a good indicator, as it can be decomposed into a country premium, an exchange rate premium and the expected real exchange rate depreciation.

However, although the surge in financial integration has been welfare increasing, it has also raised the level of international associated risk – see Rajan (2006). Different authors outline several assets whose variability has contributed to the recent financial turmoils and external imbalances. The relationship between the evolution of house prices and the current account is not new in the literature. In their survey, Gourinchas and Rey (2014) mention the existence of a stylized fact that, for many countries, turns out to be associated with the evolution of the real

[4]The idea was originally coined by The Economist in 1977 related to the discovery of natural gas fields in the Netherlands.

estate market: a joint increase in current account imbalances and persistently low world real interest rates. Additionally, they also relate global imbalances with financial fragility and agents' responses to low real interest rates.[5] Although, in general, the literature considers housing demand part of consumption, more recent analysis has outlined the role played by housing. An example is Ferrero (2012), who proposes a two-country model with tradable consumption goods and housing where the main argument is that the relaxation of borrowing constrains provokes a negative correlation between house prices and the current account.

3 Empirical literature

The increase and persistence of the external imbalances from the beginning of the 90s together with the upsurge of the intertemporal approach to the current account led to a new wave of empirical studies trying to explain the determinants of the current account in a context of growing geographical dispersion. As mentioned in Barnes et al. (2010), this issue is of relevance for many developed as well as developing countries, but has gained recent importance after the creation of the EMU. Therefore, the scale of the current account imbalances and the accumulated net foreign asset and liability positions in some euro area countries has raised questions about whether such large and unprecedented imbalances can be justified by the fundamentals, and also about their sustainability (Camarero et al., 2013, 2015).

In what follows we present a revision of the empirical literature in three stages. First, we give a more general overview of the empirical literature, stressing the main variables involved depending on various theoretical approaches; second, we focus on the research related to the study of the twin deficit hypothesis; finally, we present the main studies on external imbalances using the GVAR methodology.

3.1 Determinants of the current account used in the empirical literature

The scale of imbalances in both euro area and other OECD economies cannot be fully explained by historical unaltered relationships. The unexplained component of current account balances for the most recent period (i.ex. from 80s) is noticeably larger than for earlier decades. One explanation could be stronger financial market integration. The global credit cycle may have distorted some of the fundamental factors treated as exogenous in the analysis, such as growth differentials and real interest rates. Chinn and Prasad (2003) in a seminal paper estimate a model for a group of countries including a large set of explanatory variables. Later, Chinn and Ito (2007) extended the previous analysis to include the assessment of the role played by financial integration to explain global disequilibria. They relate current account balances to a number of explanatory variables to account for private saving and investment behavior, including demographic variables, per capita income, trade openness, as well as variability of terms of trade shocks and GDP growth. In addition, the budget balance entered in as a key macroeconomic policy variable. Additional explanatory variables included net foreign assets,

[5] In the US, the evolution of the mortgage market and the access to credit to new segments of the population are behind the subprime crisis and the origin of the financial crisis. Bernanke (2005) postulated the "global saving glut" hypothesis relating house prices and current account deficits.

and capital controls. Other authors, as Dooley et al. (2003), interpreted the US current account deficit as the outcome of concerted mercantilist efforts by East Asian state actors. This view has been criticized, among others, in Prasad and Wei (2005) and an alternative interpretation for the large scale reserve accumulation has been attributed to precautionary demand in the wake of the East Asian crises and after, during the 2000s – see Aizenman and Marion (2003) and Aizenman and Lee (2007). In the same vein, the initial NFA position had a large impact on imbalances over the period 2002 to 2007 (*saving glut hypothesis*) that meant huge financial flows as previously occurred during the 1970s led by the oil shocks.[6] In parallel, Chinn and Ito (2007) find more evidence against several of the key assertions underlying the global saving glut hypothesis. Moreover, Alfaro et al. (2008) and Gruber and Kamin (2007) also find that better quality of government institutions and regulatory environment tends to attract capital inflows – i.e., worsen current account balances.

Quantitative analyses of oil and commodity price fluctuations mostly rely on reduced-form statistical models, such as VAR – see, e.g., Kilian et al. (2009), ECB (2010) and Caldara et al. (2019) – or on semi-structural models – e.g., Dieppe et al. (2018). Using structural dynamic stochastic general equilibrium (DSGE) open economy models, recent research papers are also analyzing the role of commodity prices – see Forni et al. (2015) and Giovannini et al. (2019). Due to the limitations of the above methods, to investigate in detail the adjustment process the IMF (2006) uses two separate but consistent VAR models. The first of these, the already mentioned standard VAR, investigates the link between real oil prices and external positions – measured using both current accounts and net foreign assets – while the second one, a GVAR, looks in more detail at the link between oil prices, growth, inflation, and asset prices, to shed more light on how the adjustment takes place.

Bayoumi et al. (2013) and Gagnon et al. (2017) have stressed currency manipulation, defined as excessive foreign exchange intervention, is the root cause of a large share of global imbalances. In a variation on the theme, Caballero et al. (2008) modeled the saving glut explanation as a shortage of safe assets. The safe asset hypothesis is closely allied with the "exorbitant privilege"argument posited by Gourinchas and Rey (2007).[7] Finally, other factors also have an identifiable role in determining the current account, even if they are not deep economic fundamentals.

As for the euro area, Blanchard and Giavazzi (2002) and Abiad et al. (2007) find evidence of financial integration leading to current account deterioration. Moreover, increasing financial integration has eased constraints on international saving and borrowing and led to a widening in the dispersion of current account positions Faruqee and Lee (2009). In principle, monetary union would have been expected to reinforce the role of fundamentals for euro area countries and this has been borne out by experience (European Commission, 2009). The analysis suggests that

[6] Those shocks triggered a sharp rise in the trade balances of oil exporters, and a trade balance deterioration of the groups of advanced and (especially) non-fuel developing countries (Obstfeld and Rogoff, 1995). An important difference between the global macroeconomic environment of the 2000s and that of the 1970s, is that the 2000s saw massive growth in Emerging Markets, which suggests that the commodity price hikes of the 2000s might have been driven more by expanding demand for commodities, and less by adverse commodity supply shocks (OPEC) as it happened with the oil price hikes of the 1970s.

[7] The exorbitant privilege of being able to finance budgets cheaply is a reflection of the ability to manufacture public safe assets.

demographic factors played some role in most cases, and income and growth differentials also had an impact on the current account, reflecting the flow of capital to low-income high-growth countries, but these effects were relatively small. According to Barnes et al. (2010) fundamental factors do appear to explain a substantial part of the current account imbalances for the euro area in recent years. They use time-averaged panel econometric techniques and their results are broadly in line with earlier studies of the international evidence on this subject. At the same time, other authors have underlined the important role played by other less deep economic factors such as nominal rigidities, the fiscal policy stance and the trend level of unemployment (Cheung et al., 2013). In particular, the budget deficits in Greece and Portugal made significant contributions to their weak external positions and the strong housing investment, associated with unsustainable property booms, account for large contributions to the current account deficits of Ireland and Spain. This link deserves further attention.

3.2 The twin deficit hypothesis

There is a large number of studies investigating the *twin deficit hypothesis* on the link between fiscal and external balances. The standard rationale for the twin deficit hypothesis is that a government fiscal deficit occurs together with a current account deficit through demand, interest rate and real exchange rate effects. This channel only operates if full Ricardian equivalence does not hold such that a rise in government dissaving is not completely offset by additional private sector saving. From a theoretical perspective, fiscal expansion leads to exchange rate appreciation, which could worsen current account deficits, and ultimately, this could lead to slower economic growth. Most studies so far have assumed the relationship between fiscal and external balances to be homogeneous across countries. This hypothesis is worth to test in the context of a monetary union.

For European countries, and especially countries with large internal and external imbalances (among which Greece, Ireland, Italy, Portugal, and Spain), evidence of twin deficits is mixed: on the one hand, the hypothesis is rejected in Algieri (2013), whereas Papadogonas and Stournaras (2006) provide support for the Ricardian equivalence hypothesis (REH) for EU-15 member states. Precisely, they conclude that improvement in government balance has a positive effect on the current account balance, but the effect is rather small. Changes in government balances are strongly associated with opposite changes in the private sector savings' investment gap on the other hand; this hypothesis is confirmed for Greece, Portugal and Spain in Trachanas and Katrakilidis (2013) who take into account non-linearities (the finding shows that fiscal deficit deceases have a greater impact on the current account deficit as opposed to that of budget increases), and in Litsios and Pilbeam (2017) who use a cointegration analysis. A bootstrap panel Granger causality is applied by Xie and Chen (2014) who find support for a Keynesian (twin deficit) hypothesis for Switzerland and Norway, with bi-directional causality for Belgium, Finland, Greece and Iceland. More recently, Badinger et al. (2017) tested for the effect of fiscal rules on the relationship between the budget balance and the current account balance. Moreover, the *current account targeting* hypothesis presents a competing theory of the nexus between the external deficit and the public deficit. It asserts that there is unidirectional causality from the current account to the budget deficit. The latter evidence is characterized by a link in the

opposite direction of the one predicted by the twin deficit hypothesis.[8]

Atoyan et al. (2013) find that fiscal consolidation was one of the elements that explained the post-crisis external adjustment in Southern European debtor economies, in line with Moral-Benito and Viani (2017) for the Spanish case. Cheung et al. (2013) conclude that a large share of the current account adjustment after the 2008 crisis was due to cyclical factors. Ollivaud and Schwellnus (2013) run panel current account regressions allowing for area-specific coefficients. According to their results, the business and housing cycles account for around a half of the decline in external imbalances in Eurozone debtor countries between 2008 and 2012. Tressel and Wang (2014) find that both cyclical and structural factors contributed to the adjustment of Southern European countries.

Results from such estimates are often interpreted as "fundamentals" (Decressin and Stavrev, 2009) and used to derive "norms" on current account balances (Jaumotte and Sodsriwiboon, 2010). However, the reduced form model is inherently only an approximation to the true model. It is particularly difficult to interpret causality within this framework. According to Barnes et al. (2010), in an econometric sense there is no presumption that the right-hand side variables are independent of each other or the error term. In parallel, and in an economic sense, almost all variables are likely to be interconnected and the outcome of underlying shocks and interactions that drive the macroeconomic developments.

Bearing all these considerations in mind, a promising novel empirical approach adopted in recent literature is based on the GVAR methodology. It allows us to focus on the interactions between the different transmission channels discussed above in a flexible setting. Moreover, by including domestic, foreign and global variables in the system, it is possible to test for the existence of spillovers and analyze how policy shocks are transmitted internationally. The next Subsection revise some recent studies.

3.3 GVAR-based studies

In order to avoid some of the problems present in earlier empirical literature, the GVAR econometric approach is based on cointegration, which allows to find robust results of the fundamentals underlying the relationships between the variables used as well as robust estimation of the coefficients in the equations. As the linkages among economies become increasingly complex, it is imperative to account for global interactions among macroeconomic factors. Under this scheme, Pesaran et al. (2004) developed a framework for the analysis of global interdependencies and the propagation of shocks among the economies of the world. The GVAR methodology establishes a connection of domestic variables with the outside economy via the corresponding constructed country-specific foreign variables based on the trade pattern of the country under consideration. Thus, this context provides a nimble way to overcome the *curse of dimensionality*. Given the considerable ability of this approach to quantify international interactions, empirical application for the GVAR model appear in many fields like, i.e., global financial spillovers (Pesaran et al., 2004), international transmission of macroeconomic shocks

[8]Using a Bayesian approach Maltritz (2012) points out the importance of the trade balance in explaining the yield spreads in the EMU and Barrios et al. (2009) illustrate the role of current account imbalances in the euro area sovereign debt market between 2005 and 2009, and find that their impact on spreads, like for fiscal factors, has been quite limited, if compared to impact of liquidity effects and global risk aversion.

and global business cycles (Dees et al., 2007), global inflation linkages (Galesi and Lombardi, 2009) and common fiscal policies in the EU (Ricci-Risquete and Ramajo-Hernández, 2015). Concerning external imbalances, Chisiridis (2017), Bettendorf (2017) and Bussière et al. (2012) apply a GVAR approach. The latter, as proposed by Chudik et al. (2011), includes a set of four domestic variables and one global variable (oil price) for 21 economies. The results from Generalized Impulse Response Functions (GIRFs) indicate the importance of a positive shock in the output of US and Germany on the rest of the world and, especially, in the second case, on the European countries.

Our analysis is closely related to Bussière et al. (2012), but differs in an important way. In our paper we present fresh evidence on the long-term determinants of the current account overcoming some of the econometric flaws found in previous empirical analysis as well as including the increasing importance of the financial integration for the adjustment of the current account. Although the intertemporal approach to the current account Obstfeld and Rogoff (1996) provides the underlying theoretical framework for this study, the precise implications of this formulation are sensitive to its assumptions and there is no consensus about the correct model specification (MacDonald and Ricci, 2007). Moreover, no single theoretical model captures the entire range of empirical relationships affecting the savings-investment decisions, and hence the current account balances (Calderon et al., 2002). For this reason, we have adopted a GVAR approach in a context where the interaction between domestic and foreign variables has a predominant role, whereas some variables may capture common shocks to the system. In the next Section we present the GVAR methodology and the inclusion of real long-term rates, fiscal balances, and NFA positions as well as two global shocks, (namely, oil prices and real exchange rates) which allows us to be more specific about the effects of shocks.

4 GVAR model specification and data set

This section briefly summarizes GVAR methodology.[9] The GVAR model is a multi-country framework which explicitly allows for interdependencies among countries and markets, with a modeling strategy that consists of two steps. In the first step, each country is modeled separately in a single-country VAR model augmented with exogenous variables (VARX). In each VARX, the endogenous variables are domestic only $x_{i,t}$, while country-specific foreign variables $x^*_{i,t}$, constructed as averages of all other countriesâ variables, serve as a proxy for common unobserved factors. In this way each country is affected by its domestic developments and by the rest of the world. Each country model is estimated separately, conditional on the foreign variables, in error correction form. In the second step, the country-specific VARXs are stacked together and linked using a matrix of cross country linkages W, building in this way the global model.

Step 1 Let us denote by $x_{i,t}$ a k_i-vector of variables for the i-th unit of the panel data set and by $x_t = (x'_{1,t}, x'_{2,t}, ..., x'_{N,t})'$ a k-vector of all the variables in the panel, where $k = \sum_{i=1}^{N} k_i$, $i = 1, 2, ..., N$, $t = 1, 2, ..., T$. The GVAR includes small-scale country-specific conditional

[9] A more detailed overview can be found in Pesaran et al. (2004), Dees et al. (2007) and Chudik and Pesaran (2016).

models that can be estimated separately. These models explain the domestic variables of country $x_{i,t}$ conditional on the (country-specific) cross-section averages of foreign variables, included in the k^*-vector

$$x^*_{i,t} = \tilde{W}'_i x_t,$$

$i = 1, 2, ..., N$, where $\tilde{W}'_i$ is a $(k \times k^*)$-matrix of country-specific weights that is defined using data on bilateral foreign trade – see Pesaran et al. (2004) for further details. The model for $x_{i,t}$ is denoted as a VARX*, that is, a VAR model augmented by the foreign variables $x^*_{i,t}$ and their lagged values – for ease of presentation, we do not include a deterministic component, although it is possible to specify it:

$$x_{i,t} = \sum_{l=1}^{p_i} \Phi_{i,l} x_{i,t-l} + \Lambda_{i,0} x^*_{i,t} + \sum_{l=1}^{q_i} \Lambda_{i,l} x^*_{i,t-l} + \varepsilon_{i,t}, \tag{6}$$

where $\Phi_{i,l}$, $l = 1, 2, ..., p_i$, and $\Lambda_{i,l}$, $l = 0, 1, 2, ..., q_i$, are matrices of unknown parameters, and $\varepsilon_{i,t}$ are k_i-vectors of errors – the p_i and q_i lag orders can be selected using information criteria. Star variables in country-specific models in (6) can be treated, under some conditions, as weakly exogeneous in order to estimate the unknown coefficients of the conditional country models. Note that the individual country-models can be written in vector error correction form (VECM*) as:

$$\Delta x_{i,t} = \Lambda_{i,0} \Delta x^*_{i,t} - \Pi_i z_{i,t-1} + \sum_{l=1}^{p} H_{i,l} \Delta z_{i,t-l} + \varepsilon_{i,t},$$

where $z_{i,t} = (x'_{i,t}, x^{*'}_{i,t})'$ is a $(k_i + k^*)$-vector of domestic and country-specific foreign variables. As shown by Pesaran et al. (2004), the assumption of weak exogeneity can be tested and is typically not rejected when the country under consideration is small relative to the world.

Country-specific models allow for cointegration both among domestic and between domestic and foreign variables. Assuming $z_{i,t}$ is an integrated process of order one – i.e., $z_{i,t} \sim I(1)$ – the rank of Π_i, denoted as $r_i = rank(\Pi_i) \leqslant k_i$, specifies the number of cointegration relationships among the domestic and country-specific foreign variables. Π_i can be written as:

$$\Pi_i = \alpha_i \beta'_i, \tag{7}$$

where α_i is a $(k_i \times r_i)$ full column rank loading matrix and β_i is the full column rank matrix of cointegrating vectors.

Step 2 Once the country-models have been specified, the second step of the GVAR methodology consists of stacking these models to form a large global VAR model. This is achieved using the "link" matrix $W_i = (E'_i, \tilde{W}'_i)$, where E'_i is a $(k \times k_i)$-matrix that selects $x_{i,t}$ from x_t – i.e., $x_{i,t} = E'_i x_t$ – and $\tilde{W}'_i$ is the weight matrix to define country-specific foreign star variables:

$$z_{i,t} = (x'_{i,t}, x^{*\prime}_{i,t})' = W_i x_t.$$

Staking the models for all units $i = 1, 2, ..., N$, we obtain:

$$G_0 x_t = \sum_{l=1}^{p} G_l x_{t-l} + \varepsilon_t. \tag{8}$$

If matrix G_0 is invertible, by multiplying (8) by G_0^{-1} we can obtain the solution to the GVAR model:

$$x_t = \sum_{l=1}^{p} F_l x_{t-l} + G_0^{-1} \varepsilon_t,$$

where $F_l = G_0^{-1} G_l$, $l = 1, 2, ..., p$. Finally, it should be mentioned that it is possible to add additional common factors (ω_t), such as oil prices, in the model specification. In this case, the conditional country-specific vector of cross-section averages of the foreign variables has to be augmented by ω_t and its lagged values, such as:

$$x_{i,t} = \sum_{l=1}^{p_i} \Phi_{i,l} x_{i,t-l} + \Lambda_{i,0} x_{i,t}^* + \sum_{l=1}^{q_i} \Lambda_{i,l} x_{i,t-l}^* + D_{i,0} \omega_t + \sum_{l=1}^{s_i} D_{i,l} \omega_{t-l} + \varepsilon_{i,t}, \tag{9}$$

and the analysis proceeds as described above.

Using this framework and based on the theoretical and empirical contributions discussed in previous Sections, we apply the GVAR analysis to the study of macroeconomic imbalances. The variables that are considered in our analysis are the CA over GDP ratio ($cay_{i,t} = CA_{i,t}/Y_{i,t}$), the NFA over GDP ratio ($nfay_{i,t} = NFA_{i,t}/Y_{i,t}$), the fiscal deficit over GDP ratio ($fdy_{i,t} = FD_{i,t}/Y_{i,t}$), the real long run interest rate ($rir_{i,t}$) – as country-specific variables, which defines $x_{i,t} = (ca_{i,t}, nfa_{i,t}, fd_{i,t}, rir_{i,t})'$ – and the real price oil ($rpoil_t$) and the real exchange rate (rer_t) as global variables – which defines $\omega_t = (rpoil_t, rer_t)'$. Our database, in contrast to most of the applications using this methodology, is annual and, therefore, spans from 1972 until 2017. The sources and definitions can be found in Appendix A. The graphs including the figures for the current account and the rest of the variables for all the countries in the sample are included in Figures 1 and 2.

Before reporting the results of the paper, it can be useful to summarize the main transmission channels through which the shocks can affect the current account. We consider national shocks from the current account and primary budget and global shocks (only from the US) of the real exchange rate and oil prices. We follow Gourinchas and Rey (2014) and disentangle between the trade and the financial channels. Both channels have been reviewed in Subsections 2.2 and 2.3. The economic literature can help to predict the role that should be played by the rest of variables on the current account determination. The potential fulfilment of the "twin deficit" hypothesis justifies the inclusion of $fdy_{i,t}$ in the system. If this hypothesis is fulfilled, a positive sign should be expected. The first channel operates through trade, in particular through the so-called expenditure boosting effect (absorption). For instance, following a fiscal expansion that increases US output, US demand for imports increases as well, depending to some extent on the marginal propensity to import, both of the public and of the private sectors. Output in foreign countries can thus rise through higher export demand. This direct channel can be reinforced via third-party effects, i.e., through the aforementioned mechanism working in all the

foreign countries experiencing a boost in output. The second channel is represented by the real exchange rate. The US fiscal expansion is expected to increase domestic interest rates and to appreciate the US dollar. The real exchange rate (rer_t) characterizes the competitive position of the countries, dominated by the two main currencies, dollar and euro. The long-run real interest rate ($rir_{i,t}$) captures the country-risk perception of the markets. The relationship between the $cay_{i,t}$ and the $nfay_{i,t}$ position is that of the flow (the former) and the stock (the latter). Gourinchas and Rey (2007) put the two variables in the center of the international financial adjustment of the countries, capturing the interaction between the goods and the financial markets channels. The sign corresponding to $nfay_{i,t}$ is ambiguous, as highly indebted countries may improve their CA to reduce the imbalance, but also high external debt may discourage the entry of financial flows and affect the stock of net foreign assets (Lane and Milesi-Ferretti, 2012). Finally, the real oil price ($rpoil_t$) is the main source of external common shocks, and can be treated as a common factor in the system. For the majority of the countries, that are not oil producers, the expected sign is negative, as an increase in the oil price would worsen the current account. In contrast, for oil producers, the expected sign is positive. Overall, the magnitude of the spillovers is an empirical question. The relative importance of the aforementioned channels depends on the strength of trade and financial linkages among the source and recipient countries, and to a smaller extent, among recipient countries themselves.

Our analysis uses the information of the following twenty-four economies: Australia, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Greece, India, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States. As can be seen, we attempt to fully benefit from a large cross sectional selection along with an adequate time horizon – it should be mentioned that we have excluded from our analysis countries that their data series are unavailable, unreliable or have a short time span. The combination of different data sources have allowed us to define an annual data base that cover the period 1972-2017.[10] The main variables are defined as a percentage of GDP. This allow us to model euro area members separately and avoid the problems derived from the common monetary policy. This is an important point as we are also interested in analysing the external adjustment mechanism across EMU members. Provided the trending pattern shown by some of the variables involved in the model, we have decided to specify a (restricted) linear time trend for the deterministic component of the VECM* model. As for the lag orders of the VARX* model, we have used the Akaike's information criterion (AIC) with up to three lags for p_i, and two for q_i and s_i. In Table 1 we summarize the role of the variables, that is different for the US and the rest of the countries. Although the suitable choice of weights for the foreign variables under the GVAR scheme is a subject open to discussion, bilateral trade is one of the most important determinants of the linkages among countries. Moreover, Pesaran et al. (2004) point that trade weights show the extent that one country is linked to another. Consequently, time-varying bilateral trade computed for each year of the time period is used to obtain the foreign variables that appear in each of the country systems – note that this adds a high degree of heterogeneity in our analysis since in most contributions a fixed or, in the best cases, a short-time period of trade weights are used. In the next section we discuss the main

[10]Further details concerning the sources for the variables used in the paper are given in Appendix A.

findings obtained with the application of the GVAR methodology using the *Matlab Toolbox V 2.0* developed by Smith and Galesi (2014).

5 Empirical results

Following the recommendations of Mauro and Pesaran (2013) in their GVAR Handbook, we have specified a GVAR model using the group of variables and countries described in Section 4. Our focus is the analysis of international external imbalances with a special emphasis in the euro-area countries. The international data that we have assembled is only available in annual observations. Therefore, although the time-span is substantial (1972-2017), this type of analysis, even if partially solves the "curse of dimensionality" (see Belke and Osowski (2019)), has been mostly done using quarterly observations. Using the *Matlab* programme created by Smith and Galesi (2014), we have estimated several alternative specifications, including as many variables as possible but being aware of the limitations of this analysis in terms of lags and stability of the system.[11]

Prior to the estimation of the system, we have analyzed the time-series properties of the individual variables.[12] The overall conclusion for domestic, foreign and global variables is that they are non-stationary. Moreover, concerning the crucial assumption of weak exogeneity in the foreign variables, we have found that all are exogenous with a few exceptions.[13] Therefore, we conclude that the relevant univariate assumptions are fulfilled.

The VAR models have been specified with a restriced trend included in the long-run or cointegration relationship to account for the deterministic trends contained in some of the variables, but not shared by all of them. Concerning the number of lags in the VAR, we have estimated two specifications: the first one allowing for up to 2 lags for domestic and foreign variables and the second one, with domestic and foreign variables included in the VAR allowing for up to three and one lags, respectively. We have compared the two specifications using AIC for the individual countries and selected the best for each of them and re-estimated the global VAR. As a result, the individual country VARs contained between one and four cointegration vectors including country-specific, foreign and global variables. None of the individual country models has zero rank – i.e., at least one cointegration relationship has been estimated. These models have been stacked using the link matrices and we have obtained a stable solution to the GVAR model.

In order to normalize and partially identify the cointegration vectors obtained in the individual country-systems, we have ordered the variables according to the underlying theory. Thus, in the first vector we normalize the domestic current account ($cay_{i,t}$); in the second, the NFA position ($nfay_{i,t}$); long-run real interest rate ($rir_{i,t}$) is the variable chosen to normalize when there are three cointegration relationships, for those cases where there are four vectors, we normalize the fiscal surplus (or deficit) as a percentage of GDP ($fdy_{i,t}$). Later, in the impulse-response analysis, we will analyze the shocks coming from innovations in the current account

[11] Due to these limitations, we have only considered domestic net foreign assets, that are already net variables (assets minus liabilities), so that we have excluded the foreign NFA from the model specification.

[12] These results are not reported here but are available upon request.

[13] The current account for Austria, Germany and Greece; the real interest rate differential in the case of Germany, the fiscal balance in India and the real oil price for Finland.

and the fiscal surplus for all countries in the sample. In addition, we will assess the effects on the system variables from shocks originated from the two global variables, the real dollar-euro exchange rate (rer_t) and the real oil price ($rpoil_t$).

5.1 Cointegration results

We present in Table 3 the cointegration relationships obtained for both, eurozone and non-eurozone countries. We have marked in bold the significant coefficients, with the exception of the trend and the normalized coefficients. Concerning the EMU members, most of the countries in the group have two cointegration vectors (Belgium, France, Ireland, Italy, and Spain). Austria and Finland have three and the rest (Germany, Greece, the Netherlands and Portugal) only one. The estimated parameters are, in general, significant and of reasonable size. There are some exceptions, most of them concentrated in the second or third cointegration vectors, when the normalized variable was $cay_{i,t}$. Due to our focus on the current account, our discussion will concentrate in the first cointegration vector. Regarding the fulfillment of the *twin deficits hypothesis*, in the first vector (with the exception of the cases with three cointegration vectors), the sign of the fiscal deficit parameter is positive[14] for all the countries that have a significant coefficient, with the only exception of Italy, the Netherlands and Sweden. In the case of Spain, Portugal or the US, for example, the parameter is not significant.[15] A second remark is related to the long-run real interest rates. Not only in the first cointegration vector, but also in the rest, the parameters of the domestic and the foreign variables ($rir_{i,t}$ and $rirs_{i,t}$) are statistical significant, of similar magnitude and opposite sign.[16] This can be interpreted as evidence of the fulfillment of the *long-run real interest rate parity*, that would imply international financial integration, at least among the group of countries in the sample and the relevance of the financial channel of the current account.[17] Concerning the global variables, the parameter of the real oil price $rpoil_t$ is statistical significant for the majority of the countries, sometimes in all the cointegration vectors and with negative sign (an increase in real oil prices worsens the current account). The exceptions is the one oil producer, the Netherlands, with a positive sign, the UK and the US. Similarly, the dollar-euro real exchange rate, rer_t, is a relevant variable for most of the countries, sometimes in both vectors, with the exception of France and Italy. The expected effect of rer_t is more ambiguous, as the appreciation of the dollar (an increase in the variable) may improve the trade balance but, as oil is paid in dollars, it would also increase the price of imports. The sign (when it is significant in the first vector) is negative with the exception of Greece.

The results for the non-euro countries, as presented in the lower half of Table 3, are quite similar to the euro-area findings. The US and Mexico have two cointegration vectors and the rest have one cointegration relationship. Also in this case the evidence favours the fulfillment of the **twin deficits** hypothesis (meaning a positive and significant parameter) for Australia, Canada, New Zealand, Switzerland and Korea. The domestic fiscal deficit is also significant

[14] Note that the estimation results are presented in vectors, so that the sign for $fdy_{i,t}$ in the table is negative.

[15] The GIRFs will provide more information about the effects of shocks between these two variables.

[16] We have tested this hypothesis separately using Eviews for each individual country system, and for the majority of them, it was not rejected.

[17] The same is true for non-EMU countries.

in the cases of Switzerland and Sweden, but had a negative sign. The second relevant finding common to this group of countries is the potential verification of the long-run real interest parity. As in the EMU countries, the results point as well to the fulfillment of the parity. The parameters of the global variables are also significant in most of the cointegration vectors in this group. Looking at the current account equation ($CV1$ in Table 3), real oil prices have a significant negative effect on Denmark, Switzerland, the US (only in the first vector), India and Korea (second vector). However, the sign is positive for the UK, New Zealand, the US (second and third vectors) Brazil and Mexico (second vector). As expected, the sign is positive as well for the UK: as an oil producer, its current account tends to improve when the real price of oil increases. We will come back to this issue in the impulse-response analysis. Regarding the real exchange rate and with our focus on the first vector, the parameter of this variable is significant and negative for just Sweden, as a real appreciation of the dollar/euro means a depreciation of the euro and loss of competitiveness for them. Thus, some of these signs should be interpreted as an improvement of the EU competitor's position and a deterioration of the current account. In other cases, the sign is positive, as an appreciation of the dollar improves the Canadian or the Australian current accounts, as well as the Korean and Brazilian ones.

We concluded that the exogeneity assumption of the foreign variables could not be rejected with a few exceptions. However, in a GVAR, the foreign variables should be exogenous but have contemporaneous effects on the domestic ones. This information is provided in Table 2. For all the countries in the sample, with the only exceptions of Austria and Brazil, at least one of the foreign variables affects its domestic counterparts. These interactions or spillovers among all the variables in the GVAR can be explored using the impulse-response functions.

5.2 Generalized Impulse Response Analysis

In our next step, we investigate the dynamic properties of our GVAR by means of Generalized Impulse Response Functions (GIRFs), as proposed in Koop et al. (1996) and further developed in Pesaran and Shin (1998). Compared to the Orthogonalized Impulse Response Functions of Sims (1980), the GIRFs have the advantage that they are invariant to the ordering of the variables and of the countries. The large number of variables and the existence of domestic, foreign and global covariates in the GVAR settings make it difficult to know a priori which should be the ordering. For this reason it is preferable to employ the GIRFs. Moreover, the GIRFs assess the effects of observable-specific rather than identified shock. It is important to bear this in mind when we draw conclusions from the results. The typical (and atheoretical) GVAR analysis is based on the investigation of the geographical transmission of country-specific or global shocks. This data-driven approach implies some limitations that tend to be neglected by practitioners or just, the general public. Although we have analyzed the shocks originating in all the countries in the system, we have selected some representative and large economies that are the most likely to have spillover effects over the whole group of countries. These are Germany, France, Spain, the UK and the US.[18]

In Figure 3 we present the GIRFs of the effects of a German positive current account shock (an improvement in the current account deficit/surplus as a percentage of GDP) on the rest

[18]The results for the rest are available but have been omitted to save space.

of the variables of the system, including the bootstrap-obtained upper and lower bounds. We should emphasize that our variables have an annual frequency, and we do not expect the shocks to have significant effects after 4 to 8 periods. For that reason we present in the GIRFs only the effects for the first 10 years after the shock. In this particular case, the German current account shock has a positive effect on the current account of Belgium and Germany, whereas there is a deterioration of the UK, US and Brazilian current accounts. This behavior makes us relate the pattern of the response to the shock to the trade channel, as Germany is an important competitor for the countries that experience a negative effect, especially the UK and the US. The initial effect is positive in Belgium but it is compensated in the subsequent periods. The *cay* shock also has significant effects on the real interest rate (*rit*), not only in Germany, but also in Belgium, the Netherlands, Denmark and Sweden. In all of them the response is negative. The net foreign asset position of France and Germany, $nfay$ is also affected by this shock. As expected, the German external position clearly increases permanently, whereas the French one initially improves to be absorbed after some periods. Finally, there is a significant effect over the French fiscal deficit, so that the response would have a contractionary fiscal effect.

In Figure 4 we analyse the dynamics of the effect of a positive fiscal shock in Germany, that is, an increase in the fiscal surplus or a contractionary fiscal policy, on the rest of the system. No evidence of twin deficits is captured in the case of Germany, as there is no significant effect on the German current account. Instead, there is an initial improvement of the fiscal surplus of France (later offset), as well as in Germany, the US and India, all of them following a similar pattern. In the Netherlands, the NFA position deteriorates and the real interest rate increases in Spain after four periods.

Figure 5 includes the statistical significant effects of several GIRFs applied to the current account and fiscal surplus of France, Spain and the UK. In the case of France, the only significant response is to its own current account, where it has a permanent positive effect. In the case of Spain, an increase in the fiscal surplus has also a positive impact on itself that dies after two years. For the UK, the two shocks have positive effects on its own respective variables. In the case of the current account, the effect is permanent, whereas the fiscal positive shock is offset, as in Spain, after two years. Therefore, compared to Germany, the macroeconomic shocks to our two variables only have domestic effects and, therefore, there are no significant international spillovers. In contrast, the German shocks affect not only other European countries, but also third countries such as the US.

Finally, Figure 6 shows the four shocks originated in the US and the significant responses. The upper-left graph corresponds to the US current account shock, that has a positive and permanent effect on itself, whereas the effect is negative and also permanent on the net foreign asset position and the real price of oil. When the innovation originates in the fiscal surplus, it has spillovers on several countries: a positive effect on Spanish fiscal surplus, as well as in Canada and India. The Canadian NFA position also improves, at least initially, whereas the US current account deteriorates and latter the effect disappears. As the real exchange rate and the real oil price are exogenous to the other countries but endogenous for the US, the effects of the shocks are presented in the US analysis. A real exchange rate positive shock (appreciation of the dollar) decreases the Canadian real interest rate, worsens the US current account (up to

the third year) and tends to decrease the US real interest rate as well. In addition, this shock maintains the appreciation of the dollar for three additional years. Finally, the increase of the real price of oil deteriorates the NFA position of Portugal, Spain and Korea, with long-lasting effects, and worsens as well the Korean current account for at least two years.

These results, that should not be interpreted in terms of structural shocks, confirm, however, the stability and plausibility of the estimated GVAR, as there are only minor departures from the expected effects of the shocks and the cointegration vectors provide similar information about the long-run relationships in the system.

This analysis is also a complement to the cointegration relationships, as in the majority of the countries we found more than one cointegration vector and, without overidentifying restrictions it is difficult to interpret unless all the hypotheses are tested. For example, from the GIRF analysis the effect of an appreciation of the dollar clearly deteriorates the US current account. The next subsection will also provide additional information to assess the GVAR results.

5.3 Generalised Forecast Error Variance Decomposition

In this subsection we will analyze the results of the Generalized Forecast Error Variance Decomposition (GFEVD hereafter) in the context of our GVAR system. The advantage of this approach (in comparison with the Forecast Error Variance Decomposition or FEVD) is that, as the GIRF, it is invariant to the ordering of the variables in the system. The GFEVD is the proportion of the variance of the h-step forecast errors of each variable, explained by conditioning on contemporaneous and future values of the non-orthogonalized (or generalized) shocks of the system (see Bussière et al. (2012)). As Dees et al. (2007) show, given the general non-zero correlation between the errors, the individual shock contributions to the GFEVD need not sum to unity.

We have concentrated our GFEVD analysis of the current account on the same group of representative countries than above. Table 4 includes the cases of Germany and France, Table 5 those of Spain and the UK, whereas the US decomposition is shown in Table 6. We present the contemporaneous contribution and up to 8 years. In the case of Germany, and bearing in mind that the sum is over 200, the most important instantaneous contributor (46.66) is the German current account, as one would expect. In addition to that, the real interest rate of a large group of countries (Germany, France, the UK, the US and Sweden) contribute over 5 points instantaneously and maintain its relevance during several periods. We already observed that the real interest parity was fulfilled for the majority of the countries and the GFEVD shows the relevance of this variable in the system. The German NFA position as well as Spain's and Finland's are also among the larger contributors. In the case of German NFA the instantaneous effect is small, but it becomes larger from the first period onward and represents above 10 points. The same happens with the real price of oil and the real exchange rate, that are also relevant contributors but their effects are larger after some periods, especially the real oil price. In the case of France, in contrast to Germany, where the variables of 8 foreign countries are among the 15 largest contributors, the most relevant variables are the French ones. Not only the current account, but also the real interest rate, the NFA and the fiscal surplus are included. Second in importance along the 9 periods considered is the French real interest rate. In this case, a

larger percentage of the forecast error variance decomposition corresponds to the 15 largest contributors (from 56% instantaneous to 38% after 8 years). Third after the real interest rate is the contribution of oil prices, much larger than in Germany. Also in this case, real interest rates and NFA are the most relevant variables.

In the upper half of Table 5 the GFEVD of Spain shows the same pattern: the instantaneous most relevant contributor is the current account itself, but it decreases rapidly with time. Instead, the NFA position and the fiscal surplus gain importance after the first period. International real interest rates are also relevant but in a lower proportion than in the previous cases. Finally, the real price of oil represents almost 20 points out of 100 in the second year, an effect that diminishes but remains important during the 8 periods. In the lower half of Table 5 is the decomposition for the UK. British, German and North-American variables (both current account and interest rates) are important contributors. The real oil price or the real interest rate are much less relevant than for the other countries. In general, the domestic variables have more weight than in the other countries analyzed. Finally, in the case of the US (see Table 6) the 15 most important contributors are, first, the US variables. Three other countries (Germany, Canada and Japan) are also among the group, but their weight is relatively low, compared to the other countries analyzed.

As a conclusion, apart from each country's own current account, the exogenous variables are relevant contributors for the European countries, more oil dependent and open than the UK and the US. In general, real interest rates appear also among the most important variables, as well as the current account and the NFA of some of the neighbor countries. For those in the Eurozone (Germany, France and Spain) the number of foreign countries with relevant variables among the top 15 is larger.

6 Conclusions

The existence of increasingly large and persistent external imbalances raise the question, especially within EMU, of a prospective optimal adjustment strategy. The focus of this research is to assess the interactions between external and internal imbalances in the world economy. In this paper we have applied the GVAR methodology to study the determinants of the current account for the period 1972-2017 in a group of 24 OECD countries, 11 of them Eurozone members. The GVAR methodology presents many advantages over previous empirical approaches. First, it permits to study the countries individually but also assess the role of both domestic and foreign variables. Second, we can analyze not only the long-run relationships among the variables, but also the dynamics in the form of impulse-response functions. Third, we can test hypotheses relevant from a macroeconomic perspective, such as the twin-deficit hypothesis, the existence of spillovers between larger and the smaller economies and the role of common external shocks and their international transmission. Concerning the current account determinants, our results show that the fiscal deficit has a (significant) positive sign for the majority of the countries. This could be considered evidence in favor of the twin-deficit hypothesis. However, the dynamics do not show significant effects of the shocks from one variable to the other and the variance decomposition shows that the fiscal surplus is not among the most relevant con-

tributors to the current account variability. A second finding is the relevant role played by the real interest rate, both domestic and foreign, in the current account determination. This result, already evident in the cointegration vectors is confirmed in the variance decomposition analysis. A third important conclusion is that the current account deficit or surplus is mostly affected by its own shocks, showing an important degree of persistence. Fourth, German shocks (both on the current account and on the fiscal surplus) have effects not only within the euro area, but also on third countries such as the US. The analysis of the GFEVD reinforces the importance of the financial asset channel within the Eurozone, but also the role that Germany has on the US current account. Finally, the global shocks in terms of oil prices and competitiveness (the real exchange rates) are important determinants of the external balances of most of the countries analyzed.

All in all, it is important to keep in mind that these results are based on a non-structural model. To get a more thorough economic understanding of the linkages, structural identification of shocks will have to be performed but we leave this for future research.

From an economic policy point of view our results provide some clues about how to tackle imbalances for a prospective external adjustment. We show that core (Germany) and US origin shocks to domestic output exert a dominant influence in the rest of the European countries, while the strong linkage between trade flows within the Euro area is confirmed. According to our results, exchange rate flexibility may also play a role to facilitate external adjustment. However, the extent of integration into global value chains and trade invoicing in a dominant currency like the US dollar, can weaken some mechanisms of external adjustment and limit the benefits of exchange rate flexibility in the short term. As for the euro area, the adjustment that has taken place so far has been rather asymmetric, relying mainly on deficit countries: the latter have had to accept a sharp slowdown in prices, while prices in surplus countries have not increased enough. In this respect, it is important to enforce surveillance mechanisms to facilitate more symmetrical adjustments between surplus and deficit countries. More specifically, countries with excess current account surpluses, like Germany and Korea, should use fiscal space to boost public infrastructure investment and potential growth. Finally, carefully tailored and sequenced structural policies should play a more prominent role in tackling external imbalances.

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A Data sources

All the variables are available for the countries in the table and the period 1972-2017, unless specified:

- $cay_{i,t}$: current account surplus (+)/deficit (−) as a percentage of GDP. Source: updated version of the External Wealth of Nations database (Lane and Milesi-Ferretti, 2018).
- $nfay_{i,t}$: net foreign asset position as a percentage of GDP. Source: updated version of the External Wealth of Nations database (Lane and Milesi-Ferretti, 2018).
- $fdy_{i,t}$: public budget surplus (+) / deficit (−) as a percentage of GDP. Sources: AMECO for EU countries, Australia, Canada, Japan, New Zealand, Switzerland and the US; the World Bank for Korea; the World Bank and OECD statistics for Brazil, India and Mexico. The data is available from 1980 in the case of Brazil and from 1974 in the case of India.
- $rir_{i,t}$: 10-year-bond real interest rate. The main sources for long-term interest rates are AMECO and the IMF. In the case of Greece, the data has been interpolated between 1979-1981; for Spain, the data from 1972 until 1977 was obtained from the Ministry of Economics, MOISSES model; for Brazil, the data is only available from 1997 and has been obtained from the World Bank; for India, Korea and Mexico, the data was obtained from the World Bank and complemented using data from the IMF and from the Federal Reserve Bank of Saint Louis (FRED) database. Finally, in Mexico the data starts in 1978.
- $rpoil_t$: real oil price. Spot Crude Oil Price (West Texas Intermediate (WTI), Dollars per Barrel) deflated using US CPI. Source: Federal Reserve Bank of Saint Louis (FRED) database.
- rer_t: real exchange rate dollar-euro. Source: IMF and European Central Bank. The ECU exchange rate is used instead of the euro for the period 1972-1998. The aggregate prices are calculated for the ECU period using the weights of the participating countries in the ECU.
- Bilateral trade-flows: used to calculate the weights of the countries in the aggregation matrix. Source: Direction of Trade statistics, IMF.

B Tables

Table 1: Distribution of the variables. Endogenous and exogenous.

Variables	All countries excluding US		US	
	Endogenous	Foreign	Endogenous	Foreign
Current account ratio	cay_{it}	cay^*_{it}	cay_{USt}	cay^*_{USt}
Net Foreign Assets	$nfay_{it}$	–	$nfay_{USt}$	–
Long-run real interest rate	rir_{it}	rir^*_{it}	rir_{USt}	rir^*_{USt}
Fiscal deficit ratio	fdy_{it}	fdy^*_{it}	fdy_{USt}	fdy^*_{USt}
Real exchange rate dollar-euro	–	rer_t	rer_t	–
Real oil price	–	$rpoil_t$	$rpoil_t$	–

Table 2: Contemporaneous effects of the foreign variables on their domestic counterparts.

	cay	***rir***	***fdy***
Austria	0.428	0.906	0.388
	(0.298)	(0.151)	(0.212)
Belgium	**1.433**	**5.981**	**1.832**
	(3.383)	(4.254)	(4.504)
Finland	**2.307**	0.098	**1.226**
	(5.312)	(0.260)	(4.932)
France	0.359	**0.897**	**0.500**
	(1.111)	(6.467)	(6.733)
Germany	**-0.662**	**1.249**	**0.871**
	(-2.087)	(5.082)	(3.766)
Greece	**0.939**	-0.385	0.023
	(2.026)	(-0.680)	(0.065)
Ireland	**1.591**	**1.011**	**0.937**
	(4.484)	(3.477)	(1.994)
Italy	**1.018**	0.154	**0.266**
	(3.389)	(0.846)	(2.204)
Netherlands	**1.186**	**0.650**	**0.962**
	(3.286)	(4.875)	(5.256)
Portugal	**1.560**	-0.070	**0.825**
	(2.160)	(-0.338)	(3.115)
Spain	**1.102**	**0.599**	**0.798**
	(5.760)	(5.925)	(3.838)
Denmark	0.006	**0.592**	**0.576**
	(0.014)	(2.814)	(2.699)
Sweden	**1.101**	0.139	**0.672**
	(2.562)	(0.516)	(4.695)
UK	0.121	**0.568**	**0.752**
	(0.358)	(2.765)	(4.132)
Australia	-0.454	**1.372**	**0.579**
	(-1.733)	(7.530)	(2.496)
Canada	**-0.794**	**0.894**	**0.788**
	(-4.077)	(4.804)	(4.784)
Japan	0.186	**0.583**	0.678
	(0.753)	(3.415)	(1.395)
New Zealand	**2.874**	-0.307	**1.548**
	(4.002)	(-1.462)	(4.840)
Switzerland	0.351	0.431	0.045
	(0.451)	(1.547)	(0.483)
US	-0.368	**0.083**	**1.202**
	(-1.439)	(2.246)	(5.934)
Brazil	0.173	0.168	-0.233
	(0.289)	(0.179)	(-0.678)
India	-0.218	**8.654**	**0.688**
	(-0.635)	(2.683)	(5.237)
Korea	1.704	**0.855**	0.132
	(1.710)	(2.408)	(1.320)
Mexico	0.262	**3.799**	0.368
	(0.376)	(2.405)	(1.561)

Note: In bold significant coefficients; in parentheses Newey-West corrected t-ratio statistics.

Table 3: Cointegration vectors. All countries.

Eurozone Countries

	Austria		**Belgium**		**Finland**		**France**			**Germany**		***Greece***	
	CV1	CV2	CV1	CV2	CV1	CV2	CV1	CV2	CV3	CV1	CV2	CV1	CV2
Trend	0.10	-0.48	-0.008	0.56	-1.22	6.09	-0.61	-2.51	0.12	-0.06	1.75	0.65	-1.29
cay	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00
nfay	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00
rir	**2.00**	**-9.58**	-0.04	**-4.69**	0.48	**-7.67**	0.00	0.00	1.00	**-0.84**	2.33	-0.45	**6.27**
fdy	**-1.38**	**6.32**	**-0.36**	**-12.80**	**-3.63**	**4.09**	**-3.21**	**16.09**	**0.70**	**-2.72**	**-25.49**	**-1.15**	3.69
cays	**-0.97**	1.96	**0.91**	-3.98	**3.82**	**-52.78**	**4.23**	**21.36**	**-1.26**	**-2.13**	**-30.53**	-0.41	**20.98**
rirs	**-3.19**	**14.85**	**-0.35**	**6.72**	0.67	**5.89**	**0.66**	**2.47**	**-1.35**	0.39	**-7.83**	**-7.35**	**15.13**
fdys	**-0.88**	**3.67**	0.22	**14.53**	**7.35**	-3.89	**2.57**	**11.50**	**-0.33**	**1.51**	3.73	**-10.74**	39.02
rpoil	**-0.01**	0.004	**0.03**	**-0.51**	**0.12**	**-0.12**	**0.08**	**0.33**	0.008	**0.05**	**0.35**	**-0.37**	**1.70**
rer	**11.18**	**-91.11**	-0.52	**-52.69**	-3.12	**74.61**	5.03	26.39	1.58	**7.63**	**104.78**	**-3.98**	**60.03**

	Ireland		**Italy**			**Netherlands**	**Portugal**		**Spain**			
	CV1	CV2	CV1	CV2	CV3	CV1	CV1	CV2	CV1	CV2	CV3	CV4
Trend	-0.12	2.76	-0.29	-0.59	-0.15	-0.09	0.67	3.17	0.06	2.18	-0.17	0.19
cay	1.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	0.00	0.00
nfay	0.00	1.00	0.00	1.00	0.00	0.026	0.00	1.00	0.00	1.00	0.00	0.00
rir	**-2.77**	**25.78**	0.00	0.00	1.00	**1.47**	**-3.39**	**-4.34**	0.00	0.00	1.00	0.00
fdy	**-0.68**	0.23	**0.53**	**2.04**	**0.39**	**1.47**	-0.15	**5.99**	0.00	0.00	0.00	1.00
cays	**-9.95**	33.51	**2.47**	**10.30**	0.46	**-3.56**	**-5.17**	**-4.32**	-0.37	2.09	**2.01**	**-2.74**
rirs	**3.62**	**-40.41**	**2.11**	**7.43**	**-1.57**	-0.19	0.45	1.15	0.15	1.77	**-1.93**	**1.03**
fdys	**-1.95**	1.98	**2.43**	**8.46**	**-0.80**	**1.18**	**-0.93**	0.87	-0.03	**6.94**	-0.46	0.64
rpoil	**0.19**	-0.34	**0.18**	**0.62**	**-0.03**	**-0.03**	**-0.18**	**0.87**	0.02	**0.67**	**-0.05**	**0.05**
rer	1.68	**335.13**	9.07	17.20	1.27	**-6.65**	0.03	**87.83**	-2.40	7.74	**12.13**	-7.15

Non-eurozone countries

	Denmark		**Sweden**		**UK**		**Australia**		**Canada**	**Japan**		**New Zealand**		
	CV1	CV2	CV1	CV2	CV1	CV2	CV1	CV2	CV1	CV1	CV2	CV1	CV2	CV3
Trend	-0.01	-2.34	-0.83	1.38	**1.87**	**-14.07**	0.12	1.56	**-0.07**	-0.05	-1.22	0.17	0.10	-0.1959
cay	1.00	0.00	1.00	0.00	**1.00**	**0.00**	1.00	0.00	**1.00**	1.00	0.00	1.0000	0.00	0.00
nfay	0.00	1.00	0.00	1.00	**0.00**	**1.00**	0.00	1.00	**0.13**	0.00	1.00	0.00	1.00	0.00
rir	**-1.56**	**5.46**	**5.84**	**-13.02**	**-18.68**	**139.36**	**-0.75**	**-1.26**	**-1.22**	**0.98**	**5.50**	0.00	0.00	1.00
fdy	0.64	**7.04**	**1.82**	**-15.00**	-7.15	48.12	**-0.51**	**-2.59**	**-0.71**	-0.16	0.53	**-1.85**	**3.85**	**0.63**
cays	**-5.41**	**7.53**	**9.53**	**-27.04**	**-17.52**	**149.04**	**-1.64**	**-9.29**	**1.05**	**1.56**	-0.16	**-11.34**	-0.08	**4.30**
rirs	-0.50	**11.61**	**-6.36**	**22.53**	**19.69**	**-148.04**	**1.30**	**4.44**	**1.44**	**-0.73**	**-2.75**	**-1.96**	**6.13**	**-0.36**
fdys	-1.01	-0.36	**-2.44**	**17.62**	7.92	-54.51	0.32	1.11	**0.33**	0.14	0.75	0.35	**-4.74**	**-0.38**
rpoil	**0.07**	0.13	-0.03	0.23	**-0.89**	**6.46**	-0.01	**-0.16**	0.01	0.01	-0.12	**-0.23**	**0.17**	**0.13**
rer	-2.32	29.64	**15.14**	-25.48	37.53	-274.50	**-3.23**	**-20.28**	**-17.39**	3.26	10.36	2.62	-0.24	**8.86**

	Switzerland		**United States**				**Brazil**	**India**		**Korea**			**Mexico**	
	CV1	CV2	CV1	CV2	CV3	CV4	CV1	CV1	CV2	CV1	CV2	CV3	CV1	CV2
Trend	0.72	4.47	-0.07	2.01	0.26	-0.07	0.02	-0.02	0.50	-0.15	-1.15	0.23	0.08	0.67
cay	1.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00
nfay	0.00	1.00	0.00	1.00	0.00	0.00	**-1.07**	0.00	1.00	0.00	1.00	0.00	0.00	1.00
rir	**-5.80**	**-47.03**	0.00	0.00	1.00	0.00	**-0.15**	**-0.16**	**-0.22**	0.00	0.00	1.00	**0.90**	**-0.08**
fdy	**-11.70**	**-56.57**	0.00	0.00	0.00	1.00	-0.44	-0.24	**6.00**	**-2.55**	**11.26**	**-4.45**	**3.84**	**-1.65**
cays	**14.38**	**58.91**	-0.30	3.90	1.77	-0.11	0.50	**1.88**	**10.08**	**-6.05**	12.48	**-7.80**	-1.19	**3.86**
rirs	**11.09**	**53.73**	**0.68**	**-4.25**	**-1.32**	**0.44**	**-1.27**	**0.63**	**3.91**	0.01	1.70	**-0.94**	**-1.62**	**2.17**
fdys	**7.98**	**29.69**	**1.95**	**-10.18**	**-2.59**	0.45	-0.41	0.006	-0.50	-0.44	1.71	-0.08	-0.88	**0.92**
rpoil	**0.40**	**1.14**	**0.11**	**-0.58**	**-0.14**	**0.11**	**-0.12**	**0.02**	**-0.12**	-0.03	**0.53**	-0.07	-0.08	0.003
rer	-10.25	-44.57	**-22.03**	**194.54**	**-43.21**	**-15.65**	**-29.20**	**-3.80**	**-26.44**	-4.45	**40.98**	-4.90	15.26	**-10.19**

Note: Significant coefficients in bold.

Table 4: GFEVD of German and French current account

		Germany. Current account (%)								
		0	1	2	3	4	5	6	7	8
Germany	*cay*	46.66	34.00	29.87	25.41	21.16	19.51	18.81	18.70	18.61
Germany	*rir*	8.54	5.86	4.47	5.28	6.70	7.80	7.47	7.13	6.67
France	*rir*	7.79	4.74	3.42	2.86	2.59	2.73	2.43	2.34	2.27
UK	*rir*	6.33	4.23	2.94	2.68	2.88	2.70	2.49	2.39	2.44
US	*rir*	5.92	3.38	3.11	3.29	2.83	2.61	2.91	3.03	3.10
Sweden	*rir*	5.57	4.33	3.47	3.26	3.07	3.00	2.88	2.77	2.76
Spain	*nfay*	5.55	5.19	3.97	3.43	3.75	3.47	3.36	3.28	3.39
Italy	*rir*	4.77	3.49	2.78	2.67	2.75	2.66	2.73	2.62	2.48
Finland	*rir*	4.40	4.57	3.46	2.82	2.73	2.64	2.43	2.36	2.37
Ireland	*rir*	4.11	4.12	2.99	2.67	2.50	2.43	2.61	2.43	2.30
Germany	*nfay*	0.47	11.04	9.83	12.78	12.96	13.40	13.15	12.20	11.81
France	*fdy*	2.23	2.95	2.23	1.90	2.12	2.16	1.93	1.93	1.90
Finland	*nfay*	3.99	2.48	3.06	2.63	2.92	2.75	3.03	2.86	2.63
US	*rpoil*	2.97	3.01	5.72	6.38	6.34	6.18	6.17	5.98	5.78
US	*rer*	2.62	3.74	4.18	3.60	3.60	3.37	3.19	3.27	3.39
Sum of top 15		111.91	97.11	85.50	81.65	78.90	77.42	75.60	73.29	71.89
Sum of total		250.47	241.66	227.61	226.89	225.20	219.84	217.08	213.78	210.92
Percentage		44.68	40.19	37.56	35.99	35.03	35.22	34.83	34.28	34.09

		France. Current Account (%)								
		0	1	2	3	4	5	6	7	8
France	*cay*	67.56	37.91	31.13	26.92	26.36	25.30	24.66	23.67	23.88
France	*nfay*	0.86	5.24	5.27	4.86	4.71	4.21	3.99	3.88	4.00
France	*rir*	2.09	7.81	10.16	11.23	10.46	10.83	9.98	10.20	9.86
France	*fdy*	0.72	4.58	4.85	4.14	4.05	3.83	3.65	3.52	3.81
Germany	*cay*	1.25	1.87	2.30	2.46	2.57	2.16	2.32	2.35	2.36
Germany	*rir*	0.69	1.88	1.88	1.50	2.11	2.09	2.25	2.13	2.00
Netherlands	*nfay*	1.83	2.32	2.05	2.21	2.00	1.74	1.75	1.67	1.82
Ireland	*rir*	1.44	2.02	2.27	2.14	2.28	1.94	1.91	2.06	2.08
Italy	*rir*	1.67	1.62	1.83	1.76	1.93	1.80	1.93	1.74	1.78
Spain	*nfay*	1.22	2.35	2.59	2.32	2.27	2.10	2.16	2.19	2.16
Spain	*rir*	1.59	2.18	1.98	2.32	2.24	2.18	2.11	2.03	1.87
UK	*rir*	1.01	1.99	1.68	1.99	1.93	2.40	2.18	2.40	2.51
Japan	*cay*	1.44	2.39	2.46	2.56	3.22	3.20	3.63	3.48	3.37
US	*rpoil*	4.61	12.72	10.19	9.57	9.32	8.11	7.51	6.97	6.64
US	*rer*	4.75	4.36	4.22	3.98	3.56	4.26	4.27	3.98	3.87
Sum of top 15		92.74	91.24	84.88	79.97	78.99	76.15	74.30	72.29	72.02
Sum of total		163.74	201.11	196.72	196.00	196.87	193.84	191.04	188.64	187.98
Percentage		56.64	45.37	43.14	40.80	40.12	39.28	38.89	38.32	38.31

Table 5: GFEVD of Spanish and British current account

		Spain. Current account (%)								
		0	1	2	3	4	5	6	7	8
Spain	*cay*	49.92	21.78	13.90	10.55	7.41	6.31	5.44	4.86	4.71
Spain	*nfay*	5.88	7.79	6.53	5.52	5.79	6.12	5.42	4.52	4.24
Spain	*rir*	5.66	4.53	5.89	6.70	6.29	5.86	4.88	4.83	4.64
Spain	*fdy*	4.14	10.08	8.60	7.30	6.01	4.84	4.47	4.41	3.98
Finland	*cay*	4.83	6.09	5.03	4.84	4.24	4.72	4.64	3.83	3.46
Finland	*nfay*	3.99	5.55	5.31	4.66	4.15	4.40	3.93	3.72	3.71
Finland	*rir*	3.74	3.97	3.80	3.65	3.25	3.21	2.97	2.62	2.53
France	*rir*	2.57	2.71	2.89	2.85	3.27	2.84	2.83	2.75	2.72
France	*fdy*	2.95	2.33	2.27	2.47	2.38	2.34	2.45	2.26	2.08
Germany	*cay*	3.00	2.51	2.59	2.95	2.90	2.69	2.64	2.81	2.80
Ireland	*rir*	4.41	4.64	3.56	3.37	3.36	2.98	2.82	2.45	2.31
Sweden	*rir*	3.56	6.40	6.07	4.97	4.83	4.43	4.17	3.79	3.81
Japan	*rir*	4.31	5.23	4.61	5.44	4.97	5.43	5.37	5.14	4.71
US	*rpoil*	4.44	18.49	14.09	11.88	8.68	7.84	8.19	7.69	7.89
US	*rer*	4.22	5.17	6.14	5.89	4.82	5.18	6.34	6.90	6.59
Sum top 15		107.64	107.27	91.27	83.04	72.37	69.21	66.55	62.58	60.18
Sum total		221.67	251.52	233.94	227.15	220.45	214.62	210.27	205.68	203.05
Percentage		48.56	42.65	39.02	36.56	32.83	32.25	31.65	30.43	29.64

		UK. Current account (%)								
		0	1	2	3	4	5	6	7	8
UK	*cay*	80.38	55.48	41.67	34.03	29.72	26.80	25.39	24.37	23.82
UK	*nfay*	0.99	3.43	2.64	2.40	2.26	2.23	2.18	2.06	1.95
UK	*rir*	1.44	3.34	4.31	3.59	3.40	2.79	2.97	3.04	2.97
Germany	*cay*	2.40	7.65	7.31	8.08	7.55	7.14	6.24	5.70	5.44
Germany	*rir*	1.16	3.13	3.06	3.39	3.14	3.19	2.95	2.76	2.69
Germany	*cay*	2.40	7.65	7.31	8.08	7.55	7.14	6.24	5.70	5.44
Germany	*rir*	1.16	3.13	3.06	3.39	3.14	3.19	2.95	2.76	2.69
US	*cay*	1.79	1.62	1.87	2.08	2.54	2.88	4.77	5.04	5.43
US	*rir*	3.30	3.54	3.37	3.28	3.24	3.00	2.95	2.73	2.60
France	*rir*	1.25	2.58	2.94	2.79	2.35	2.25	2.00	1.90	1.99
Ireland	*rir*	2.38	2.21	2.50	2.55	2.30	2.11	2.06	2.04	1.90
US	*fdy*	2.14	2.79	4.27	4.08	3.45	3.81	3.62	3.60	3.53
Japan	*rir*	1.61	1.72	2.49	2.24	2.16	2.10	2.21	1.96	2.04
US	*rpoil*	1.28	5.90	6.64	6.67	5.40	4.83	4.68	4.45	4.41
US	*rer*	1.86	2.67	2.36	2.98	2.68	2.95	2.63	2.61	2.57
Sum Top 15		105.51	106.86	95.80	89.63	80.89	76.41	73.85	70.72	69.46
Sum all		171.78	201.98	206.35	199.49	192.81	189.66	184.89	180.17	176.66
Percentage		61.42	52.90	46.43	44.93	41.95	40.29	39.94	39.25	39.32

Table 6: GFEVD of US current account

		US. Current account (%)								
		0	1	2	3	4	5	6	7	8
US	cay	62.62	46.23	37.25	31.76	28.26	26.55	25.94	24.20	22.62
US	$nfay$	1.40	4.14	3.60	3.93	3.46	3.57	3.14	3.01	3.16
US	rir	1.39	1.41	1.76	2.24	2.31	2.14	2.14	2.04	2.05
US	fdy	12.45	9.04	7.23	7.48	6.47	6.84	6.17	5.75	5.72
US	$rpoil$	2.80	3.16	3.61	4.62	4.58	5.07	4.79	4.51	4.46
US	rer	8.24	8.39	6.93	5.72	5.24	5.02	4.75	4.64	4.60
Germany	cay	3.95	2.62	2.96	3.05	2.95	2.70	2.47	2.33	2.39
Germany	rir	1.58	2.17	2.16	2.48	2.46	2.41	2.66	2.39	2.51
Canada	cay	3.22	2.74	2.66	2.84	2.76	2.50	2.56	2.44	2.34
Canada	rir	1.00	1.44	1.79	2.15	2.07	2.04	2.18	2.15	2.08
Canada	fdy	1.00	2.49	2.98	4.31	5.04	5.35	5.13	5.08	4.82
Japan	cay	3.64	4.00	3.79	5.51	6.01	6.94	8.43	8.44	8.05
Japan	$nfay$	1.62	2.06	2.59	2.60	2.67	2.39	2.64	2.63	2.65
Japan	rir	2.24	2.73	3.59	3.74	3.35	3.73	3.76	3.82	3.65
Japan	fdy	2.60	4.98	4.86	5.68	5.27	5.44	4.81	4.76	4.71
Sum top 15		109.75	97.60	87.75	88.10	82.90	82.71	81.57	78.18	75.81
Sum all		217.90	209.70	197.10	199.06	191.48	189.52	186.14	180.27	176.47
Percentage		50.37	46.54	44.52	44.26	43.29	43.64	43.82	43.37	42.96

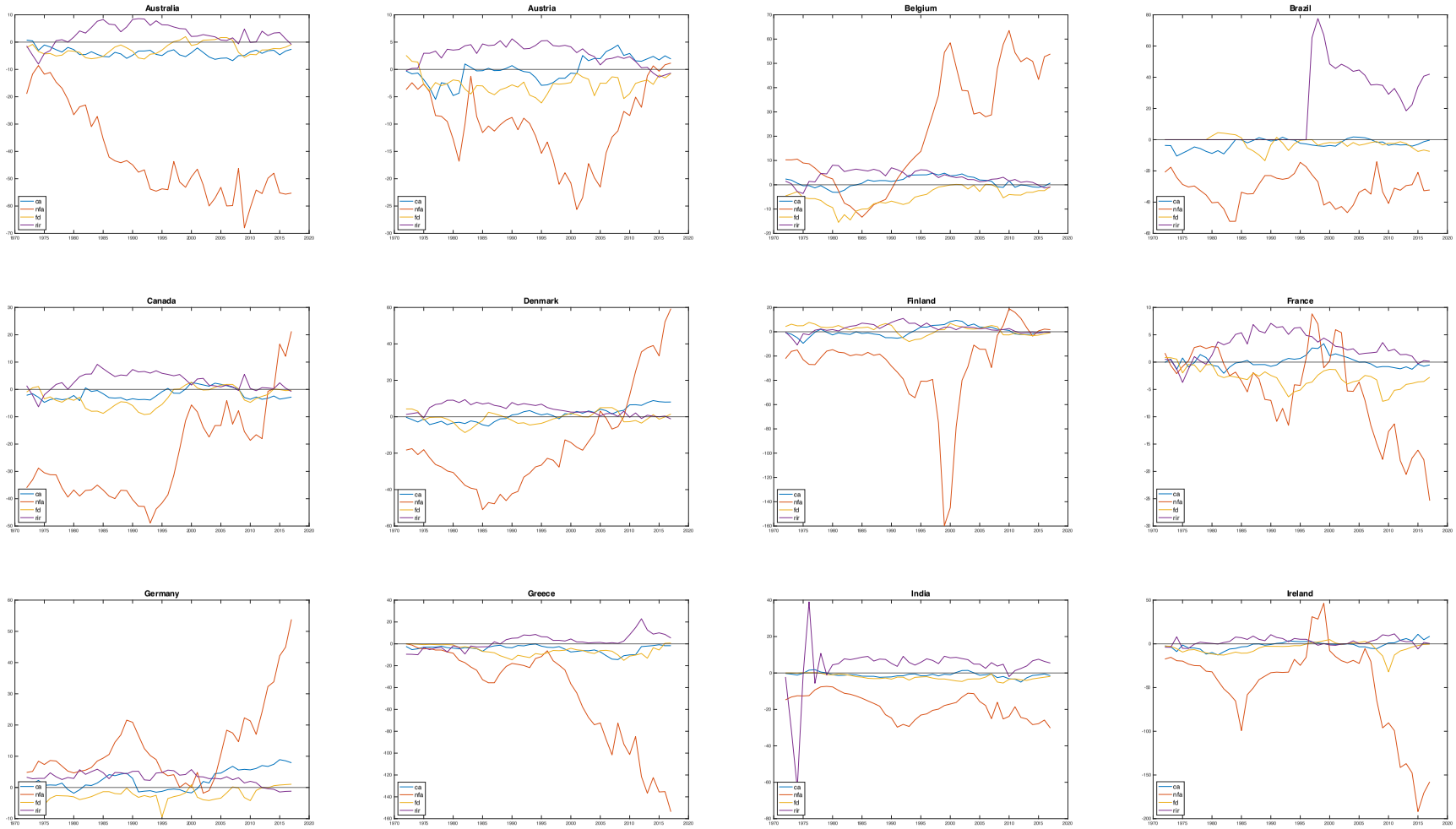


Figure 1: Current account and determinants

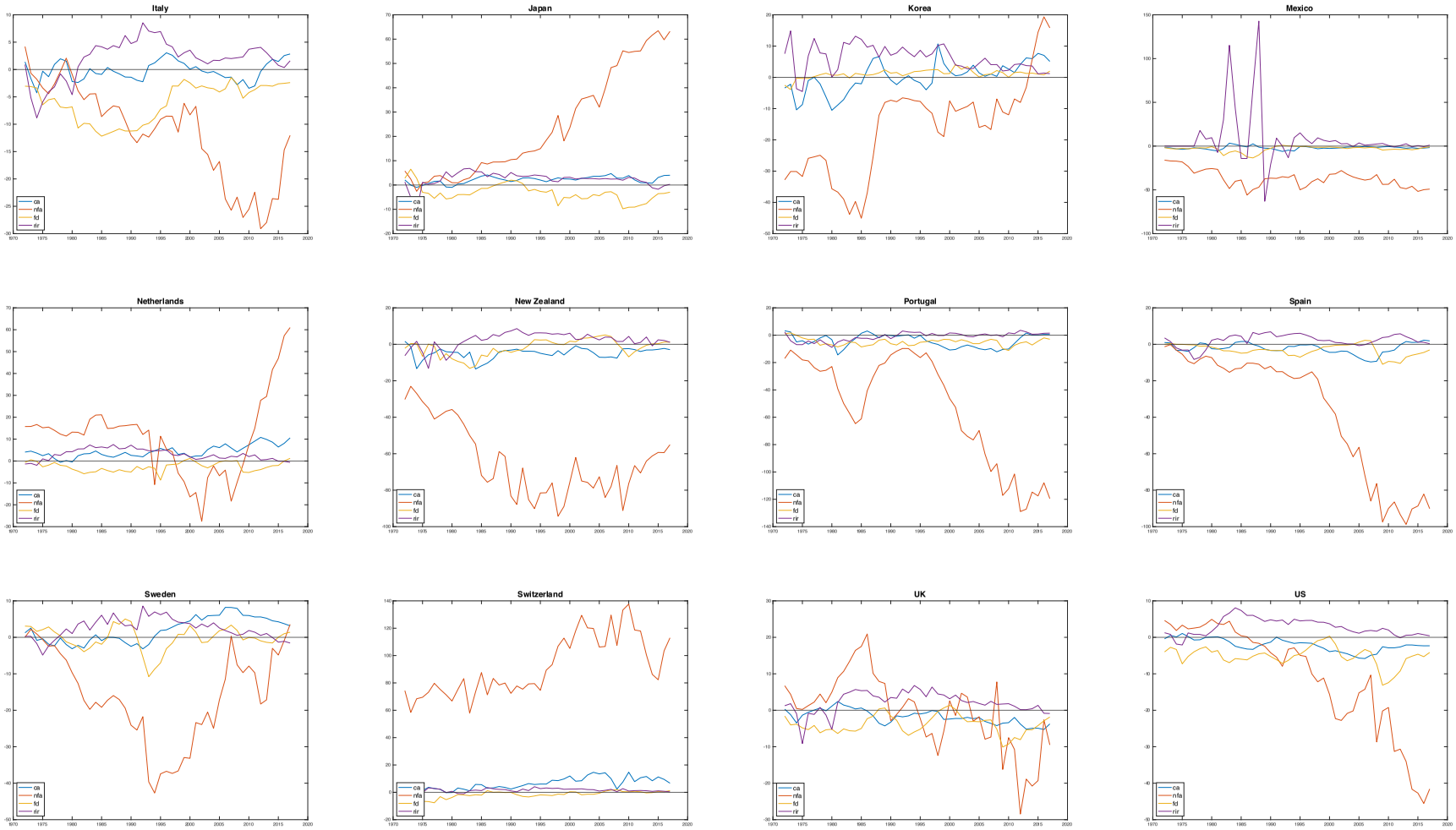


Figure 2: Current account and determinants

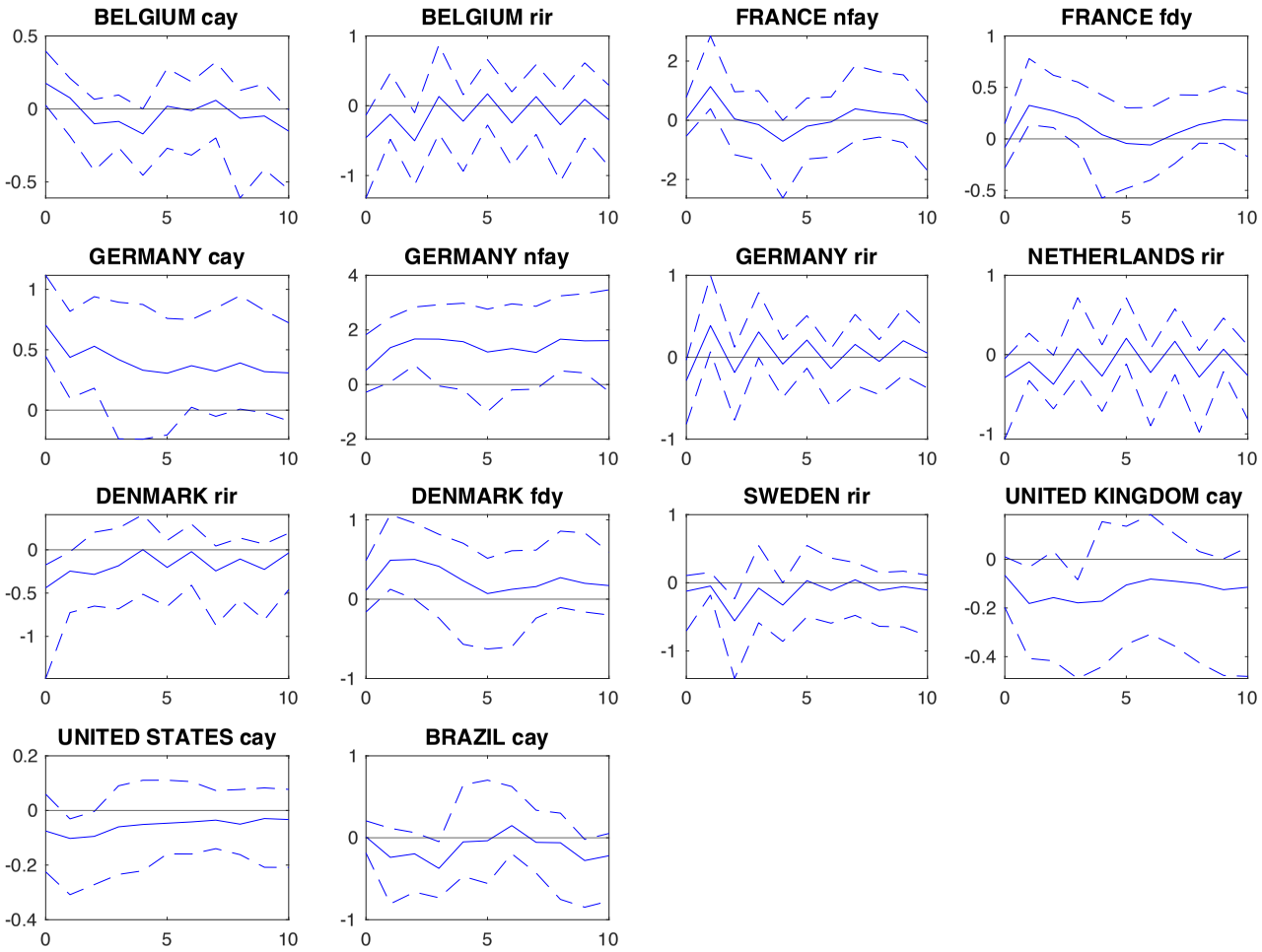


Figure 3: GIRF of a one-standard-error shock (+) to Germany cay_t on the variables across countries (bootstrap median estimates with 90% bootstrap error bounds)

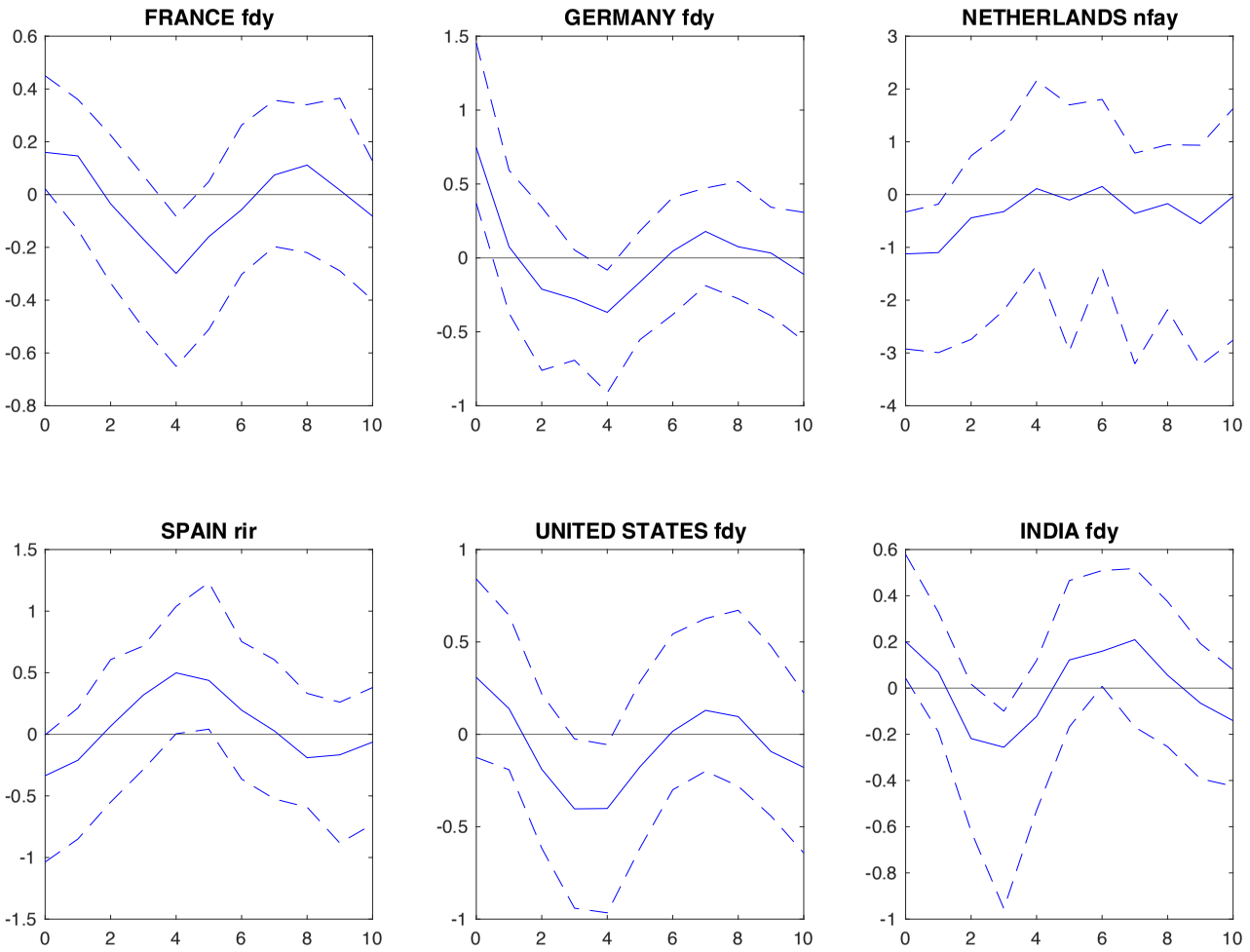
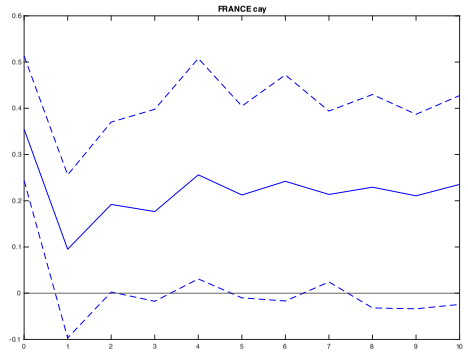
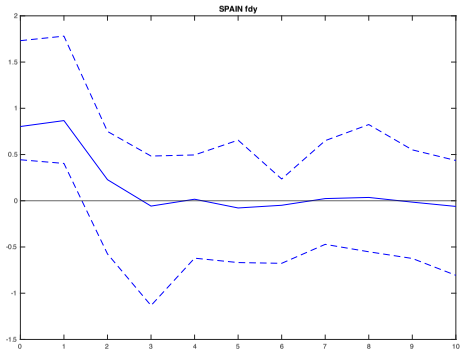


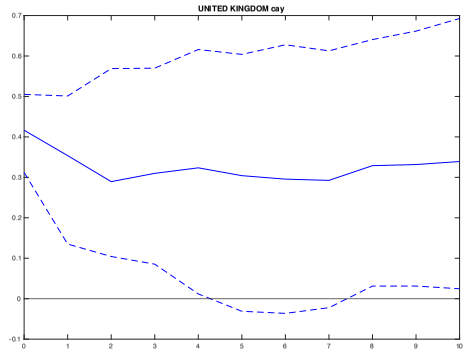
Figure 4: GIRF of a one-standard-error shock (+) to Germany fdy_t on the variables across countries (bootstrap median estimates with 90% bootstrap error bounds)



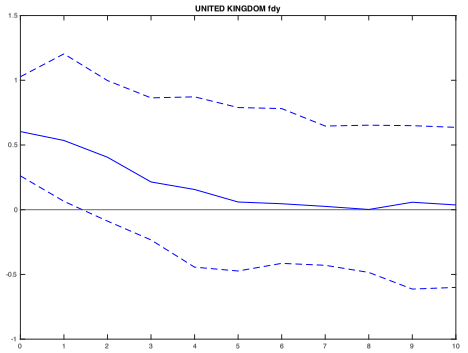
(a) France cay_t



(b) Spain fdy_t

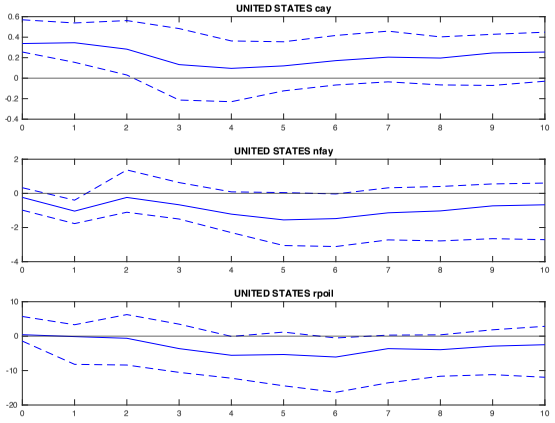


(c) UK cay_t

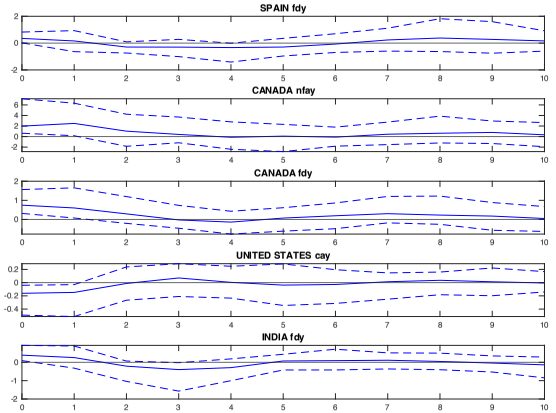


(d) UK fdy_t

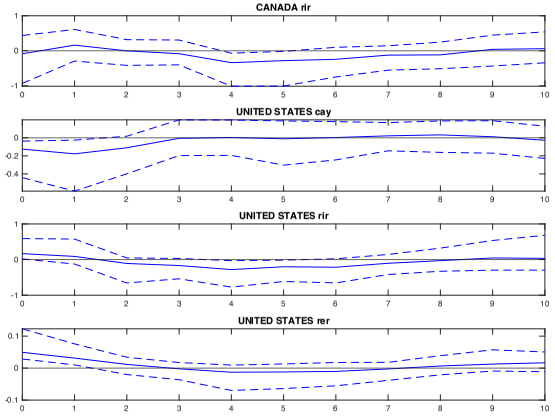
Figure 5: GIRF of a one-standard-error shock (+) to France, Spain and UK cay_t or fdy_t, depending on the case, on the variables across countries (bootstrap median estimates with 90% bootstrap error bounds)



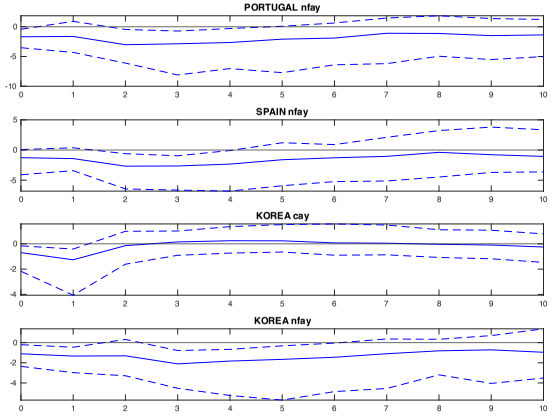
(a) US cay_t



(b) US fdy_t



(c) US rer_t



(d) US $rpoil_t$

Figure 6: GIRF of a one-standard-error shock (+) to US cay_t, fdy_t, rer_t and $rpoil_t$ on the variables across countries (bootstrap median estimates with 90% bootstrap error bounds)