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Florian Morvillier



UMR 7235

EconomiX - UMR7235  
Université Paris Nanterre  
Bâtiment G - Maurice Allais, 200, Avenue de la République  
92001 Nanterre cedex

Email : [secretariat@economix.fr](mailto:secretariat@economix.fr)



# On the impact of the launch of the euro on EMU macroeconomic vulnerability

Florian MORVILLIER\*

## Abstract

This paper aims at investigating the role played by the euro's inception on external imbalances and macroeconomic vulnerability of the eurozone. To this end, we estimate a panel VAR model over the pre-euro (1980-1998) and EMU (1999-2016) periods for eleven eurozone members. Our findings show that with the adoption of the single currency, current account vulnerability to demand and currency misalignments shocks increases significantly. The correction of external imbalances within the euro area also becomes more difficult because of the disparition of a slow-growth process and devaluations as adjustment tools.

## Keywords:

Global imbalances, current account, output gap, exchange-rate misalignments, panel VAR.

## JEL Codes:

F32, F31, C33.

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\*EconomiX-CNRS, University of Paris Nanterre. 200 Avenue de la République, 92001 Nanterre Cedex, France. Email: [morvillier.florian@parisnanterre.fr](mailto:morvillier.florian@parisnanterre.fr)

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# 1 Introduction

The adhesion to the Economic and Monetary Union (EMU) of the European Union constitutes an important challenge for the macroeconomic stability of its members countries. Indeed, they lost their monetary policy independence and have only a limited management of their exchange rate policies. Thus, on the one hand, the macroeconomic adjustment of the eurozone members to idiosyncratic shocks becomes harder as they are not able to use their interest rate as a tool. On the other hand, the reduction of external imbalances is also much more complicated as EMU members can not rely on devaluations, leading to additional difficulties to regain lost competitiveness (Gnimassoun and Mignon, 2015; Staehr and Vermeulen, 2018). This is particularly painful for the Southern eurozone countries that widely relied on devaluations during the period preceding the euro's inception (Fernández-Villaverde et al., 2013; García Solanes et al., 2017).

These different sacrifices were expected to have only limited effects as the launch of the euro should encourage widespread structural reforms for the Southern countries (see Fernández-Villaverde et al., 2013), which were not implemented in practice calling for further policies at the present time (see Bénassy-Quéré et al., 2018). Furthermore, the launch of the EMU also causes convergence in interest rates between the core and peripheral countries (Fernández-Villaverde et al., 2013; Honkapohja, 2014; Eichengreen et al., 2014), contributing to the creation of consequent imbalances in the eurozone through a credit boom. In the same time, the euro's inception is also associated with an increase in the level and persistence of currency misalignments for eurozone members (Coudert et al., 2013).<sup>2</sup> It raises the crucial question of vulnerability of eurozone countries in a situation characterized by an interaction between the internal and external imbalances (Gnimassoun and Mignon, 2016).

However, only few contributions exist on the role played by the euro's introduction on the external imbalances adjustment and vulnerability of the eurozone. Berger and Nitsch (2010) and Lane (2010) show that the euro's inception is associated with a widening and increasing persistence of intra-euro trade imbalances. The launch of the euro also led to a considerable increase in the level and persistence of current account imbalances (Schoder et al., 2013; Hope, 2016). Furthermore, these disequilibria are more persistent in the case of low overvaluations for the eurozone members (Gnimassoun and Mignon, 2015). However, several crucial questions on the role played by the euro on a variety of issues remain unanswered. How evolves current account vulnerability to demand and exchange rate misalignment shocks? How the adhesion to the EMU affects the correction of external imbalances in the eurozone? Does the relation between internal and exchange rates disequilibria changed since the launch of the single currency?

This paper aims at answering these different questions through an in-depth empirical analysis over the pre-euro (1980-1998) and EMU (1999-2016) periods. After the computation of current ac-

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<sup>2</sup>Currency misalignments are defined as the gap between the real effective exchange rate and its equilibrium level (see *infra*). The correction of this macroeconomic disequilibrium comes at the cost of severe austerity programs, appearing thus as unsustainable as mainly are driven by demand compression rather than by an improvement in the fundamentals (Saadaoui, 2018).

count imbalances on these two sub-periods, we estimate panel Vector Autoregressive (PVAR) models which include output gaps, current account disequilibria and exchange rate misalignment. Our main results are the following. After the euro's inception, the current account vulnerability to domestic and exchange rate misalignment shocks increases significantly. Furthermore, the advent of the eurozone implies a harder current account correction because of the disparition of a slow-growth process and devaluations as adjustment tools.

Our article contributes to the literature in several ways. We adopt a dynamic perspective as we investigate the evolution of vulnerability of the current account to internal and external shocks. Considering the switch from a flexible to a fixed exchange rate regime also allows us to document the role played by the exchange rate regime in the current account adjustment dynamic. In addition, we contribute to the literature studying the roots of current account discrepancies in the eurozone. Indeed, we estimate the relative contributions of the competitiveness and demand channels in the build-up of current account imbalances. Moreover, the possible interaction between demand shocks and Real Effective Exchange Rates (REER) is also tackled thanks to the estimation of the PVAR model.

The rest of our article is organized as follows. Section 2 offers an overview of the main drivers of the current account imbalances in the euro area. Section 3 provides a brief survey of the key current account determinants for the industrialized economies. The dataset and the methodology implemented are described in Section 4. Section 5 displays and discuss our econometric results, and also provides some robustness checks. Finally, Section 6 concludes the article and gives several policy implications.

## **2 Current account imbalances' drivers in the euro area**

The origins of the build-up of current account imbalances within the euro area remain an open question that gave birth to an extensive literature. Several drivers have been identified, but a lack of consensus exists about the main causes of these disequilibria.

### **2.1 Current account imbalances in the euro area: a catching-up process ?**

The emergence of current account imbalances in the euro area can be potentially driven by the presence of a catching-up process. Indeed, in accordance with standard macroeconomic theory, capital should flow from rich to poor countries because of higher marginal capital productivity in less developed countries. Hence, current account deficits experienced by Southern countries and surpluses for Northern, appear as a "natural process". In line with the previous affirmation, Blanchard and Giavazzi (2002) argue that the apparition of deficits in Greece and Portugal was the result of "good imbalances", rather than "bad imbalances", as they come from high growth prospects leading to higher investment.

In this context, the importance of over-optimistic expectations about future growth is emphasized by Lane and Pels (2012) and Lane (2013). They show that such expectations played a significant role

in the apparition of deficits in the Southern euro area countries. Considering an intertemporal current account (ICA) model, Campa and Gavilan (2011) find a similar result. They provide evidence that the creation of the EMU increases expectations of future growth relative to existing output for France, Italy, Portugal and Spain, which worsen their current accounts. Considering also an ICA model, Ca 'Zorzi and Rubaszek (2012) investigate the relevance of the catching-up process hypothesis. They show that a " moderate pace of catching-up" explains the divergence in the current account dynamics within the euro area. Using the Gros Domestic Product Per Capita (GDP PC) to examine this hypothesis, Belke and Dreger (2013) find only low support for existence of a catching-up process.

Decomposing the euro trade balances in two components (intra-euro and extra-euro balances), Schmitz and Von Hangen (2011) show that, since the introduction of the euro, the elasticity of net capital flows to per capita income increases for euro area countries. However, controlling for additional intra-balance determinants, Niemen (2015) fails to find a similar result.

## **2.2 Domestic demand and credit booms**

The launch of the single currency led to a significant shift in the macroeconomic environment faced by the eurozone members, explaining the emergence of credit and demand booms. Indeed, the elimination of the exchange rate risk interlinked with an accommodant monetary policy result in a large drop of interest rates for the peripheral members (Fernández-Villaverde et al., 2013) which converge to the level of the core countries (Fernández-Villaverde et al., 2013; Honkapohja, 2014; Eichengreen et al., 2014). This evolution has been pointed out to be at the roots of the build-up of current account imbalances in the euro area (Barnes, 2010; Holinski et al., 2012; Honkapohja, 2014).

The abundance of cheap money for the Southern countries fuels a credit boom which deteriorates their current account balances (Honkapohja, 2014; Hale and Obstfeld , 2016). More precisely, the flows of bank loans to the non financial private sector impact negatively the current account position of the euro area countries over the period 1999-2013 (Unger, 2017). This additional liquidity was mainly used in an unproductive manner in the non tradable sector (Eichengreen, 2010; Giavazzi and Spaventa, 2011; Lane, 2013), contributing thus to explain why the strong housing investment is an important determinant of the current account deficits for Spain and Ireland over the last decade (Barnes et al., 2010).

The role of domestic demand booms is also emphasized by Comunale and Hessel (2014) who study the relative importance of the financial cycle and competitiveness channel in the shape of current account imbalances in the euro area. Using a panel error-correction model, they conclude that domestic demand booms driven by the financial cycle are at the root of current account imbalances in the eurozone. Finally, Sanchez and Varoudakis (2013) also find that the sharp increase in demand leads to a worsening of current accounts for monetary union members.

### 2.3 Competitiveness channel

The role played by the competitiveness channel in the build-up of current account imbalances remains a question widely discussed in the literature. Loss of competitiveness is seen as a consequence of the domestic demand booms and not as the cause of the current account imbalances (Gros, 2012; Gaullier and Vicard, 2012; Wyplosz, 2013).

While weak evidences in favor of the competitiveness channel are found (Sanchez and Varoudakis, 2016; Staehr and Vermeulen, 2018), Belke and Dreger (2013) show that the lack of competitiveness is the main explanation for rising European current account imbalances. Their result is confirmed by Arghyrou and Chortareas (2008) and Comunale and Hessel (2014) who find a negative impact of the REER on the current account balances. Durcova and Mirdala (2017) also provide evidence that the external competitiveness determinants were the main driver of current account imbalances before the crisis.

Gnimassoun and Mignon (2016) are interested in the effect of currency misalignments within the euro area. They show that a rise in overvaluations leads to a worsening of the current account. Based on panel causality tests, they also establish a strong and robust causal link from overvaluations to current-account imbalances.

## 3 Current account determinants in industrialized countries: an overview

Since the beginning of the 2000's, we observe a resurgence of global imbalances in the world economy, underlining the importance of understanding current account dynamics. International institutions such as the International Monetary Fund (IMF) and the European Commission have developed methodologies to monitor current accounts' evolutions. The first institution relies upon the External Balance Assessment<sup>3</sup> (EBA) methodology (2012), in order to document current account developments in 49 countries.<sup>4</sup> Turning to the European Commission, it has implemented the Macroeconomic Imbalance Procedure (MIP, 2011) to look at macroeconomic imbalances' evolutions in the European Union, including the current account imbalances. As can be seen from the renewed interest of institutions for current account balances, identifying their determinants remains a crucial point.

Given the important numbers of potential current account determinants, we rely on the Bayesian Model Averaging (BMA) approach to select the most relevant ones. In the following we present the different potential current account determinants, by focusing only on determinants specific to industrialized countries.<sup>5</sup> Furthermore, we do not consider short run determinants as we are interested in imbalances arising in the medium to long term.

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<sup>3</sup>The EBA approach succeeds to the Consultative Group on Exchange Rate Issues methodology in 2012.

<sup>4</sup>To this aim, the EBA approach uses a wide range of current account determinants such as structural factors, financial factors and cyclical factors in panel regressions.

<sup>5</sup>Some current account determinants are relevant only for developing countries and we do not consider such variables (see Calderon et al., 2002 for a survey.)

The empirical literature mainly uses structural equations which are estimated relying on the saving-investment approach.<sup>6</sup> By definition:

$$CA = S - I = S^P + S^G - I \quad (1)$$

$$CA = S^P + T - G - I \quad (2)$$

Where CA is the current account, S denotes national saving and I stands for national investment.  $S^P$  (resp.  $S^G$ ) denotes private (resp. government) savings. T sets for the government current receipts and G government current expenditures.

As can be seen from equations (1) and (2), the variables affecting both investment and savings decisions can be potential current account determinants. Let us now review the set of those possible determinants.

### 3.1 Borrowing constraints channel

Jappelli and Pagano (1994) argue that regulation can lead to borrowing constraints for households with a potential effect on the current account. In the following, we present the main determinants used to assess the borrowing constraints channel and its impacts.

#### 3.1.1 Financial development

Several proxies are employed to investigate the role of financial development on the current account. Chinn and Ito (2008) use the private credit to GDP ratio, while Ca'Zorzi et al. (2012) rely upon the sum of foreign assets and liabilities.<sup>7</sup> From a theoretical point of view, the effect of financial development on the current account is ambiguous. On the one hand, higher financial development may increase possibilities to save (Barnes et al., 2010, Ciocyte and Rojas-Romagosa, 2015) due to a larger availability of financial instruments (Moral-Benito and Roehn, 2016). On the other hand, the relaxation of the borrowing constraints reduces precautionary savings (Mendoza et al., 2009 and Lane, 2010) and rises investment, impacting negatively the current account. Thus, the relationship between both variables is not clearcut. Based on an overlapping-generations model with households facing liquidity constraints, Jappelli and Pagano (1994) show that such constraints rise saving by interacting with growth. This is confirmed by the fact that a rise in the Loan To Value (LTV) ratio<sup>8</sup> leads to a decline in net national savings. More recently, Chinn and Prasad (2003) and Cheung et al. (2013) fail to find a significant effect of financial deepening on a sample of industrialized countries, while Gnimassoun and Mignon (2015) provide only weak evidence for this channel. Finally, Chinn and Ito (2013) show that a rise in the Chinn-Ito index improves the current account, while Saadaoui (2015) obtains an opposite result.

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<sup>6</sup>In this approach, most of the variables are computed as the deviation from the main trading partners (Lane and Milesi-Ferretti, 2012).

<sup>7</sup>Another proxy frequently used is M2 to GDP ratio (see Gnimassoun and Mignon, 2015).

<sup>8</sup>The LTV ratio is defined as the ratio between Mortgage Amount and the appraised value of property. A rise in this ratio is interpreted as a strengthening of the borrowing constraints faced by households as a higher LTV leads to a higher down payment, resulting in an increase in forced savings.



### 3.1.2 Financial (de-)regulation

Financial (de-)regulation encompasses different aspects going from credit controls to security markets regulation.<sup>9</sup> Financial deregulation can influence current account balances in several ways. As suggested above, it can reduce precautionary savings but could also increase savings by lowering "transaction costs, offering a wider range of saving instruments" (Moral-Benito and Roehn, 2016). Relying on a BMA approach, Moral-Benito and Roehn (2016) provide evidence that financial regulation constitutes a relevant determinant for a sample of 30 industrialized and emerging countries. Different aspects of financial (de-)regulation present differentiated effects on the current account. In line with the borrowing constraints view, they find that easing bank entry barriers worsen the current account, while deregulating securities markets and privatizing banks have a positive impact.<sup>10</sup>

## 3.2 Demographics

Countries' demographic profiles can affect current account by their influence on domestic savings. The life cycle theory proposed by Modigliani (1966) allows us to understand the effect of a modification in the age distribution on savings' behaviour. Indeed, a young (resp. active) people has a negative (resp. positive) saving rate, while retired households dissave. The importance of such determinant is confirmed by Higgings (1998) showing a strong effect of demographics on the current account.<sup>11</sup> In the following, we present the main determinants used to investigate demographics' influence.

### 3.2.1 Ageing speed

The ageing speed is a "relatively new" current account determinant due to Lane (2010).<sup>12</sup> Ageing speed is measured as the "expected change in the old-age dependency ratio in the future" (Lane and Milesi-Ferretti, 2012).<sup>13</sup> This variable is able to influence the current account as a population getting old more rapidly tends to save more (Lane and Milesi-Ferretti, 2012). It constitutes a relevant determinant for the current account dynamics as illustrated by Lane and Milesi-Ferretti (2012), IMF (2013), Tressel and Wang (2014) and Gnimassoun and Mignon (2015) who find a significantly positive coefficient.

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<sup>9</sup>In their article, Moral-Benito and Roehn (2016) use different variables to take into account several aspects of regulation: credit controls, bank entry barriers, privatization of the banking sector, prudential regulation and supervision of the banking sector and securities market regulation.

<sup>10</sup>The explanation is that these reforms enhance private savings, contributing positively to the current account.

<sup>11</sup>It should be noted that demographic profiles matter for the current account as soon as they differ across countries (Chinn and Prasad, 2003).

<sup>12</sup>He identifies a significantly negative effect of this variable on the Net Foreign Asset position, justifying the use of this variable as a potential current account determinant.

<sup>13</sup>Contrary to Lane and Milesi-Ferretti (2012), Lane (2010) defined ageing speed as the difference between current working-age population and the projected future working-age population. This different methodology explained the counter-intuitive sign obtained in his article.

### **3.2.2 Dependency ratio**

A higher dependency ratio (ratio of people younger than 15 or older than 64 to the working-age population) leads to an increase in consumption relative to income which reduces private savings. This determinant should exert a negative influence on the current account. Barnes et al. (2010) provide evidence that the dependency ratio presents the expected sign found in the literature (see Chinn and Prasad, 2003; Jaumotte and Sodsriwiboon, 2010; Cheung et al., 2013). However, over the period 1969-2008, Lane and Milesi-Ferretti (2012) fail to find support for this determinant.

### **3.2.3 Old dependency ratio**

According to the life cycle hypothesis, the old dependency ratio (ratio of people older than 64 years to the working age population) could negatively impact the current account, as older people tend to deplete their savings. Kamin and Gruber (2007) and Jaumotte and Sodsriwiboon (2010) confirm Modigliani (1966)'s view as they show that higher old dependency ratio worsens significantly the current account. On a sample of 22 industrialized countries, Gninaoune and Mignon (2015) find no support for this determinant.

### **3.2.4 Population growth**

A higher population growth is expected to deteriorate the current account because of the lack of savings among the very young (Gninaoune and Mignon, 2015). Furthermore, a rise in the fertility rate increases the future labour force, which can foster foreign investment and then worsen the current account (Ciocyte and Rojas-Romagosa, 2015). As expected, Gninaoune and Mignon (2015) show that a rise in population growth relatively to the main trading partners has a strongly significant and negative effect on the current account. Considering 11 euro area countries, Decressin and Stavrev (2009) find a similar result.

### **3.2.5 Young dependency ratio**

An increase in the young dependency ratio (ratio of people younger than 15 years to the working-age population) can be interpreted as a rise in future labor force, increasing investment. So, it should weaken the current account balance. Restricting their sample to industrialized countries, Chinn and Prasad (2003) show that the young dependency ratio is only weakly negatively significant. Barnes et al. (2010) find constrained evidence for this determinant as a rise in the young dependency ratio can both worsen or improve the current account balance.

## **3.3 Economic development**

Countries at different stages of development present different growth prospects. Such heterogeneity can have differentiated impacts on their current accounts. In the following, we review the main variables used to investigate the economic development channel.

### 3.3.1 Economic growth

A high growth rate is associated with higher expected incomes which increase current consumption at the expense of savings. As a rise in future demand is expected, domestic investment follows the same path. So, it is expected that greater economic growth worsens the current account. However, from an empirical point of view, economic growth does not constitute a robust current account determinant (Barnes et al., 2010); Kamin and Gruber (2007) and Decressin and Stavrev (2009) finding only weak evidence for this variable.

### 3.3.2 Gross Domestic Product Per Capita (GDP PC)

According to standard economic theory, low-income countries should run current account deficits while rich countries are expected to experience surpluses. High investment opportunities in poor countries favorise inflows going from rich to low-income countries. Hence, it is expected that an increase in GDP PC improves the current account balance. This determinant is found to be robust among different specifications (Barnes et al., 2010). On a sample of industrialized countries, Giavazzi and Blanchard (2002), Kamin and Gruber (2007) and Chinn and Ito (2008) find that higher GDP PC is associated with higher current account position.

### 3.3.3 Squared relative income

Squared relative income is used to investigate the "stage of development hypothesis" (Debelle and Faruqee, 1996; Roldos, 1996). Following this hypothesis, the GDP PC-current account relationship is expected to take the form of an U-shaped curve.<sup>14</sup> In other words, low income countries run current account deficits while rich countries experience a surplus. Masson al. (1998), Chinn and Prasad (2003) and Cheung et al. (2013) present no support for this hypothesis as a significantly negative sign is obtained for the squared relative income.<sup>15</sup>

### 3.3.4 Productivity

Productivity shocks are one of the main determinants of the current account (Glick and Rogoff, 1995; Bussière et al., 2010). Temporary and permanent shocks have differentiated impact on the current account. Following Gossé and Serranito (2014), a permanent productivity shock negatively impacts the current account as higher productivity rises investment because of higher return to capital. Moreover, the expectation of higher yields decreases savings. Considering a temporary and positive productivity surge, it should improve the current account as this shock rises the output. To assess the importance of this determinant, Gossé and Serranito (2014) rely upon labor productivity in the total economy and GDP PC. With the second proxy, they find a significantly negative effect of productivity on the current account, while a rise in labor productivity improves it. Contrary to Gossé and Serranito (2014), Gnimmassoun and Mignon (2015) failed to find support for this determinant.

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<sup>14</sup>To investigate this hypothesis, GDP PC and its squared value are used as regressors of the current account. To validate the "stage of development hypothesis", GDP PC and relative income squared must be positively signed.

<sup>15</sup>This result is rather in line with the Lucas' paradox as an inversed U-shape is obtained.

### 3.4 International environment

The international environment faced by a country can affect its current account by influencing its capacity to repay its external debt.

#### 3.4.1 Long term interest rate

The long term interest rate affects both domestic savings and investment, but antagonist effects are at play. To discuss the mechanism beyond this variable, we follow Obstfeld and Rogoff (chapter 1, 1996) and distinguish 3 effects of the interest rate on the current account:

- Substitution effect: A rise in the interest rate increases the opportunity cost of present consumption. Hence, it should cause substitution toward future consumption, improving the current account.

-Income effect: A rise in the interest rate leads to an increase in the feasible consumption pushing people to rise current consumption, reducing their saving rate. Following the income effect, a rise in the interest rate should negatively impact the current account.

-Wealth effect: A rise in the world real interest rate lowers the market discount factor and, therefore, the present value of lifetime income. This negative wealth effect acts to reduce present consumption and to improve the current account.

In addition to the effect on households, investment is also penalized by a rise in the interest rate. As stressed above, the substitution effect and the wealth effect tend to improve the current account balance, while the income effect goes in the opposite direction. Hence, the sign of the long term interest rate is ambiguous. Barnes et al. (2010) find strong support for this determinant showing that long term interest rate positively affects the current account. Belke and Dreger (2013) also confirm this result showing that a rise in this variable increases the surplus of the euro area countries, except for the deficit members where the inverse is observed.

#### 3.4.2 Net foreign asset (NFA) position

To understand the effect of NFA on the current account, we use the augmented balance of payment identity which sets :

$$CA_t = \underbrace{(NFA_t - NFA_{t-1})}_{\text{NFA variation}} - VE_t \quad (3)$$

$CA_t$  is the current account balance at year  $t$  and  $VE_t$  stands for the valuation effects.  $NFA_t$  (resp.  $NFA_{t-1}$ ) denotes the NFA position of a country at year  $t$  (resp. year  $t-1$ ). As can be seen from equation (3) a year to year improvement in the NFA position should positively impact the current account. However, Ciocyte and Rojas-Romagosa (2015) argue that NFA effect on the current account is ambiguous. On the one hand, as a higher NFA position rises the net investment incomes, it improves the external position. On the other hand, it also increases resources available in the economy which

can deteriorate the current account. The empirical literature shows that the positive effect largely outweighs the negative one, as an improvement in the NFA ameliorates the current account position (see Chinn and Prasad, 2003; Chinn and Ito, 2008 and Gnimassoun and Mignon, 2015 among others).

### 3.5 Fiscal policy: government budget balance

The government budget balance<sup>16</sup> constitutes a key determinant of the current account position (Chinn and Ito, 2008; Bussière et al., 2010; Moral-Benito and Roehn, 2016). From a theoretical point of view, the government budget balance-current account nexus receives important considerations (see Sachs, 1981 ; Frenkel and Razin, 1986 and Glick and Rogoff, 1995 among others). Sachs (1981) stresses the importance of distinguishing between temporary and permanent shocks in the government deficits as different effects can arise from both shocks. The relevance of this distinction is confirmed by Glick and Rogoff (1995) who show that a temporary increase in budget deficits leads to a deterioration of the current account while a permanent rise has no effect.<sup>17</sup> Allowing for the presence of non-Ricardian behavior, Bussière et al. (2010) find that country-specific innovations in the primary government balance may affect the current account position.

The link between both variables can be apprehended through the "twin deficits hypothesis", according to which a government deficit translates into a trade balance deficit (see Bernheim, 1998 for a discussion). To better understand this hypothesis, we consider the following national income accounting identities:

$$Y = C + S^P + T \quad (4)$$

$$Y = C + I + G + (X - M) \quad (5)$$

Combining equations (4) and (5) and simplifying, it comes :

$$\underbrace{T - G}_{\text{Budget surplus}} = \underbrace{(X - M)}_{\text{Trade balance}} + I - S^P \quad (6)$$

Y stands for income, C for consumption, T for taxes and  $S^P$  for private savings. Equation (6) states that government budget surplus is the sum of 2 components, namely the trade balance and the difference between investment and private savings.

Assuming no modification in investment and private savings, equation (6) shows that a reduction in the government budget surplus leads to a deterioration of the trade balance in line with the twin

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<sup>16</sup>This variable is suspected by Fair (2017) to be an endogenous regressor. To argue about the possible endogeneity of government spendings, he considers a negative consumption shock which reduces income and thus leads to a reduction in government savings. It is worth noting that this potential endogeneity has been tackled by the IMF in its EBA approach by instrumenting government budget balance by several variables as the output gap, the lagged world cyclically adjusted fiscal balance and the exchange rate regime.

<sup>17</sup>A permanent rise in government spending will be fully offset by a permanent reduction of consumption.

deficits hypothesis. More precisely, in absence of Ricardian equivalence,<sup>18</sup> a 1% increase in the budget balance leads to a lowering of the current account of 1% (else things being equal).<sup>19</sup> Controlling for the presence of structural breaks, Katrakilidis and Trachanas (2013) find strong support for the twin deficits hypothesis for four Eurozone countries. More recently, Litsios and Pilbeam (2017) also validate this hypothesis showing the existence of a cointegration relationship between fiscal balance and the current account in Greece, Portugal and Spain.

### **3.6 Labor market**

The extent to which the labour market is regulated can influence countries' current account position. Regulation can affect households savings' behaviour and also domestic and foreign investment.

#### **3.6.1 Ratio of minimum wage to mean wage**

The ratio of minimum wage to mean wage matters for the current account through its effect on countries' competitiveness (Ivanova, 2012). Indeed, a higher minimum wage may hurt competitiveness by increasing labor costs. Considering a sample of 49 advanced and emerging countries, Jaumotte and Sodsriwiboon (2010) show that higher minimum wage lowers the current account. On a sample of OECD countries, Ivanova (2012) confirms this finding.

#### **3.6.2 Social protection level**

The level of social protection offered by a country can influence households savings' behavior. The relevance of this determinant is investigated using public health expenditures (IMF, 2013; Tressel and Wang, 2014) or the gross unemployment replacement rate (Ivanova, 2012). IMF (2013) and Tressel and Wang (2014) show that higher public health expenditures significantly lower the current account by reducing the need for precautionary savings. Relying on the gross unemployment replacement rate to proxy social protection policy, Ivanova (2012) finds a somewhat different result. She provides evidence that a rise in this variable improves the current account arguing that it encourages precautionary savings.<sup>20</sup>

#### **3.6.3 Structural rigidities**

The presence of structural rigidities in the labor market plays on firms' incentive to invest in the home economy. Substantial rigidities can discourage foreign investment and then improve current account balance. In the empirical literature, investigation concerning this determinant receives only little attention. This channel has been explored by Barnes et al. (2010) using the Non Accelerating

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<sup>18</sup>Ricardian equivalence (Ricardo, 1817 and Barro, 1974) sets that the effect of a rise in the government budget balance can be offset by private households' reaction. In fact, under several assumptions, they rise their savings to face the future increase in taxations coming from the present increasing deficit.

<sup>19</sup>Generally, the presence of Ricardian behavior is empirically confirmed as the government budget balance's coefficient is frequently below 1.

<sup>20</sup>She argued that, according to the empirical literature, increasing gross unemployment replacement rate leads to higher unemployment rate and increases the probability of becoming unemployed. Hence, to face this rising risks households, augment their savings.

Inflation Rate of Unemployment (NAIRU) to proxy for the structural rigidities. As expected, they find that a rise in the NAIRU helps to ameliorate the external position.

### 3.7 Macroeconomic uncertainty

While macroeconomic uncertainty seems to be considered as a quite new current account determinant;<sup>21</sup> Gosh and Ostry (1997) have already proposed a model allowing to deal with its effects. They show that a rise in uncertainty about "national cash flow" increases precautionary savings improving in turn the current account.

#### 3.7.1 Standard deviation of the real GDP

From an empirical point of view, Fogli and Perri (2015) measure uncertainty as the standard deviation (SD) of countries' quarterly real GDP from the average of SD over a ten years interval,<sup>22</sup> while Brzozowski and Prusty (2013) use simply the SD of real GDP growth. Fogli and Perri (2015) show that a rise in volatility relatively to the trading partners improves countries' NFA position. Their empirical result is also encompassed in a standard macroeconomic model allowing for precautionary motive. Brzozowski and Prusty (2013) find a somewhat similar result on a sample of 19 OECD countries, higher uncertainty improving the current account position.

#### 3.7.2 Terms Of Trade (TOT) volatility

TOT volatility<sup>23</sup> can be used to proxy macroeconomic uncertainty. This determinant impacts the current account through several mechanisms. Households facing more volatile TOT might save more for precautionary reasons in order to smooth their consumption streams (Chinn and Prasad, 2003). In the same time, domestic investment can decrease as higher uncertainty is synonym of riskier investment. Moreover, countries facing volatile TOT are also less attractive to capital flows. All in all, a positive sign is expected for this variable. In the empirical literature, only mixed evidence for this determinant is present. Chinn and Prasad (2003) find that higher TOT volatility worsens the current account position, while Chinn et al. (2013) show that the external position is unaffected.

### 3.8 Trade integration

Trade integration covers several aspects which are able to affect current account dynamics. It can influence the capacity of a country to repay its external debt and its vulnerability to external shocks. In the following, we review the main variables used to investigate the relevance of trade integration.

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<sup>21</sup>Besides the variables detailed in the following, note that macroeconomic uncertainty can also be measured using the Jurado et al. (2015) index and the VXO stock market volatility index of Bloom (2009).

<sup>22</sup>In the next section, we detail the computation of the uncertainty proxy proposed by Fogli and Perri (2015).

<sup>23</sup>TOT volatility is generally computed as the standard deviation of the TOT index as in Chinn and Prasad (2003). It can also be estimated using a Generalized AutoRegressive Conditional Heteroskedasticity (GARCH(1,1)) model (see Bleaney and Greenaway, 2001).

### 3.8.1 Terms Of Trade

The use of the Terms Of Trade (TOT)<sup>24</sup> as a current account determinant relies upon the well-known Harberger-Laursen-Metzler (HLM hereafter) effect (1950). Considering a small Keynesian open economy, they show that a rise in TOT improves the current account: an amelioration in TOT increasing domestic output, it leads to a rise in private savings because of a propensity to consume less than unity. Considering a large number of small open economies, Otto (2003) finds support for the HLM effect. On the contrary, Bouakez and Kano (2008) show no significant effect of TOT fluctuations on the current account in Australia, Canada and the United Kingdom.<sup>25</sup>

### 3.8.2 Trade openness

Higher trade openness can be interpreted as lifting trade barriers which increase countries' attractiveness and investment opportunities (Gomes et al., 2017). Furthermore, Chinn and Prasad (2003) argue that more opened economies have higher capacity to generate foreign exchange earnings through exports, signaling a better ability to service external debt. Thus trade openness' sign is ambiguous because of these two opposite effects. In the empirical literature, it is shown that the second effect prevails over the first one, as a rise in openness improves current account balances (see Chinn and Ito, 2008; Lane and Milesi-Ferretti, 2012 and Gnimmassoun and Mignon, 2015 among others).

## 3.9 Institutional quality

Quality of institutions can impact the current account by affecting domestic savings, but also domestic and foreign investment. Several mechanisms are at play. An improvement in institutional quality should increase countries' attractiveness for foreign investments (Gnimmassoun, 2015). Moreover, better protection of property rights can worsen the current account balance as it reduces uncertainty (Ciocyte and Rojas-Romagosa, 2015) diminishing the need for precautionary savings. Following De Santis and Lührmann (2008), Ca' Zorzi et al. (2012) argued that a positive sign is expected for this determinant as "legal rights, functioning markets and efficient institutions should all ease access to international capital markets". From an empirical point of view, civil liberties are used to measure institutional quality (see Ca' Zorzi et al., 2012; Gnimmassoun, 2015). Relying on a BMA approach, Ca' zorzi et al. (2012) provide evidence that civil liberties constitute a robust current account determinant and is positively signed. Hence, according to them, better institutional quality helps to improve current account position.

## 3.10 Oil dependency

Countries' oil dependency can affect the current account as oil balance is one of its components. This determinant should also have a differentiated impact depending whether the economy under consideration is a net-oil importer, or net oil-exporter. Using a BMA approach, Ca' zorzi et al. (2012) and Moral-Benito and Roehn (2016) show that oil balance belongs to the robust current account drivers.

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<sup>24</sup>Terms of trade are defined as the ratio of export prices to import prices.

<sup>25</sup>See Singh (2007) for a survey on intertemporal optimizing models of trade and current account balances.



This findings is confirmed by several studies (Decressin and Stavrev, 2010; Gossé and Serranito, 2014; Gnimassoun and Mignon, 2015) showing that an amelioration in the oil balance improves the current account. As highlighted above, it is essential to distinguish between net exporters and importers.<sup>26</sup> For net oil exporters (resp. importers), a rise in the oil price translates into an increase (resp. decrease) in oil balance, improving (resp. worsening) in turn their current account position. Considering a panel of 91 countries over the period 1984-2009, Hufington (2015) provides evidence that net oil exports are a significant factor in explaining current account surpluses, but that net oil imports influence current account deficits only for relatively rich countries. Finally, it is worth mentioning that, as noticed by Couharde et al. (2014), the effect of oil price on oil exporters' current account depends on the degree of financial development.

### **3.11 Dummy variables**

In the empirical literature, dummy variables are sometimes used to control for the occurrence of different events such as financial crises and major structural changes. In the following, we briefly present the main dummies used and their relevance.

#### **3.11.1 Euro area**

To control for the effect of the adoption of the euro and the adhesion to the EMU, Barnes et al. (2010) and Jaumotte and Sodwisroom (2010) use several dummy variables in their regressions. Barnes et al. (2010) show that the adoption of the euro by the peripheral countries boosts their deficits, while there is no significant effect for the core countries.<sup>27</sup> Jaumotte and Sodwisroom (2010) find a similar result on the first group of countries, but provide evidence that euro's adoption by Northern countries has significantly negatively impacted their current accounts. They also show that adhesion to the EMU improves current account balances for Northern countries, while there is no effect for Southern economies.

#### **3.11.2 Financial and banking crises**

On the one hand, financial and banking crises impact negatively the current account by affecting countries' ability to finance their external deficits (Ca'zorzi et al., 2012). On the other hand, they can disrupt the access to capital markets and improve the current account balance (Lane and Milesi-Ferretti, 2012). Hence, the sign expected for this determinant is ambiguous. According to Kamin and Gruber (2007), the occurrence of financial crises significantly lowers the current account.

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<sup>26</sup>See Morsy (2009) for the current account determinants specific to oil-exporting countries.

<sup>27</sup>Barnes et al. (2010) used the following classification for core and peripheral countries:

Core countries: Austria, Belgium, France, Germany, Italy, Luxembourg and the Netherlands.

Euro peripheral: Finland, Greece, Ireland, Portugal, Slovak Republic and Slovenia.

## 4 Data and methodology

### 4.1 Empirical strategy

In the empirical strategy detailed below, the procedure used to compute current account imbalances is applied to the 1980-1998 and 1999-2016 sub-samples. The same holds for the panel unit root tests and the estimation of PVAR models.

#### 4.1.1 Current account imbalances computation

##### First step : Selection of the robust current account determinants

As illustrated by our overview of the potential current account determinants, there is substantial uncertainty surrounding model's specification. To tackle this uncertainty, we rely on the Bayesian Model Averaging (BMA) procedure to select the most relevant variables.<sup>28</sup> The determinants found to be robust are then used in the second step. We consider two sub-samples (1980-1998 and 1999-2016) as the switch to the euro, as well as the modification of the macroeconomic environment faced by countries are likely to modify the forces beyond the current account dynamic. Hence, using results issued from the application of the BMA approach over the whole period can lead to misleading results for both sub-periods.

##### Second step: Structural current account regressions

As highlighted in the literature (Lane and Milesi-Ferretti, 2012; Cheung et al., 2013; Gninaou, 2015; Gninaou and Mignon, 2015), it is not the evolution of the current account which matters but its deviation from its equilibrium level. Thus, we compute the medium term equilibrium level after having regressed the current account on its determinants obtained from the previous step:

$$CA_{it} = \alpha + f_t + \beta X_{it} + \epsilon_{it} \quad (7)$$

$i$  stands for country and  $t$  for time.  $CA_{it}$  denotes the current account (in % of GDP),  $X_{it}$  is the vector of current account determinants,  $f_t$  is temporal dummy variable and  $\epsilon_{it}$  is an i.i.d error term.

Following the usual practice in the context of current account regressions, equation (7) is estimated relying on the pooled Ordinary Least Squares (OLS) estimator (see Chinn and Prasad, 2003; Chinn and Ito, 2007; Gruber and Kamin, 2007; Lane and Milesi-Ferretti, 2012; Gninaou and Mignon, 2015 and Coulibaly, Gninaou and Mignon, 2018 among others).<sup>29</sup> This estimator is widely used because, as shown by Chinn and Prasad (2003), a substantial part of current account variations arises from cross-section variations. In such context, using the within estimator is inadequate as it sweeps out these variations by removing the cross-sectional means. Another important feature is the presence of strong current account autocorrelation (IMF, 2013) which could affect our results if not properly taken into account. Following the IMF (2013) and Moral-Benito and Viani

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<sup>28</sup>The methodological choices as well as the list of determinants retained are detailed in the next subsection.

<sup>29</sup>See Desbordes et al. (2018) for a discussion on the relevance to pool individuals in the context of current account regressions.

(2017), we use the Feasible Generalized Least Squares (FGLS) estimator with an AR(1) autocorrelation structure for the error term.<sup>30</sup>

### Third step : current account equilibrium computation

The third step of our empirical strategy consists to compute the current account equilibrium using the results from the FGLS estimations.<sup>31</sup> The current account medium term equilibrium level, denoted  $\overline{CA}_{it}$  is computed as follows :

$$\overline{CA}_{it} = \widehat{\beta}^{FGLS} * Z_{it} \quad (8)$$

$\widehat{\beta}^{FGLS}$  is the estimated vector of coefficients of the current account determinants and  $Z_{it}$  denotes the significant current account determinants.

### Fourth step : Current account imbalances computation

The last step involves the computation of current account imbalances, denoted  $CA_{it}^D$ . Using results from the previous step, we get:

$$CA_{it}^D = CA_{it} - \overline{CA}_{it} \quad (9)$$

As the current account disequilibrium is viewed as a temporary process, the current account imbalance is normalized so that its mean equals 0 over the period under consideration.

## 4.2 Methodology

### 4.2.1 Bayesian Model Averaging (BMA) procedure

The starting point of the BMA methodology is to consider a linear regression model as follows:

$$Y = X\beta + \epsilon \quad (10)$$

Where  $Y$  is the vector of the dependent variable,  $X$  the matrix of explanatory variables and  $\beta$  ( $q \times 1$ ) contains the  $q$  parameters to be estimated.  $\epsilon$  stands for the error term which is i.i.d and normally distributed. Assuming that it is possible to set some components of  $\beta$  to be equal to zero, there is a set of  $2^q$  candidate models to be estimated indexed by  $M_j$  for  $j=1, \dots, 2^q$ . The posterior distribution for  $\beta$  given the data  $D$ , denoted as  $P(\beta|D)$ , calculated using  $M_j$  is computed as follows:

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<sup>30</sup>To deal with current account autocorrelation, its lagged value can be used as a regressor. However, inclusion of the lagged endogenous variable leads to the well-known Nickell's bias (1981) and also to potential endogeneity issues. To deal with the first issue, estimators correcting for this bias can be used (see Kiviet, 1995 for example). Although correcting for Nickell's bias, such estimators do not correct for endogeneity issues and, most importantly, endogeneity issues may arise as the lagged current account and its determinants are included in the same regression. This potential endogeneity issue can be solved relying on the Generalized Method of Moments (see Arellano and Bond, 1991; Arellano and Bover, 1995 and Blundell and Bond, 1998). Given our panel, this methodology is not appropriate as it is mostly designed for panel data where the individual dimension is superior to the temporal one.

<sup>31</sup>We exploit the results arising from the FGLS estimator, rather than the pooled OLS estimator as the former allows us to take into account autocorrelation in the current account.

$$P(\beta|D) = \sum_{j=1}^{2^q} P(\beta|D, M_j)P(M_j|D) \quad (11)$$

$P(M_j|D)$  is the posterior model probability for model  $j$ , given data  $D$ .

As can be seen from equation (11), the posterior density is a weighted average of the posterior model probabilities for all models including a given variable weighted by the posterior model probability for all models.

Using Bayes rule and for a given prior model probability ( $P(M_j)$ ), the posterior model probability for model  $M_j$  is given by :

$$P(M_j|D) = \frac{P(D|M_j)P(M_j)}{\sum_{j=1}^{2^q} P(D|M_j)P(M_j)} \quad (12)$$

This posterior model probability for a given model can be seen as a measure of relative data fit (Moral-Benito and Roehn, 2016) and is used to compute the posterior inclusion probability (PIP). More specifically, it is computed as the sum of the posterior models' probabilities for all the models including a variable  $X_k$  :

$$PIP = P(\beta_k \neq 0|D) = \sum_{\beta_k \neq 0} P(M_j|D) \quad (13)$$

The PIP for a variable can be interpreted as the probability attached to models that include the variable  $X_k$ . To rank the potential growth determinants according to their relevance, we refer to the classification proposed by Raftery (1995).<sup>32</sup> More generally, a PIP over 0.50 indicates a robust variable.

The BMA methodology requires the specification of a prior on the model and parameter space.<sup>33</sup> Concerning the prior on the parameter space, we follow Fernández et al. (2001a) and use the Risk Inflation Criterion (RIC) and the Unit Information Prior (UIP). For the model space, we consider an uniform prior assuming that every model has the same *a priori* probability (see Fernández et al., 2001b for example). Following Ley and Steel (2009), we also specify a binomial beta prior as it allows us to reduce the sensitivity of the posterior model probabilities compared to the uniform prior (Moral-Benito, 2015).

#### 4.2.2 Panel unit root tests

The estimation of the PVAR model requires stationarity of the considered variables. We apply three different unit root tests : the Levin, Lin and Chin (LLC) test (2002), the Im, Pesaran and Shin (IPS) test (2003) and the CIPS test proposed by Pesaran (2007). LLC is a three step procedure testing the null hypothesis of unit root among each individual time series, against the alternative that each time

<sup>32</sup>According to Raftery (1995), a PIP between 0.75 and 0.95 denotes positive evidence of a regressor having an effect. A PIP between 0.95 and 0.99 denotes very strong evidence and a PIP over 0.99 denotes a decisive evidence of a regressor.

<sup>33</sup>A large panel of priors has been proposed by the literature (see Moral-Benito, 2015 for a survey).

series is stationary (Baltagi, 2008). As noted by Baltagi (2008), this test is restrictive in the sense that it is based on the assumption of homogeneity across individuals. To overcome this limit, we also perform the IPS test to be able to control for heterogeneity. While in the case of the LLC test the coefficient associated to the autoregressive coefficient is homogeneous, the IPS test allows for a heterogeneous coefficient. Under the null hypothesis, all the individuals have a unit root, while under the alternative hypothesis some individuals may have a unit root.

LLC and IPS belong to the first generation of panel unit root tests which is based upon the assumption of independence across individuals. As in practice this assumption can be violated, we also implement the CIPS test which controls for the presence of cross section dependence (CSD). The method proposed by Pesaran (2007) consists to augment the usual ADF regression with the lagged cross-sectional mean and its first-difference allowing to capture the presence of CSD. As an alternative to the CIPS test, we also ride out potential CSD by subtracting the cross section means.

### 4.2.3 Panel Vector Autoregressive approach

The PVAR model can be seen as a combination of (i) the traditional Vector Autoregressive (VAR) which treats all variables as endogenous and interdependent, and (ii) a cross-sectional units, hence allowing for unobserved individual heterogeneity. The reduced PVAR model is defined as follows :

$$Y_{it} = \alpha_i + \Gamma(L)Y_{it} + \epsilon_{it} \quad (14)$$

where  $i$  ( $i=1, \dots, N$ ) denotes the country, and  $t$  ( $t=1, \dots, T$ ) the time.  $Y_{it}$  stands for the vector of endogenous variables,  $\Gamma(L)$  represents the matrix polynomial in the lag operator  $L$ ,  $\alpha_i$  is the country fixed effects and  $\epsilon_{it}$  the vector of error terms.

A maybe strong assumption behind the PVAR model is that all individuals share the same underlying process. As in practice this assumption could be violated (Love and Zicchino, 2006), we include country fixed effects to control for unobserved heterogeneity. As we have a dynamic panel data model, the fixed effects estimator is inconsistent (see Nickell, 1981). To overcome the Nickell's bias, we use the generalized method of moments (Arellano and Bond, 1991 and Blundell and Bond, 1998) suitable for dynamic panel data specifications. This approach uses the lagged endogenous variables as well as their first difference as instruments. The fixed effects are removed using the Helmert procedure/ forward orthogonal deviation procedure (Arellano and Bover, 1995). It consists to subtract the mean of the remaining future observations available in the sample and to equalize the variance. This transformation allows us to use the lagged regressors as instruments as orthogonality between the transformed variables and lagged regressors is conserved. Moreover, to check the validity of these instruments, we apply the Hansen test. In order to be able to interpret our impulse response functions (IRF), we use the Cholesky decomposition which requires to order the VAR variables from the most exogenous to the most endogenous ones. As discussed earlier, our PVAR model encompasses three different variables: output gap ( $OG_{it}$ ), current account imbalances ( $CA_{it}^D$ )

and currency misalignments ( $MIS_{it}$ ). Considering these three variables, our PVAR model is specified as follows:

$$Y_{it} = (OG_{it}, CA_{it}^D, MIS_{it}) \quad (15)$$

Given our ordering, the output gap impacts contemporaneously the current account gap and the misalignment.<sup>34</sup> We assume that the misalignment is the most endogenous variable because as in Gnimassoun and Mignon (2015), it is jointly determined by the productivity through the Balassa-Samuelson effect, and by the external position (NFA). Thus, it depends crucially on the current account and output gap. Furthermore, we assume that the output gap affects contemporaneously the current account misalignment. This assumption is relevant as it is the excess demand booms which fuel the current account imbalances in the euro area (Sanchez and Varoudakis, 2013 and Comunale and Hessel, 2014; ), justifying the second place devoted to this variable. The optimal lag numbers are selected using the usual information criteria (AIC and BIC). Then, we derive the orthogonalized IRF and also perform a variance decomposition analysis. This latter allows us to show the percent of the variation in one variable that is explained by the shock to another variable, accumulated over time.

## 4.3 Data

### 4.3.1 The sample

Our sample is composed of eleven countries, namely Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain, which joined the EMU in 1999, except Greece in 2001. Our dataset spans from 1980 to 2016.

### 4.3.2 Current account determinants

A detailed description of the data sources and comments about the variables are available in Table 6 in appendix.<sup>35</sup> The current account position (% GDP) is extracted from the Organisation for Economic Co-operation and Development (OECD) and from the World Economic Outlook (WEO) provided by the IMF. Demographic and economic development determinants<sup>36</sup> are extracted from World Development Indicators (WDI) of the World Bank, except the ageing speed. As in Lane and Milesi-Ferretti (2012), ageing speed is defined as the difference between the prediction of the old age dependency ratio in  $t+20$  and the actual dependency ratio. The prediction of the old age dependency ratio comes from the United Nations population projections. The long term interest rate and the government budget balance are issued from the OECD. The instrumental variable for the government

<sup>34</sup>The main results are robust to changes in the variables' order retained in the Cholesky decomposition. Additional results are available upon request to the author.

<sup>35</sup>Due to data availability issues, the following current account determinants cannot be considered: financial regulation variables, gross unemployment replacement rate, health expenditures, labor productivity, M2 to GDP ratio, NAIRU, private credit to GDP ratio and ratio of minimum wage to mean wage.

<sup>36</sup>Our set of demographic and economic development determinants include the following variables: the young and old dependency ratio, the dependency ratio and the population growth, the GDP PC, the squared GDP PC and the growth rate of GDP PC.

budget balance, extracted from IMF (2013), is obtained with the following variables: lagged world cyclically adjusted fiscal balance, the exchange rate regime, the polity index, GDP per capita, lagged U.S. corporate credit spread, lagged world growth, lagged output gap, lagged world output gap, and the time average of fiscal balance.<sup>37</sup> The lagged NFA (% GDP) position is extracted from the Lane and Milesi-Ferretti database (2007). The civil liberties index comes from the Freedom House. TOT are taken from the OECD and trade openness, calculated as the sum of exports and imports (% GDP), from WDI. The financial and banking crisis dummies are constructed using the Laeven and Valencia (2012) database. Following Gruber and Kamin (2007), these dummies are set to one during the crisis year and in the two following years, and zero otherwise. A dummy to discriminate between Northern and Southern euro area countries is also created. This dummy is equal to 1 for Northern countries, 0 otherwise.<sup>38</sup> Capital account openness is extracted from Chinn and Ito (2006) database. Using Lane and Milesi-Ferretti database (2007), we compute financial integration as the sum of assets and liabilities (% GDP). To proxy macroeconomic uncertainty, we use TOT volatility and GDP relative volatility. TOT volatility is estimated using a GARCH(1,1) model (Bleaney and Greenaway, 2001). GDP relative volatility's computation follows Fogli and Perri (2015). Denoting  $s(t)$  the first quarter of year  $t$  and let  $g_{i,s}$  be the log difference of real GDP of country  $i$  between quarter  $s$  and  $s-1$ . Macroeconomic relative volatility in country  $i$  at year  $t$ , denoted as  $\sigma_{i,t}$  is computed as follows:

$$\sigma_{i,t} = \left( \sum_{j=-20}^{+20} g_{i,s(t)+j}^2 - \overline{g_{i,s(t)}} \right)^{1/2} \quad (16)$$

where  $\overline{g_{i,s(t)}} = \frac{1}{41} \sum_{j=-20}^{+20} g_{i,s(t)+j}$

GDP relative volatility, denoted  $\sigma_{i,t}^r$  is then given by:

$$\sigma_{i,t}^r = \sigma_{i,t} - \frac{1}{N(t)} \sum_{j \neq i} \sigma_{j,t} \quad (17)$$

where  $N(t)$  indicates the number of countries that have an observation for volatility in year  $t$ .

Quarterly GDP series used in the computation are from OECD.<sup>39</sup> As the indicator obtained is quarterly, we average it year by year to obtain usable series. GDP relative volatility series are displayed in Figure 3 in appendix.

Oil dependency is approximated using the oil balance (% GDP), which is computed using the net oil trade from the International Energy Agency (IEA), the crude oil prices from British Petroleum (BP) and GDP series from OECD. As noticed in the previous section, some variables have to be expressed as a deviation from the weighted average trade partners series as it is the evolution relatively to the

<sup>37</sup>This instrumental variable is only available from 1986 (1999 for Ireland) to 2013.

<sup>38</sup>The Northern countries are: Austria, Belgium, France, Finland, Germany, and the Netherlands. Southern is composed of the following economies: Italy, Ireland, Greece, Portugal and Spain.

<sup>39</sup>Due to data availability, our computation is based on the following list of commercial partners: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea republic, Luxembourg, Mexico, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom and the United States of America.

rest of the world which matters (Moral-Benito and Roehn, 2016).<sup>40</sup> For each country, we consider the top fifteen trading partners. Time-invariant weighting scheme representative of foreign trade between 2008-2012 from the Centre d'études prospectives et d'informations internationales (CEPII) is used (Couharde et al., 2018).

Concerning the data required to estimate the Equilibrium Exchange Rates (EER), we extract the REER from the EQCHANGE database (Couharde et al., 2018) as well as the proxy for the Balassa-Samuelson (BS, hereafter) effect using time invariant trade weights representative of the 2008-2012 period. Finally, output gap is taken from OECD and WEO.

### 4.3.3 Computation of currency misalignments

Currency misalignments are estimated relying on the Behavioral Equilibrium Exchange Rate (BEER) approach proposed by Clark and MacDonald (1999) based on the existence of a long run, cointegrating relationship between the REER and its long term determinants. Following Alberola et al. (1999), Alberola (2003) and Coudert et al. (2013) a stock-flow consistent model is estimated :

$$reer_{it} = \mu_i + \beta_1 rprod_{it} + \beta_2 NFA_{it} + \epsilon_{it} \quad (18)$$

Where  $\mu_i$  stands for country-fixed effects. *reer* is the logarithm of the REER. *rprod* is the logarithm of a proxy for the BS effect.<sup>41</sup> *NFA* denotes the Net Foreign Asset position (% GDP). As previously discussed, two PVAR models are estimated. Hence, in order to obtain consistent misalignments, EER are estimated over the 1980-1998 and 1999-2016 periods. As in Couharde et al. (2018), we perform the estimations relying on the Pooled Mean Group (PMG) estimator (Pesaran et al., 1999) which allows the short run coefficients and error variances to differ across countries. Results are available in Table 7 and in Figure 4 in appendix.

As shown in Table 7, the error correction term is negatively signed, as expected. Regardless of the sub-samples considered, the coefficient of the proxy for the BS effect is correctly signed, a rise in relative productivity leading to an exchange rate appreciation. The relation between NFA and REER is less clearcut with significant differences between both sub-periods. On the one hand, before the launch of the common currency, a 1% improvement in the NFA position is associated with a REER depreciation of 0.205%. Assuming that the portfolio of the home country agents is mainly composed of domestic assets, the REER can depreciate through an increasing demand for foreign currency. On the other hand, our estimation over the 1999-2016 period shows that a rise in the NFA appreciates the REER in line with Ricci et al. (2013)'s findings. Considering an economy intertemporal budget constraint, an improvement in the NFA resulting in a build-up of current account surplus has to be associated with an appreciation of the currency to restore equilibrium through an adjustment of the trade balance. Finally, our results also point out a faster adjustment toward equilibrium over the pre-euro area period.

<sup>40</sup>See Table 6 in appendix for the list of variables computed in relative terms.

<sup>41</sup>The BS effect is proxied using countries' relative GDP PC in PPP (see Couharde et al., 2018).



## 5 Econometric results

Section 5.1 presents the findings of the BMA analysis. Section 5.2 discusses the current account regressions results and the computation of the current account imbalances is presented in Section 5.3. Finally, we display in Section 5.4 the results of our PVAR estimations and examine them.

### 5.1 BMA results

#### 5.1.1 BMA results: 1980-1998 period

Table 1 below displays the results of the BMA methodology over the 1980-1998 period.

**Table 1 - Posterior Inclusion Probabilities: 1980-1998**

Model prior	Random	Random	Fixed	Fixed	Uniform
Parameter prior	UIP	RIC	UIP	RIC	UIP
Posterior Inclusion Probability					
GDP relative volatility	<b>1.000<sup>a</sup></b>	<b>1.000<sup>a</sup></b>	<b>1.000<sup>a</sup></b>	<b>1.000<sup>a</sup></b>	<b>1.000<sup>a</sup></b>
Oil balance	<b>1.000<sup>a</sup></b>	<b>0.999<sup>a</sup></b>	<b>0.999<sup>a</sup></b>	<b>0.999<sup>a</sup></b>	<b>0.999<sup>a</sup></b>
Government budget balance	<b>0.691</b>	<b>0.696</b>	<b>0.570</b>	<b>0.572</b>	<b>0.699</b>
Lagged NFA	<b>0.687</b>	<b>0.689</b>	<b>0.654</b>	<b>0.652</b>	<b>0.702</b>
Population growth	<b>0.659</b>	<b>0.668</b>	<b>0.500</b>	0.493	<b>0.661</b>
Real interest rate	<b>0.531</b>	<b>0.545</b>	0.293	0.298	<b>0.532</b>
GDP PC	<b>0.525</b>	<b>0.543</b>	0.226	0.235	<b>0.524</b>
Dependency ratio	0.473	0.493	0.273	0.277	0.469
Squared GDP PC	0.424	0.446	0.149	0.149	0.427
Kaopen	0.398	0.412	0.192	0.195	0.423
Young dependency ratio	0.386	0.378	0.283	0.285	0.392
TOT	0.369	0.378	0.192	0.190	0.381
Crisis	0.361	0.363	0.215	0.218	0.367
Old dependency ratio	0.291	0.301	0.171	0.183	0.295
Ageing speed	0.269	0.277	0.090	0.099	0.270
TOT volatility	0.227	0.231	0.109	0.101	0.232
Openness	0.212	0.214	0.108	0.099	0.210
Growth	0.170	0.169	0.063	0.064	0.168
Financial integration	0.168	0.175	0.075	0.083	0.179
Civil liberties	0.161	0.163	0.061	0.062	0.176
Euro dummy	0.153	0.152	0.058	0.055	0.155

*Note:* The results are based on 100.000 burn-ins and 200.000 draws. Simulations are made using birth-death MCMC sampler. "a" denotes a PIP over 0.99 and decisive evidence of a regressor. Numbers in bold denote PIP over 0.50 and evidence of robustness. RIC=Risk Inflation Criterion. UIP= Unit Information Prior. We use the BMS (Feldkircher and Zeugner, 2015) package.

Among our initial set of twenty one current account determinants, seven emerge as robust, i.e. having a PIP over 0.50. Our estimations provide very strong support for including GDP relative volatility, while TOT volatility presents a very low PIP. We confirm the decisive role of the oil balance in the current account dynamic as previously evidenced (Ca'zozzi et al., 2012; Gnimassoun, 2015 and Moral-Benito and Rohen, 2016) with a PIP almost equals to 1 in the different specifications. Our estimations also corroborate the great influence of the government budget balance and lagged NFA. Considering the set of demographic determinants, population growth appears as the only relevant

one. We also find support for the long term interest rate as it displays a PIP over 0.50 in three of our five specifications. Our initial set of potential determinants also includes variables related to countries' economic development. Among them, only GDP PC appears as a robust variable, while the influence of the relative income (squared and growth) is not supported. Furthermore, during the pre-euro area period, TOT and openness do not belong to the decisive current account determinants. The relevance of the financial development channel is also invalidated as illustrated by the small PIP of capital account openness and financial integration. Moreover, the BMA methodology infirms the influence of the financial and banking crises. Finally, the euro area dummies and the civil liberties index are the two variables displaying the lower PIP.

### 5.1.2 BMA results: 1999-2016 period

Table 2 below displays our results regarding the 1999-2016 period.

**Table 2 - Posterior Inclusion Probabilities: 1999-2016**

Model prior	Random	Random	Fixed	Fixed	Uniform
Parameter prior	UIP	RIC	UIP	RIC	UIP
Posterior Inclusion Probability					
Population growth	<b>1.000<sup>a</sup></b>	<b>1.000<sup>a</sup></b>	<b>1.000<sup>a</sup></b>	<b>1.000<sup>a</sup></b>	<b>1.000<sup>a</sup></b>
Lagged NFA	<b>0.997<sup>a</sup></b>	<b>0.996<sup>a</sup></b>	<b>0.995<sup>a</sup></b>	<b>0.995<sup>a</sup></b>	<b>0.997<sup>a</sup></b>
Government budget balance	<b>0.982<sup>a</sup></b>	<b>0.978<sup>a</sup></b>	<b>0.972<sup>a</sup></b>	<b>0.964<sup>a</sup></b>	<b>0.982<sup>a</sup></b>
Young dependency ratio	<b>0.981<sup>a</sup></b>	<b>0.983<sup>a</sup></b>	<b>0.945<sup>b</sup></b>	<b>0.945<sup>b</sup></b>	<b>0.986<sup>b</sup></b>
GDP relative volatility	<b>0.929<sup>b</sup></b>	<b>0.926<sup>b</sup></b>	<b>0.784<sup>b</sup></b>	<b>0.801<sup>b</sup></b>	<b>0.929<sup>b</sup></b>
Openness	<b>0.907<sup>b</sup></b>	<b>0.904<sup>b</sup></b>	<b>0.775<sup>b</sup></b>	<b>0.769<sup>b</sup></b>	<b>0.898<sup>b</sup></b>
Oil balance	<b>0.688</b>	<b>0.665</b>	0.374	0.358	<b>0.674</b>
Old dependency ratio	<b>0.672</b>	<b>0.656</b>	<b>0.641</b>	<b>0.624</b>	<b>0.662</b>
Squared GDP PC	<b>0.609</b>	<b>0.606</b>	0.340	0.342	<b>0.614</b>
Dependency ratio	<b>0.602</b>	<b>0.608</b>	0.445	0.454	<b>0.599</b>
Ageing speed	<b>0.578</b>	<b>0.563</b>	0.224	0.214	<b>0.577</b>
Crisis	<b>0.552</b>	<b>0.549</b>	0.249	0.271	<b>0.561</b>
Kaopen	<b>0.526</b>	<b>0.528</b>	0.275	0.275	<b>0.523</b>
GDP PC	0.469	0.456	0.220	0.216	0.440
Real interest rate	0.431	0.417	0.115	0.116	0.423
Financial integration	0.398	0.391	0.105	0.113	0.410
TOT volatility	0.341	0.335	0.093	0.095	0.343
TOT	0.326	0.317	0.093	0.091	0.327
Growth	0.295	0.292	0.090	0.091	0.296
Euro dummy	0.275	0.275	0.071	0.066	0.271
Civil liberties	0.273	0.275	0.079	0.065	0.285

*Note:* The results are based on 100.000 burn-ins and 200.000 draws. Simulations are made using birth-death MCMC sampler. "<sup>a</sup>" denotes a PIP over 0.99 denotes and decisive evidence of a regressor. "<sup>b</sup>" indicates a PIP between 0.75 and 0.95 denoting a positive evidence of a regressor having an effect. Numbers in bold denote PIP over 0.50 and evidence of robustness. RIC=Risk Inflation Criterion. UIP= Unit Information Prior. We use of the BMS (Feldkircher and Zeugner, 2015) package.

A first striking result is the presence of both notable similarities and divergences between the two sub-periods. Such differences, hence, confirm our methodological choice. We start our discussion by highlighting the similarities between the two sub-periods under consideration. As previously,

we find support for the inclusion of government budget balance, lagged NFA, population growth and GDP relative volatility. All these determinants have a PIP over 0.75 confirming their relevance. Moreover, three of these four variables present significantly higher PIP than on the period 1980-1998. Again, the oil balance robustness is confirmed by our estimations as this determinant has a PIP over 0.50 in three of our five specifications.

One major difference with the previous estimations is the disparition of the long term interest rate and GDP PC as decisive current account determinants. They displayed a PIP ranging from 0.115 to 0.469. Contrary to the pre-EMU period, the young dependency ratio and the openness ratio have a strong influence on the external position. This result is in line with Moral-Benito and Roehn (2016) who also provide strong support for the trade integration channel. We note the proliferation of variables having a PIP over 0.50 as soon as a fixed prior for the model space is not considered. More precisely, among our initial set of determinants, thirteen fulfill this criterion.<sup>42</sup> Thus, our results provide indication of robustness for the demographic channel as illustrated by the PIP of the ageing speed, dependency ratio and old dependency ratio. Finally, contrary to the pre euro-period, the capital account openness and the crisis dummy seem to constitute relevant variables as illustrated by their PIP.

## 5.2 Current account regressions

To investigate the robustness of our findings to potential endogeneity issues, we consider three different specifications. Our first specification includes all the determinants obtained thanks to the BMA methodology, except GDP relative volatility. Indeed, as shown by Fogli and Perri (2015) this variable is a driver of NFA leading to a potential model misspecification if both variables are included simultaneously.<sup>43</sup> Our second specification augments the first one with the GDP relative volatility. Finally, as stressed by the IMF (2013) and Fair (2017), the government budget balance is suspected to be an endogenous regressor. To tackle this potential endogeneity, our third specification replaces the government budget balance with its instrumental variable provided by the IMF (2013). These three different models are estimated relying on pooled OLS and FGLS estimators.

### 5.2.1 Current account regressions: 1980-1998 period

Table 3 below presents the results of our current account regressions for the 1980-1998 period. Our first specification shows that only lagged NFA is a significant current account determinant. Its significance and effect are almost unaffected by the inclusion of GDP relative volatility. Indeed, considering our first specification, a 1% increase in the lagged NFA improves the current account position by 0.067% against 0.077% if GDP relative volatility is included. Our results are consistent with Gnimasoun and Mignon (2015)'s findings who get a coefficient equals to 0.055 for this variable. Thus, the interaction between lagged NFA and GDP relative volatility seems not to be a crucial issue.

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<sup>42</sup>The relevance of the inclusion of all these variables in our regressions is discussed further in the article.

<sup>43</sup>This misspecification is likely to be mitigated as we use the lagged NFA rather than its present value.

Furthermore, strong evidence in favor of the uncertainty channel is supported by results in columns (2), (3), (5) and (6) showing that GDP relative volatility worsens the current account position. This result contradicts Fogli and Perri (2015)'s findings showing that higher uncertainty leads to an improvement in the NFA position.<sup>44</sup> However, our result is consistent with Chinn and Prasad (2003) highlighting that TOT volatility improves the current account position for a sample industrialized economies.

**Table 3 - CA regressions 1980-1998**

	Pooled OLS	Pooled OLS	Pooled OLS	FGLS	FGLS	FGLS
	(1)	(2)	(3)	(4)	(5)	(6)
Government budget balance	0.0511 (0.0377)	0.0248 (0.0345)		0.0462** (0.0194)	<b>0.0428**</b> (0.0186)	
Instrumental variable			0.0365 (0.140)			0.0331 (0.0816)
Lagged NFA	0.0677*** (0.0119)	0.0777*** (0.0119)	0.0679*** (0.0165)	0.00576 (0.0107)	0.0111 (0.00988)	-0.0167 (0.0104)
Relative volatility		-0.0586*** (0.0117)	-0.0543*** (0.0134)		<b>-0.0440***</b> (0.0125)	0.0454*** (0.00601)
Oil balance	0.386 (0.314)	0.415 (0.315)	-0.835 (0.638)	0.942*** (0.187)	<b>0.996***</b> (0.183)	1.778*** (0.508)
Population growth	-0.155 (0.243)	-0.461 (0.290)	-0.219 (0.377)	0.0712 (0.118)	-0.0579 (0.117)	-0.0525 (0.103)
GDP PC	0.0355 (0.0990)	0.0671 (0.0961)	0.230* (0.125)	0.0828*** (0.0293)	<b>0.0706**</b> (0.0290)	0.0502** (0.0251)
Real interest rate	-0.0548 (0.112)	-0.0919 (0.106)	-0.365** (0.148)	-0.109*** (0.0405)	<b>-0.110***</b> (0.0402)	-0.112*** (0.0319)
Constant	2.896*** (1.095)	3.204*** (1.107)	0.528 (1.238)	0.161 (0.297)	0.333 (0.304)	1.095* (0.571)
Observations	209	209	127	209	209	90
R-squared	0.401	0.445	0.317			
Number of countries	11	11	11	11	11	10
Time series dummies	YES	YES	YES	YES	YES	YES

Note: \*\*\*, \*\*, and \* denote the levels of statistical significance at 1, 5, and 10%, respectively. Robust standard errors are reported in parentheses. Coefficients in bold denote estimations used in the computation of the current account imbalances.

Once government budget balance endogeneity is addressed, GDP PC and long term interest rate become significant current account drivers (see column (3)) presenting the expected sign.<sup>45</sup> In line with previous studies (Chinn and Ito, 2008; Barnes et al., 2010), our third specification shows that higher GDP PC is associated with an improvement in the current account position as richer countries tend to run current account surpluses. Contrary to Barnes et al. (2010), a higher long term interest rate lowers the current account. From a theoretical perspective, this result suggests the dominance of the income effect over the wealth and substitution effects discussed in the third section. Surprisingly, considering regressions (1) and (2), the government budget balance and the oil balance are not corre-

<sup>44</sup>To our best knowledge, this is the first time that this proxy is used in current account regressions.

<sup>45</sup>It is difficult to know if this difference between the second and third estimations comes from endogeneity as the instrument substantially reduces the number of observations available for this sub-period.

lated with the current account. After having addressed the issue of autocorrelation (columns (4) and (5) ), both determinants turn out to be significant. A 1 % increase in the government budget balance relatively to the main trading partners improves the current account position by 0.0428 %. As Jau-motte and Sodsriwiboon (2010), Gossé and Serranito (2014) and Gnimassoun and Mignon (2015), an improvement in the oil balance has a positive effect on the external position. We also find evidence of a very strong effect for this determinant, a 1% increase in the oil balance enhances the current account by 0.966% consistent with the consequent crude oil price fluctuations over the 1980-1998 period. Indeed, the sharp decrease of crude oil prices between 1985 and 1986 improves significantly the oil balance of euro area countries (see Figure 5 in appendix), allowing them to ameliorate their current account position. Finally regressions (1) to (6) show no significant effect of population growth on the current account position.

### 5.2.2 Current account regressions : 1999-2016 period

Table 4 displays the results associated with the current account regressions on the post-euro period.

**Table 4 - CA regressions 1999-2016**

	Pooled OLS	Pooled OLS	Pooled OLS	FGLS	FGLS	FGLS
	(1.1)	(2.2)	(3.3)	(4.4)	(5.5)	(6.6)
Government budget balance	0.600** (0.235)	0.541*** (0.187)		0.0317 (0.0396)	<b>0.0892**</b> (0.0448)	
Instrumental variable			0.918*** (0.198)			0.619*** (0.119)
Lagged NFA	0.0230** (0.00920)	0.0285*** (0.00719)	0.0356*** (0.0110)	-0.00619 (0.00437)	<b>0.00959*</b> (0.00491)	-0.00444 (0.00403)
GDP relative volatility		-0.116*** (0.0217)	-0.0682*** (0.0237)		<b>-0.0575***</b> (0.0140)	-0.0683*** (0.00898)
Population growth	-1.270*** (0.373)	-2.413*** (0.444)	-2.095*** (0.419)	-0.316** (0.132)	<b>-0.691***</b> (0.175)	-0.902*** (0.122)
Young dependency	-0.384*** (0.0997)	-0.220** (0.0888)	-0.269** (0.118)	-0.0316 (0.0204)	-0.0235 (0.0237)	-0.0612*** (0.0201)
Openness	0.0850*** (0.0235)	0.0323 (0.0212)	0.0426* (0.0251)	0.00443 (0.00550)	-0.00104 (0.00631)	0.00729 (0.00445)
Constant	6.524*** (1.353)	8.302*** (1.212)	5.229*** (1.474)	2.150*** (0.301)	5.059*** (0.323)	4.165*** (0.341)
Observations	198	198	165	198	198	165
R-squared	0.386	0.496	0.531			
Number of countries	11	11	11	11	11	11
Time series dummies	YES	YES	YES	YES	YES	YES

Note: \*\*\*, \*\*, and \* denote the levels of statistical significance at 1, 5, and 10%, respectively. Robust standard errors are reported in parentheses. Coefficients in bold denote estimations used in the computation of the current account imbalances.

As the number of variables found to be robust is high, we follow Desbordes et al. (2018) and consider as relevant only determinants with a PIP over 0.75. The justification behind this methodological choice is twofold. First of all, our preference goes to a more parsimonious specification as it allows us to track more easily the origins of the current account equilibrium's evolution. Secondly, the inclusion of this large set of variables can also be the source of high colinearity between our regressors

especially the demographic ones. Using them simultaneously is a major issue as the dependency ratio is directly used in the computation of the ageing speed.

As previously, the interaction between lagged NFA and relative volatility does not affect the effect of lagged NFA (see columns (1.1) and (2.2) ). As discussed earlier, a higher GDP relative volatility lowers the current account position. Compared to the previous estimations, the effect of the uncertainty channel is greater after the euro's inception with a coefficient ranging from -0.0575 to -0.116. The regression (2.2) shows that all our variables are significant except openness, which becomes significant as soon as endogeneity is tackled. In line with Chinn and Prasad (2003)'s intuition, a higher openness relatively to the main trading partners improves the current account position by 0.0426%. This regression also shows that a 1 % increase in the population growth leads to a deterioration of the current account of 2.413%.<sup>46</sup> The young dependency ratio is negatively correlated with the external position because of the low propensity to save among the very young. Compared to our estimation on the pre-euro area period, we evidence a stronger effect of the government budget balance consistent with Katrakilidis and Trachanas (2013) and Litsios and Pilbeam (2017)'s findings. A 1% increase in the government budget balance, relatively to the main trading partners, improves the current account by 0.0892% (0.0428% for the pre-euro period). More interestingly, our results are robust to potential endogeneity arising from the government budget balance. Indeed, our variables remain significant and their coefficients are not strongly affected by this issue. Finally, the government budget balance instrumental variable displays high significance among our different regressions (columns (3.3) and (6.6)).

### 5.3 Current account imbalances computation

#### 5.3.1 Current account imbalances before the launch of the euro

As detailed in the empirical strategy, the current account equilibrium is computed as follows:

$$\overline{CA}_{it} = \widehat{\beta^{FGLS}} * Z_{it}$$

Using the results from column (5) extracted from Table 3, we get:

$$\begin{aligned} \overline{CA}_{it} = & 0.0428 * Gov_{it} - 0.0440 * Volatility_{it} + 0.996 * Oilb_{it} + 0.0706 * GDP PC_{it} \\ & - 0.110 * rir_{it} \end{aligned} \quad (19)$$

Where GOV denotes the government budget balance, Volatility the GDP relative volatility, Oilb the oil balance, and rir the real interest rate. The current account position, its equilibrium level and the corresponding misalignment values are available in Figure 6 in appendix. We also display the evolution of the fitted fundamentals to understand the current account equilibrium's behavior. A first observation is the presence of mainly negative current account equilibrium values explained both by the fundamentals' coefficients and by their values. GDP relative volatility and the long term interest rate influence negatively the current account. They also take a large majority of positive values which

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<sup>46</sup>This estimation is very close to that reported in Gninafon and Mignon (2015) who find a marginal effect ranging from a low of 2.714 to a high of 2.829.

drive the equilibrium into a negative position. Although the net lending and the oil balance display positive coefficients, they also contribute to push down the current account equilibrium because of the majority of negative values for both determinants. Only GDP PC pushes up the current account equilibrium.

Let us now briefly present the current account equilibrium evolutions common to all countries. At the beginning of the 1980s, we note the presence of high negative values ranging from -7% for Portugal to around -4% for France, explained by a strongly negative oil balance coming from the second oil shock in 1979.<sup>47</sup> Few years later, we observe a significant improvement in countries' oil balance in line with the shrink in oil prices explaining the convergence of the current account equilibrium around 0.

### 5.3.2 Current account imbalances after the launch of the euro

Using estimation in column (5.5) from Table 4, the current account equilibrium is given by:

$$\overline{CA}_{it} = 0.0892 * Gov_{it} + 0.00959 * NFA_{it} - 0.0575 * Volatility_{it} - 0.691 * popg_{it} \quad (20)$$

where  $popg$  denotes the growth rate of the population. The observed current account, its equilibrium, the current account imbalances and the fundamentals are available in Figure 7 in appendix.

As for the previous period, the large majority of current account equilibrium estimates present negative values explained by the combination of negative coefficients and positive values for the variables. The inverse combination is also relevant to understand the sign of this variable. More precisely, in addition to its positive effect, NFA mainly takes negative values except for Belgium, Germany and the Netherlands. In the same time, the government budget balance as well as the population growth rate display negative values. All in all, this contributes to the existence of a negative equilibrium.

Concerning the current account equilibrium dynamic, we note a sizeable differences between the core and the periphery. The former presents quasi-systematically lower current account equilibrium values than the latter. Greece, Portugal and Spain experience largely negative equilibrium current accounts fluctuating around 2%. Greece experiences a sharp decrease following the subprime crisis. This divergence between these two groups of countries has two main explanations. On the one hand, Southern economies have higher budget deficits pushing down their current account equilibrium. On the other hand, they also rely more on foreign economies to finance their current account deficits.

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<sup>47</sup>The crude oil price has been multiplied approximatively by 2.7 between 1978 and 1980.

## 5.4 PVAR analysis

### 5.4.1 Panel unit root tests

Panel unit root tests results are presented in Table 8 in appendix. The first generation of panel unit root tests (IPS and LLC) are suitable for a panel dataset where there is no CSD. Thus, both tests are applied on current account imbalances and currency misalignments as cross sectional mean has been removed from these variables. As shown in Table 8, LLC and IPS tests both indicate that the current account imbalances and currency misalignments are stationary on both sub-samples.<sup>48</sup>

Concerning the pre-euro area period, the CIPS test shows that the output gap is stationary, except if the model specified contains a constant. Moreover, the LLC test also indicates that the output gap is stationary. Turning to the post-euro area period, we find only low evidence of stationarity for the output gap as CIPS fails to reject the null hypothesis although the output gap is stationary on the 1980-2016 period. As soon as the first difference of the output gap is employed, our tests show that this variable is stationary. Hence, to tackle possible instability in the PVAR, we consider the first-difference of output gap in our estimations over the 1999-2016 period.

## 5.5 IRF and variance decomposition

This section is devoted to the presentation of our Panel VAR analysis results. The IRFs are available in Figure 1 below and the variance decomposition results are displayed in Table 5. Considering the pre-euro area period, the IRFs show a weakly negative effect of output gap on the current account imbalances. In other words, an economy overheating deepens the current account deficits during a very short time period explaining almost 6% of the variance. Following the euro's introduction, the role played by the demand shock is reinforced. Over the 1999-2016 period, there is evidence of a negative and more lasting effect of the output gap on external imbalances. Our findings are in line with previous studies (Lane and Pels, 2013; Phillips et al, 2013; Gnimmassoun and Mignon, 2016) and are explained in light of two sets of mechanisms. On the one hand, an economy with limited resources facing rising internal demand is expected to increase its imports because of the inability of national firms to satisfy this growing demand. Thereby, this affects negatively the current account position through the trade balance. On the other hand, an overheating is associated with lower savings and higher investment deepening the current account deficits (Phillips et al., 2013).<sup>49</sup> The switch to the euro also significantly increases the contribution of the domestic overheating to the current account disequilibria variance, allowing us to explain 10.97% of its variation. Thus, our PVAR estimation confirms the major role played by the demand channel in the build-up of external imbalances in the euro area (Comunale and Hessel, 2014). All in all, our results show an increasing vulnerability of the current account to demand shocks as euro area members lost their ability to change their interest rate.

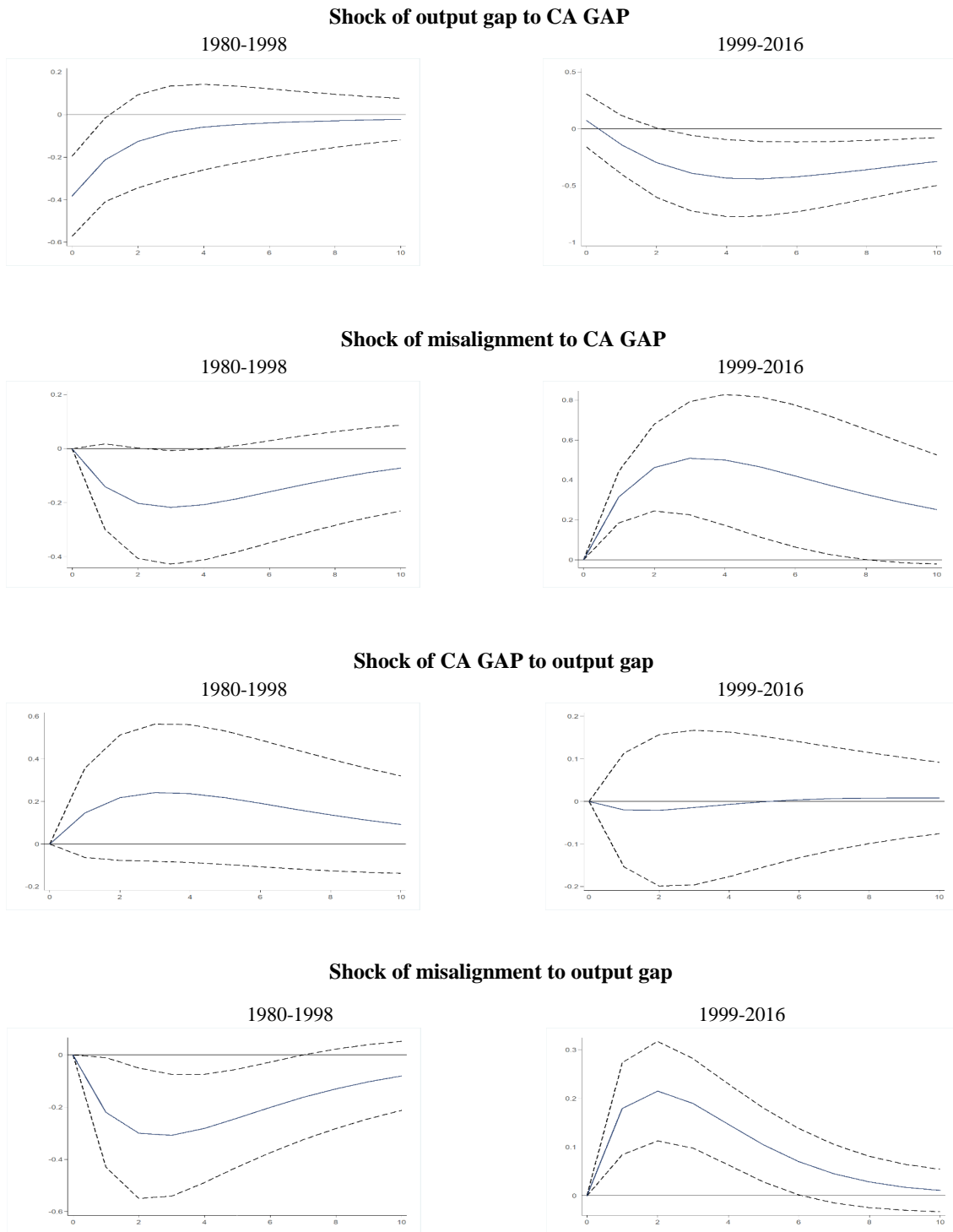
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<sup>48</sup>One exception is for the current account misalignment for which the IPS test (model with a trend and a constant) concludes to the presence of a unit root.

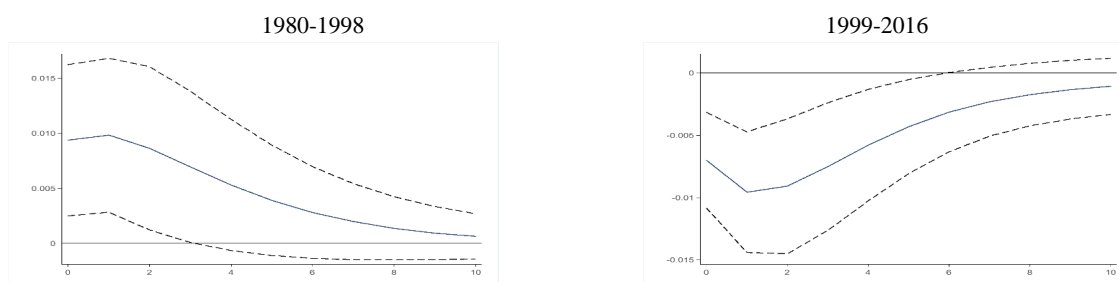
<sup>49</sup>This mechanism mainly operates through an adjustment of domestic investment which is more volatile than domestic savings.



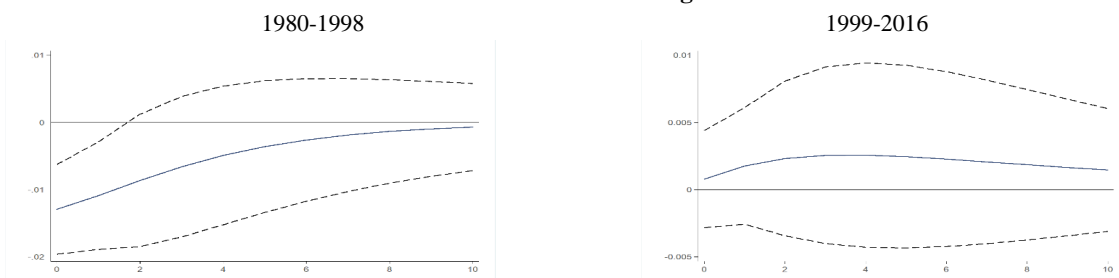
**Figure 1: Impulse Response Functions: benchmark**



### Shock of output gap to misalignment



### Shock of CA GAP to misalignment



Note: Impulse-responses are represented by solid lines. Standard-error bands (dashed lines) are generated through Monte-Carlo simulations with 1000 repetitions.

**Figure 1— Continued.**

The switch to the euro also influences drastically the adjustment of the current account to a misalignments shock. While on the 1980-1998 period, misalignments have no effect, they become the most important driving force beyond the build-up of external imbalances in the euro area explaining 12.9% of their variation. More specifically, a higher misalignment is associated with a current account improvement. Such results can not be understood in light of the trade channel which sets that a higher misalignment hurts competitiveness, affecting negatively the external position through a deterioration of the trade balance. Several arguments can be put forward to explain the reduction of the relevance of this channel for the euro area period. First of all, the launch of the common currency fosters intra-euro area trade reducing the relevance of this channel for monetary union members. Moreover, as noticed by Gaulier and Vicard (2012), current accounts and exports are very weakly correlated in the euro area. The misalignment effect on external imbalances can also operate through the investment channel. By lowering the profit margins, an overvalued currency discourages domestic investment (Gala, 2008), improving countries' external position, other things being equal.

We also investigate the interaction between the output gap and the exchange rates, useful to understand the short-run dynamic of the REER (see IMF, 2013). The period preceding the euro's inception displays a positive response of real exchange rate misalignments to an output gap shock. This variable capturing domestic demand shocks (Philips et al., 2013; Adler and Grisse, 2017), a rise in the output gap is followed by an increase in inflation pressures in the domestic economy. Thus, it appreciates the real exchange rates pushing up currency misalignments. The output gap contributes for 10% in explaining the real exchange rate misalignments. The switch to the euro drastically modifies

**Table 5 - Variance decomposition**

	<b>OG</b>	<b>CA MIS</b>	<b>MIS BEER</b>
<b>1980-1998</b>			
<b>OG</b>	0,838	0,068	0,094
<b>CA MIS</b>	0,059	0,873	0,074
<b>MIS BEER</b>	0,100	0,125	0,775
<b>1999-2016</b>			
<b>OG</b>	0,934	0,001	0,065
<b>CA MIS</b>	0,110	0,761	0,129
<b>MIS BEER</b>	0,224	0,032	0,744

*Note:* This table reports the percentage of variation in the variable in row explained by the variable in column. The figures reported are averages over 10, 20 and 30 years.

the reaction of the misalignment to a demand shock through the non-tradable sector development. Our IRF point out that an overheating reduces currency misalignments. Excessive demand in the euro area feeds mainly the non-tradable sector (Eichengreen, 2010; Gaulier and Vicard, 2012; Piton, 2018), increasing non-tradable prices (Piton, 2018). This last evolution leads to an appreciation of the REER explaining misalignment's evolution. Furthermore, the strong dependence of the REER to demand shocks in the euro period is also confirmed by our variance decomposition. An acceleration in the output gap contributes to 22.4% of the variation of the misalignment.

The abandonment of the national currencies also affects the dynamic of the external adjustment. Consistent with Freund (2005), on the pre euro area period, a current account reversal is followed by a currency depreciation. The pre-euro area period being characterized by the use of the nominal exchange rates as a macroeconomic adjustment tool in some euro area countries (Fernández-Villaverde et al., 2013; Garcìa Solanes et al., 2017), the current account adjustment can occur through a depreciation. Such adjustment is lost since the inception of the euro because of the institution of a fixed exchange rate regime between members, explaining the absence of significant reaction of the misalignment to a current account disequilibrium shock over the 1999-2016 period. The variance decomposition also confirms the disparition of adjustment through an exchange rate modification. The contribution of current account imbalances to misalignment goes from 12.5% and reduces to 3.2% over the 1999-2016 period.

As noticed by Freund (2005), a current account reversal can also operate through a growth adjustment. The pre-euro period provides evidence in favor of such adjustment as a positive shock on the external position lowers the output gap during a two years period. Over the post euro period, evidence in favor of the slow-growth process disappears as the current account disequilibrium shock

is insignificant. This finding is also illustrated by the variance decomposition analysis showing a reduction in the current account imbalances' explanation from 6.8% to approximately 0%. Concerning the misalignment effect on the output gap, we find constrained evidence. The results for the pre-EMU period are consistent with the bulk of literature studying the effect of misalignments on growth, while the post euro period is characterized by different findings. More precisely, over the 1980-1998 period, a misalignment shock lowers the output gap through the reduction of growth (see Rodrik, 2008 among others). The switch to the euro reduces the contribution of misalignments to the output gap variation, decreasing from 9.4% to 6.5%.

All in all, our results can be summarized in three key points. First, the euro's inception has significantly increased current account's vulnerability of euro area members to domestic as well as external shocks. Then, the EMU also hinders the current account adjustment as evidenced by the disparition of adjustment through the nominal exchange rate and output gap. Finally, demand shocks play an important role for the REER dynamic in the euro area.

## 5.6 Robustness checks

We investigate the robustness of our findings to the misalignment measure. As detailed previously, we rely on the BEER approach to estimate the equilibrium exchange rates. However, there is still no consensus concerning the methodology to compute exchange rates misalignments, even if in practice they correspond to the same model applied to different temporal horizons (Bénassy-Quéré et al, 2010). As an alternative to the BEER methodology, we use the Atheoretical Permanent Equilibrium Exchange Rate (APEER) approach (see Bénassy-Quéré et al., 2009) which consists in computing the equilibrium exchange rates using a Hodrick-Prescott filter. IRF and variance decomposition are available in appendix (see Figure 2 and Table 9). We start to discuss the results concerning the current account disequilibrium's reactions. Considering misalignment shocks, our results are consistent with the BEER approach. Indeed, on the pre-euro area period, as previously, a misalignment shock deepens current account deficits, while the external position is positively affected over the second sub-period. On the 1980-1998 period, an output gap shock continues to fuel current account deficits. However, we fail to confirm the lasting effect of a domestic demand boom on the current account disequilibrium. Interestingly, the variance decomposition analysis confirms the increasing vulnerability of euro area members. More specifically, currency misalignments continue to be the main driving force behind current account disequilibria accounting for 18.20% of their variation.

The slow-growth process evidenced before the launch of the euro is no more observed. However, over the 1999-2016 period, we confirm the absence of current account adjustment through a growth reduction. Finally, we do not find a significant response of the output gap to a currency misalignment shock. Using the APEER methodology, we confirm the presence of a depreciation following a current account reversal on the 1980-1998 period. Moreover, as with the BEER approach during the second sub- period such adjustment disappears. Finally, we corroborate that a boom in domestic demand, through its feed of the non-tradable sector, reduces currency misalignments after the launch of the euro.

## 6 Conclusion

The adhesion to the EMU involves several sacrifices for its members. It implies the renouncement to an independent monetary policy as well as the impossibility to use an exchange rate stabilization policy. This lost constitutes a challenging issue for the euro area members' stability, especially since it is harder to adjust under a fixed exchange rate regime (Friedman, 1953; Gosh et al., 2013). Falling into this context, our article aims to investigate how the EMU affects the macroeconomic adjustment of the eurozone considering three key macroeconomic imbalances (external imbalances, internal imbalances and exchange rates imbalances).

Our results point out that with the adoption of the single currency, current account vulnerability to demand and exchange rate misalignment shocks increases significantly. Following the launch of the EMU, the contribution of both variables to current account disequilibria variation increases substantially. Thus, our results suggest that macroeconomic stability is substantially affected by the impossibility to use the exchange rate adjustment mechanism and by the absence of an independent monetary policy. The threat of macroeconomic stability is also reinforced by the presence of asymmetric shocks within the euro area. Furthermore, our findings also point out that the advent of the eurozone implies a harder current account adjustment.

In face of these additional difficulties to resorb external imbalances, the external position's evolution has to be monitored carefully as sizeable current account deficits increase the probability of banking crises through a higher marginal effect of private credit growth (Davis et al., 2016). Our results also suggest that alternative adjustment mechanisms have to be proposed within this monetary union to manage the negative effect of external imbalances. Although socially costly, the internal devaluation is a potential adjustment tool.

Our article also contributes to the identification of the roots of the current account imbalances in the euro area. The capital inflows from the Northern to the Southern euro area countries (Hobza and Zeugner, 2014) play a central role in the build-up of current account imbalances as they fuel a private credit boom. Hence, they contribute significantly to house prices dynamic which is now identified as a robust current account driver (see Geerolf and Grjbine 2013; Aizenman and Jinjark, 2014 and Unger, 2017 among others). Thus, a natural extension of our article would be to investigate the interaction and causality between credit boom, house prices and current account imbalances in the eurozone.

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## A Data appendix

**Table 6 - Data sources and definition**

Primary	Data sources	Deviation	Comments
Current account balance	OECD	NO	Expressed in % GDP
<b>Demographics</b>			
Ageing speed	Author's calculation	YES	Difference between the dependency ratio in year $t + 20$ and year $t$
Dependency ratio	WDI	YES	Ratio of people younger than 15 or older than 64 to the working-age population
Young dependency ratio	WDI	YES	Ratio of young people (<15 years) to middle-age (15–64)
Old dependency ratio	WDI	YES	Ratio of older people (>64 years) to middle-age (15–64)
Population growth	WDI	YES	Annual growth of total population
<b>Dummies</b>			
Euro area dummies	Author's calculation	NO	1 for northern euro area countries, 0 otherwise
Financial and banking crisis	Laeven and Valencia (2012)	YES	Equal to one in crisis year and during the two following years
<b>Economic development</b>			
Relative income	Author's calculation	YES	GDP PC is GDP divided by midyear population
GDP adjusted PPP	PWT 9.0		Expenditure-side real GDP at chained PPPs (in millions)
Population	PWT 9.0		Population (in millions)
Growth rate of GDP PC	WDI	YES	Real GDP PC growth rate
Relative income squared	WDI	YES	Squared GDP PC series
<b>External financing and international environment</b>			
Long term interest rate	OECD	YES	Long-term interest rates refer to government bonds maturing in ten years
Net Foreign asset	Lane and Milesi-Ferretti (2007)	NO	Expressed in % GDP
<b>Financial development</b>			
Capital account openness	Chinn and Ito (2006)	YES	Index that ranges from -1.84 (closed) to 2.48 (open)
Financial integration	Author's calculation	YES	Sum of assets and liabilities in % GDP

**Table 6 (continued)**

<b>Fiscal policy</b>			
Government budget balance	OECD	YES	Expressed in % GDP
Government budget balance's instrument	IMF (2013)	YES	Instrumentation of several macroeconomic variables (see p21)
<b>Institutional quality</b>			
Civil liberties	Freedom House	YES	Coded from 1 (free) to 7 (not free)
<b>Macroeconomic uncertainty</b>			
Volatility of GDP growth	Author's calculation	YES	Fogli and Perri (2015)'s computation
Quarterly real GDP	OECD		
Term Of Trade Volatility	Author's calculation	NO	Estimation using a GARCH(1,1) model
<b>Oil dependency</b>			
Oil balance	Author's calculation	NO	Oil balance is expressed in % GDP
Oil net trade	IEA		Oil net trade is expressed in Mtoe
Crude oil prices	BP		Crude oil prices per barrel over the period 1980-2016
GDP series	OECD		logarithm of GDP in millions US dollars
<b>Other variables</b>			
Real Effective Exchange Rate	EQCHANGE	NO	REER based on 186 trade partners using the 2008-2012 trading weights
Balassa-Samuelson Effect	EQCHANGE	YES	Deviation of countries GDP PC from trading partners. BS based on 186 partners using the 2008-2012 trade trading weights
Output gap	OECD	YES	Deviation of the GDP from its potential level expressed in % potential GDP
<b>Trade integration</b>			
Trade Openness	WDI	YES	Sum of exports and imports in % GDP
Terms Of Trade	OECD	NO	Ratio of export prices to import prices

*Note:* BP=British Petroleum; CEPII=Centre d'études prospectives et d'informations internationales ; OECD= Organisation for Economic Co-operation and Development; IEA=International Energy Agency; WDI=World Development Indicator (World Bank). GDP= Gross Domestic Product; PC= Per capita; PPP= Purchasing Power Parity.

## B Additional results

**Table 7 - Equilibrium exchange rates estimation**

Short run dynamic		
	Coef.	Coef.
ec	-0.350*** (0.0862)	-0.220*** (0.0641)
D.rprod	-0.0664*** (0.0235)	-0.0995 (0.0620)
D.NFAGDP	-0.0258 (0.152)	-0.0590 (0.0375)
Long run dynamic		
	Coef.	Coef.
rprod	0.0206*** (0.00501)	0.182*** (0.0535)
NFAGDP	-0.205*** (0.0656)	0.0543*** (0.0180)
Constant	1.589*** (0.391)	0.954*** (0.281)
Observations	209	198
Period	1980-1998	1999-2016
Half life	2.30	3.48

*Note:* Estimation performed with the Pooled mean group estimator. Standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. ec denotes the error correction term.



**Table 8 - Unit root tests**

	LLC With trend and constant	LLC With constant	CIPS IPS With trend and constant	CIPS IPS With constant
CAMIS	-5.16*** (0.000)	-2.37*** (0.008)	-0.63 (0.26)	-1.82** (0.0341)
Period	1980-1998	1980-1998	1980-1998	1980-1998
CAMIS	-3.92*** (0.000)	-2.43*** (0.007)	1.43 (0.92)	-1.791** (0.036)
Period	1999-2016	1999-2016	1999-2016	1999-2016
Output gap	-5.85*** (0.000)	-3.59*** (0.000)	-2.873***	-2.033
Period	1980-1998	1980-1998	1980-1998	1980-1998
Output gap	-5.21*** (0.000)	-4.22*** (0.000)	-1.616	-2.106
Period	1999-2016	1999-2016	1999-2016	1999-2016
D.output gap	-2.70*** (0.003)	-4.87*** (0.000)	-2.315	-2.359**
Period	1999-2016	1999-2016	1999-2016	1999-2016
Output gap	-4.61*** (0.000)	-5.52*** (0.000)	-2.81**	-2.733***
Period	1980-2016	1980-2016	1980-2016	1980-2016
MIS	-4.44*** (0.000)	-2.96*** (0.000)	-2.48*** (0.006)	-2.96*** (0.001)
Period	1980-1998	1980-1998	1980-1998	1980-1998
MIS	-3.20*** (0.000)	-3.54*** (0.000)	-5.56*** (0.000)	-2.29*** (0.001)
Period	1999-2016	1999-2016	1999-2016	1999-2016
MISHP	-5.60*** (0.000)	-8.19*** (0.000)	-2.832**	-2.917***
Period	1980-1998	1980-1998	1980-1998	1980-1998
MISHP	-7.34*** (0.000)	-9.44*** (0.000)	-3.268***	-3.422***
Period	1999-2016	1999-2016	1999-2016	1999-2016

*Note:* CAMIS indicates the current account misalignment variable, MIS is the misalignment exchange rates. MISHP is the currency misalignments computed using the Hodrick Prescott filter. LLC: Levin, Lin and Chin (2002) test. CIPS: CADF test of Pesaran (2007). IPS : Im, Pesaran and Shin (2003). Lags selected using the AIC criterion, max lag authorized for the variable equals 2. IPS test used for CAMIS and MIS. CIPS test used for the output gap and MISHP. LLC test for Output gap and MISHP use demean option.

**Table 9 - Variance decomposition: robustness check**

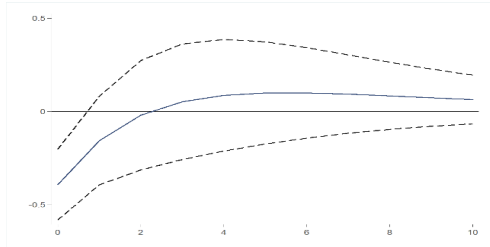
	<b>OG</b>	<b>CA MIS</b>	<b>MIS HP</b>
<b>1980-1998</b>			
<b>OG</b>	0,887	0,098	0,016
<b>CA MIS</b>	0,046	0,881	0,073
<b>MIS HP</b>	0,008	0,063	0,929
<b>1999-2016</b>			
<b>OG</b>	0,864	0,111	0,025
<b>CA MIS</b>	0,055	0,763	0,182
<b>MIS HP</b>	0,129	0,056	0,814

*Note:* This table reports the percentage of variation in the variable in row explained by the variable in column. The figures reported are averages over 10, 20 and 30 years.

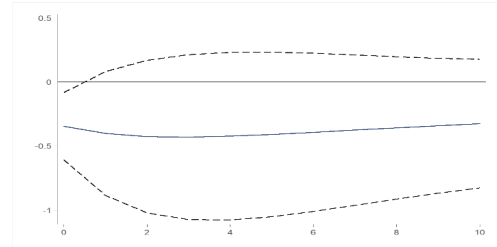
**Figure 2: Impulse Response Functions: robustness check**

**Shock of output gap to CA GAP**

1980-1998

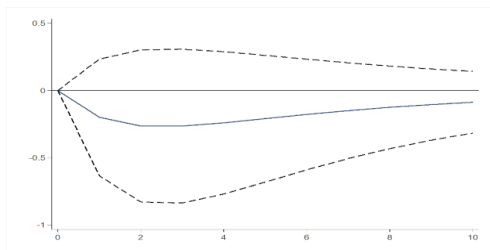


1999-2016

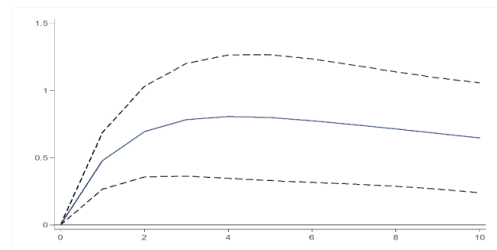


**Shock of misalignment to CA GAP**

1980-1998

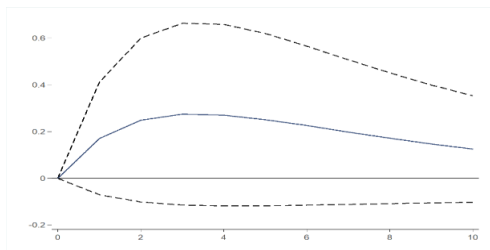


1999-2016

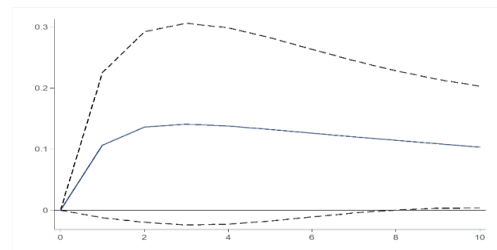


**Shock of CA GAP to output gap**

1980-1998

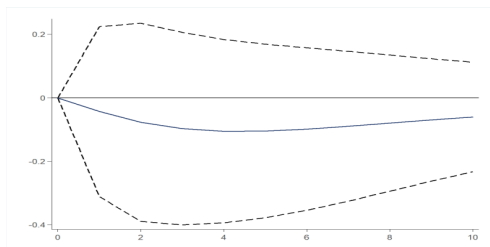


1999-2016

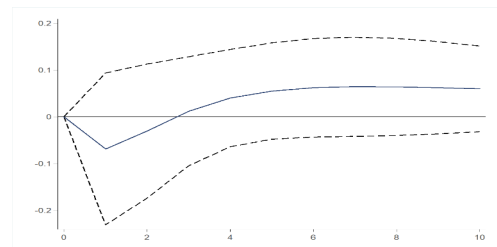


**Shock of misalignment to output gap**

1980-1998

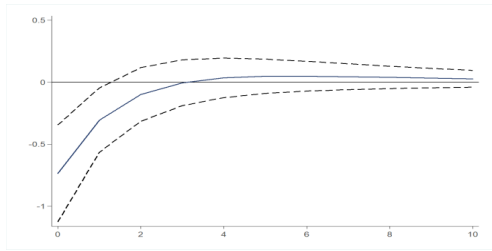


1999-2016

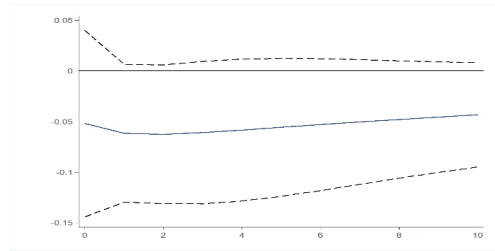


### Shock of CA GAP to misalignment

1980-1998

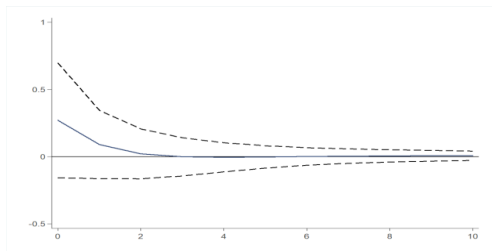


1999-2016

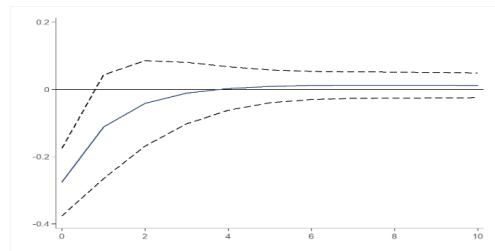


### Shock of output gap to misalignment

1980-1998



1999-2016

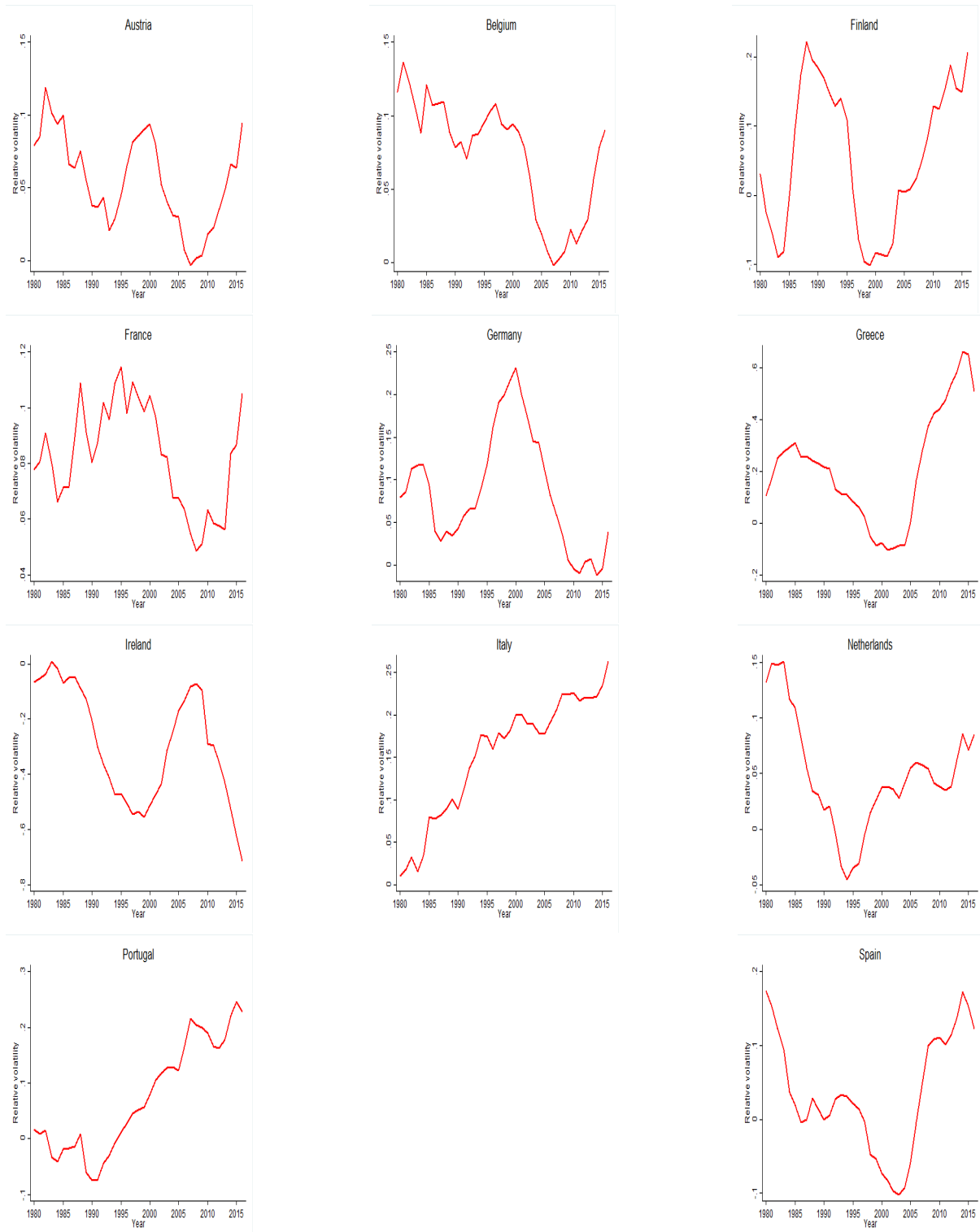


**Note:** Impulse-responses are represented by solid lines. Standard-error bands (dashed lines) are generated through Monte-Carlo simulations with 1000 repetitions.

**Figure 2— Continued.**

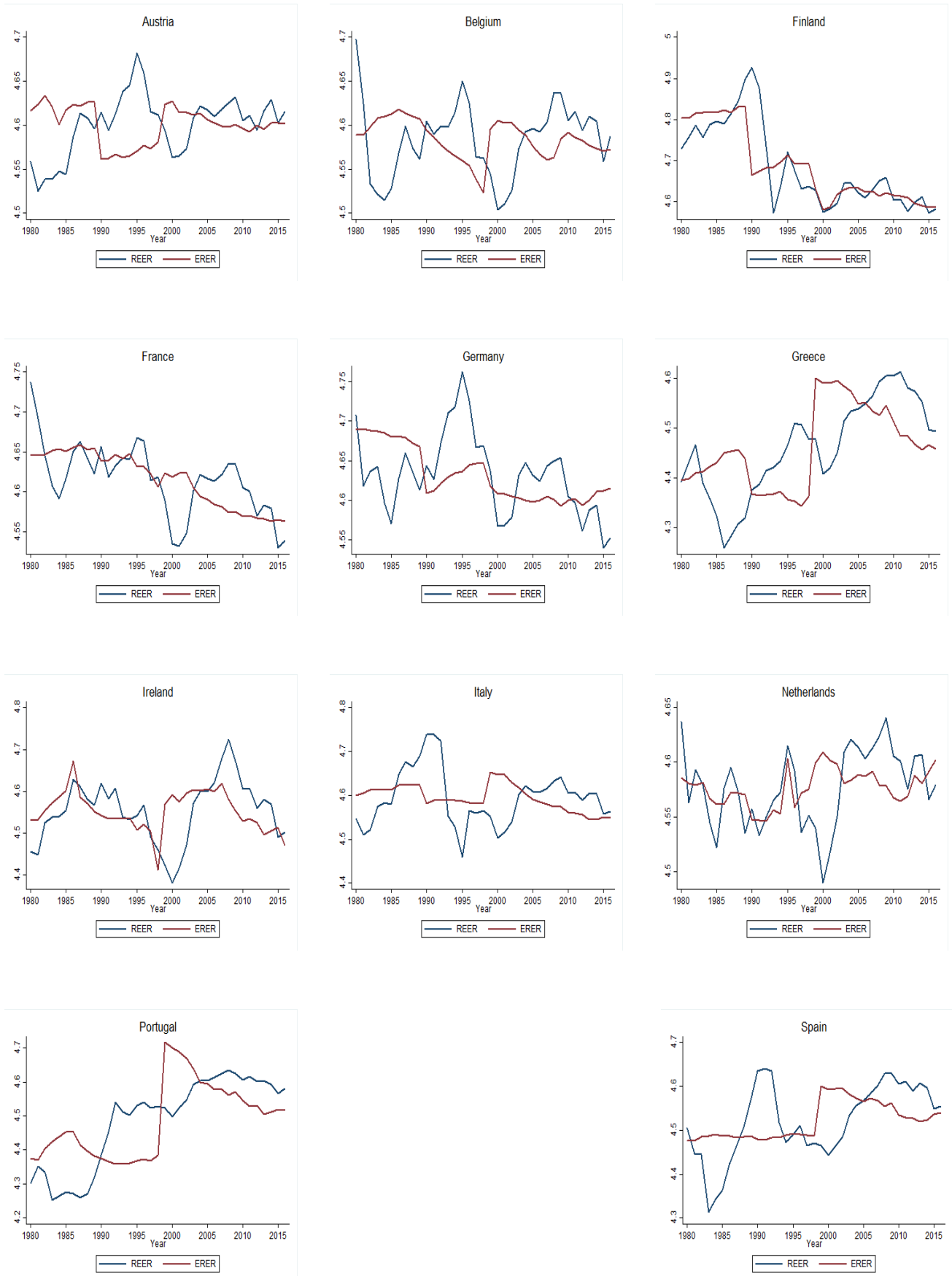
# C Figures

## Figure 3: GDP relative volatility



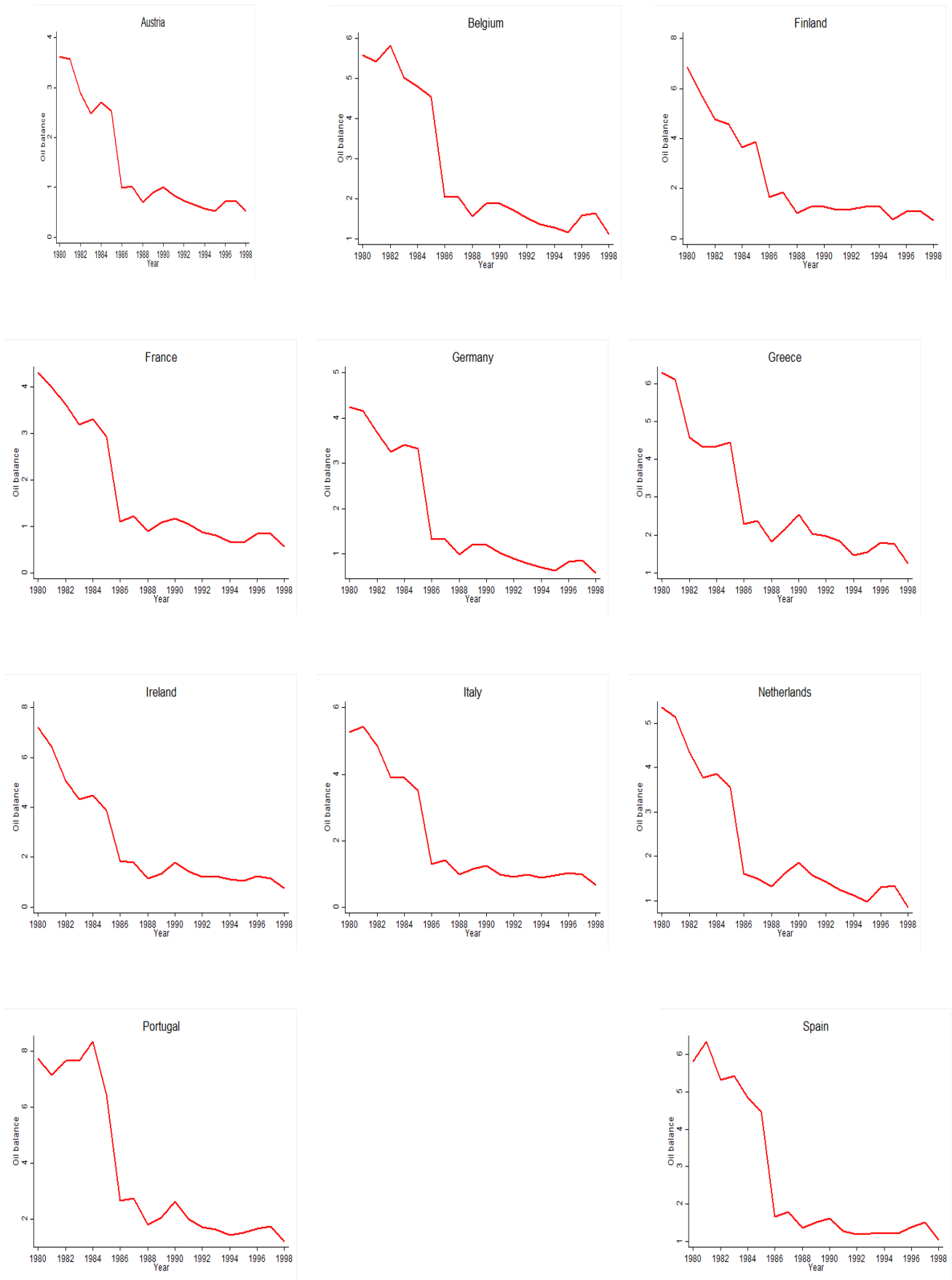
Source: Author's calculations

**Figure 4: REER AND ERER**



**Note:** REER (resp. ERER) indicates the logarithm of the Real Effective Exchange Rates (resp. Equilibrium Real Exchange Rate).

**Figure 5: Oil balance series**



**Source:** Author's calculations

Figure 6: CA and fundamentals (1980-1998)







Figure 6— Continued.

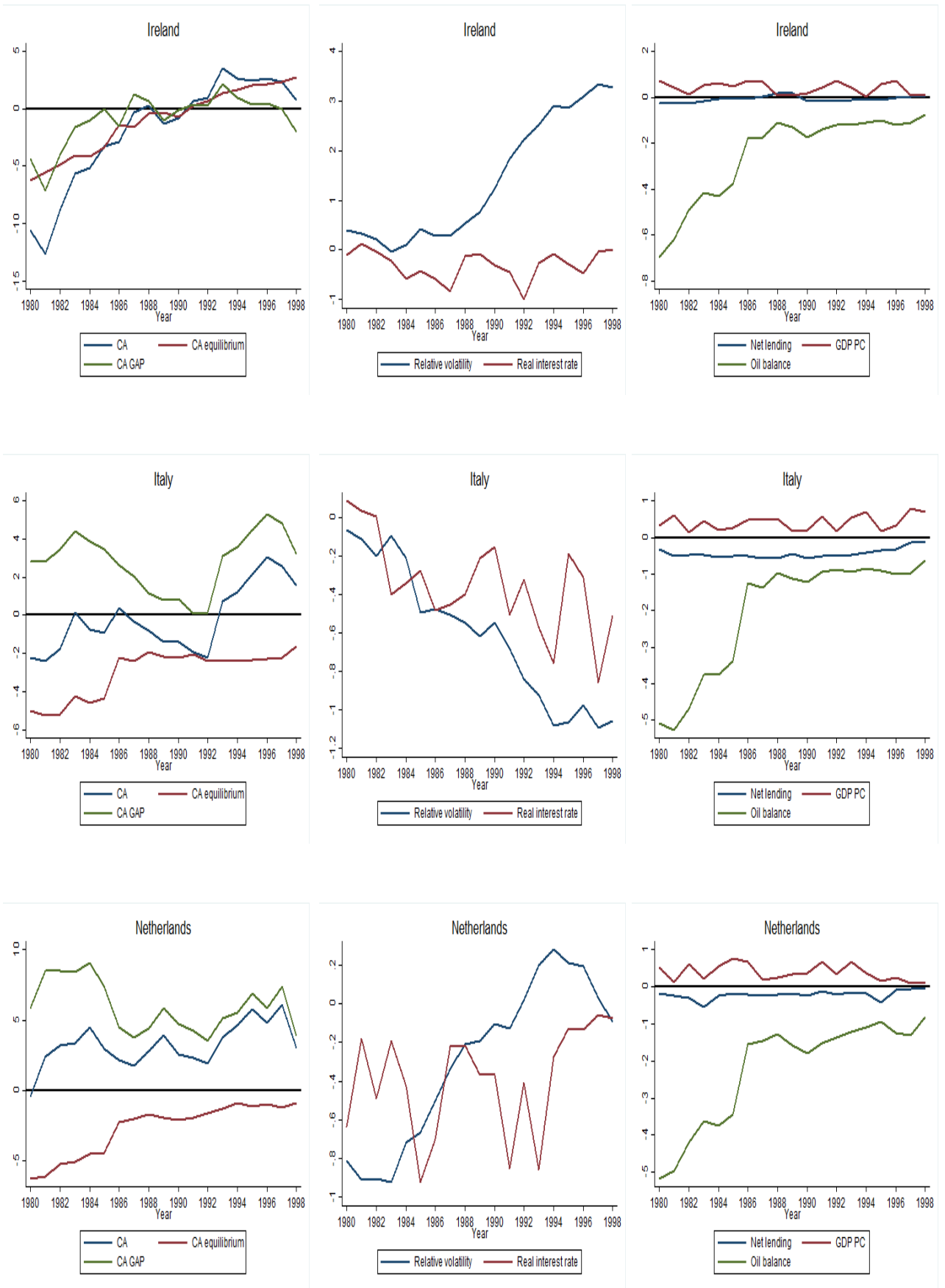
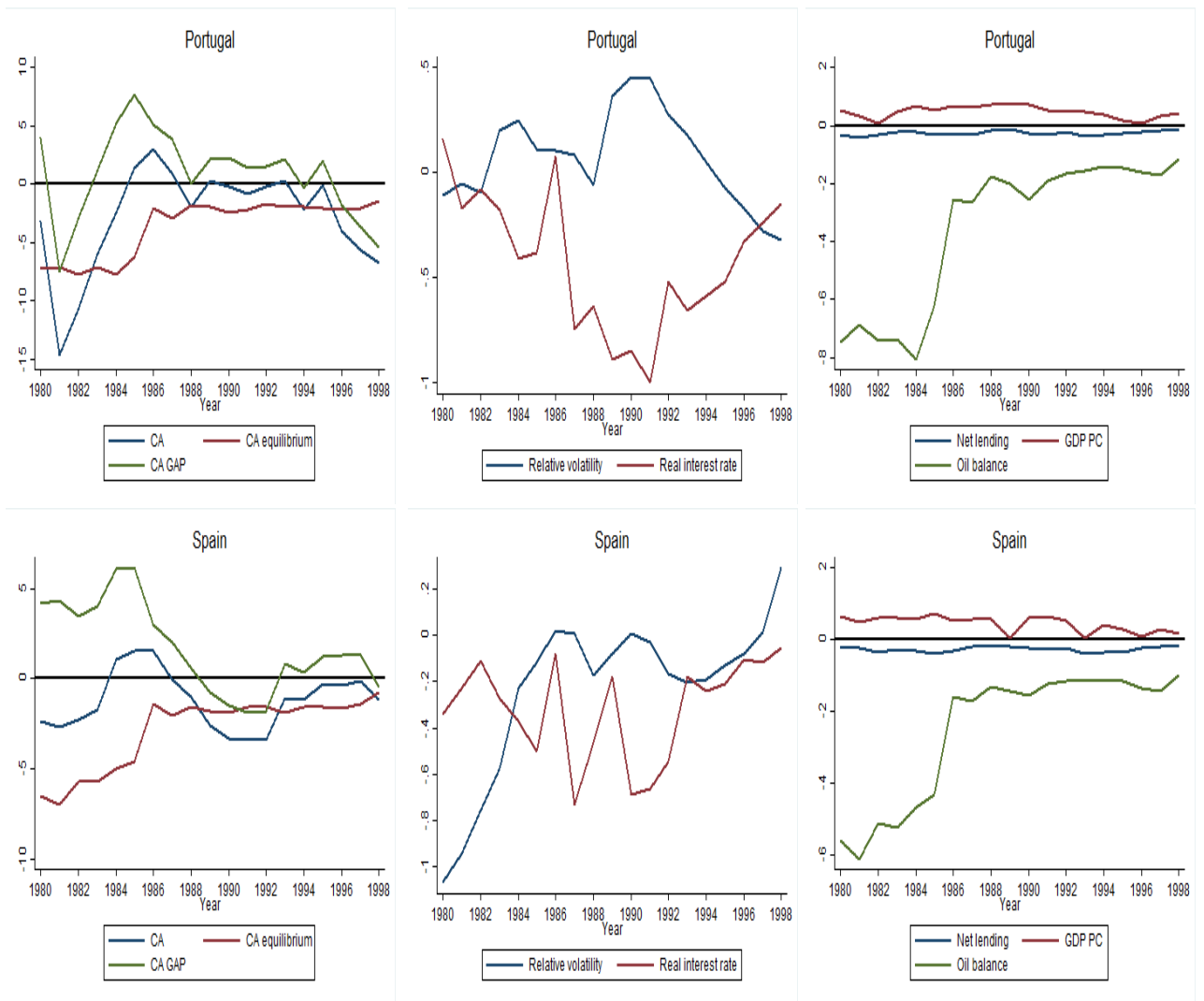


Figure 6— Continued.



**Figure 6— Continued.**

**Note:** CA (resp. CA equilibrium) is the observed (resp. equilibrium) current account. CA GAP denotes the current account imbalances computed as the difference between the observed and equilibrium current account.

Figure 7: CA and fundamentals 1999-2016

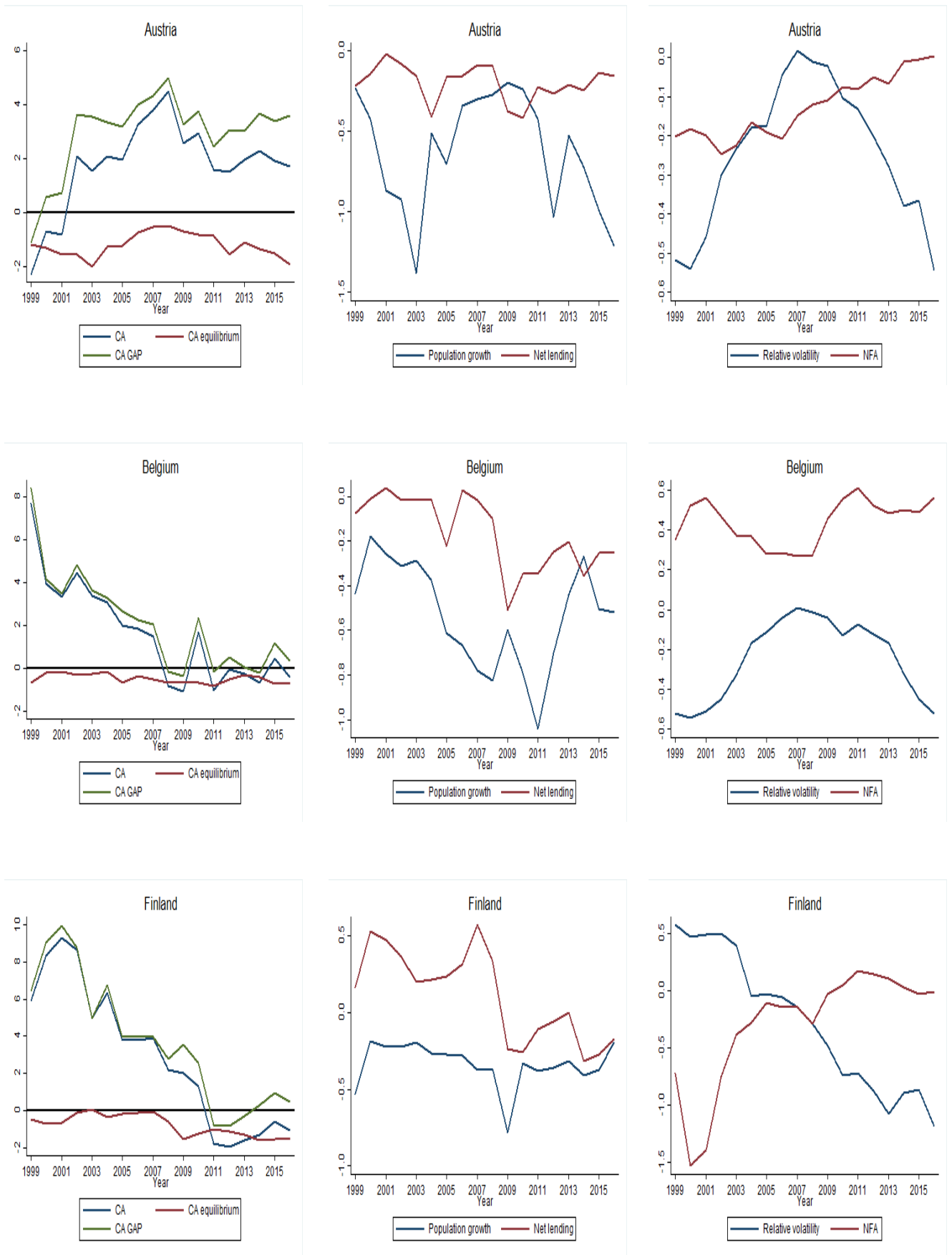


Figure 7— Continued.

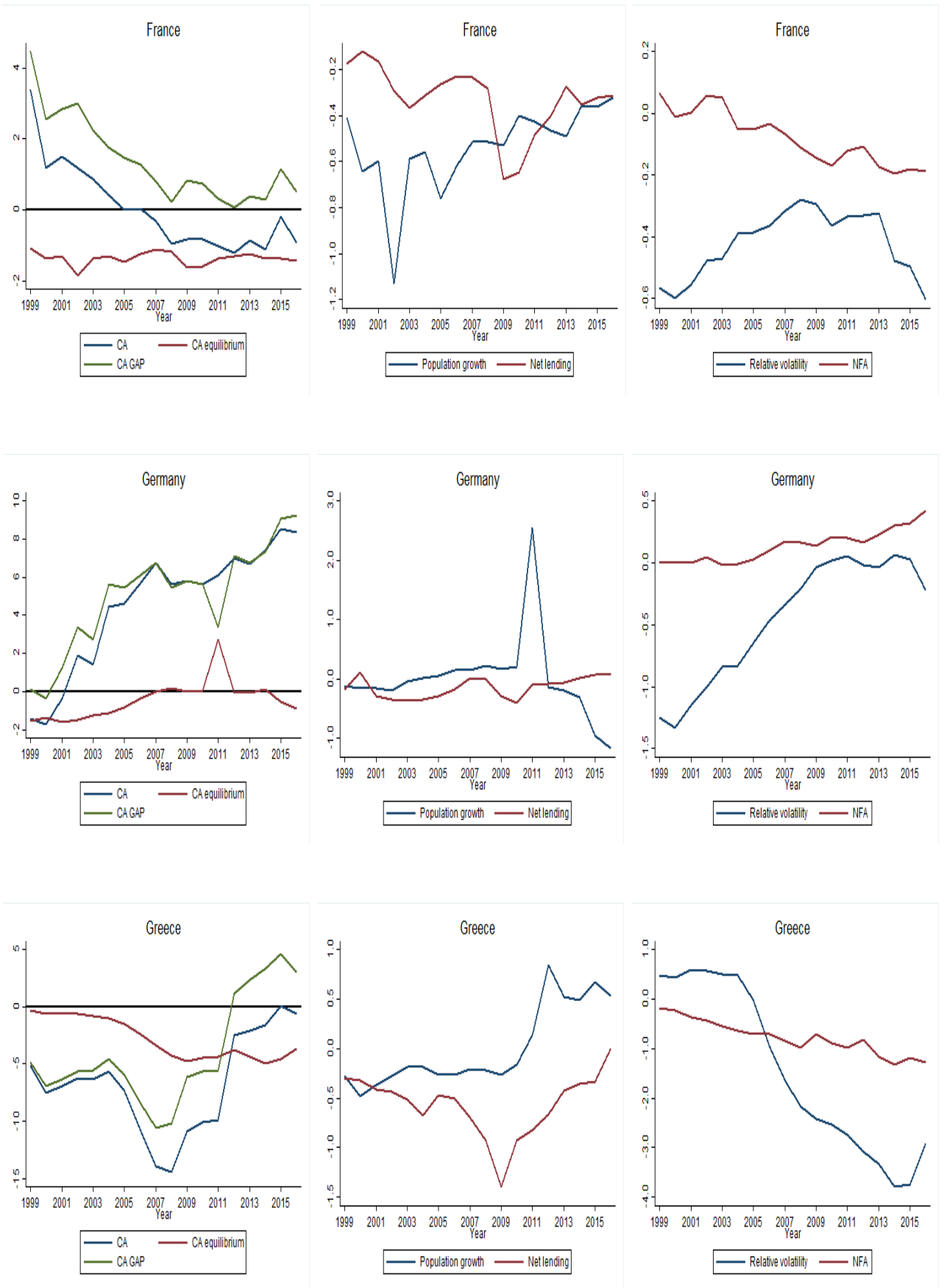
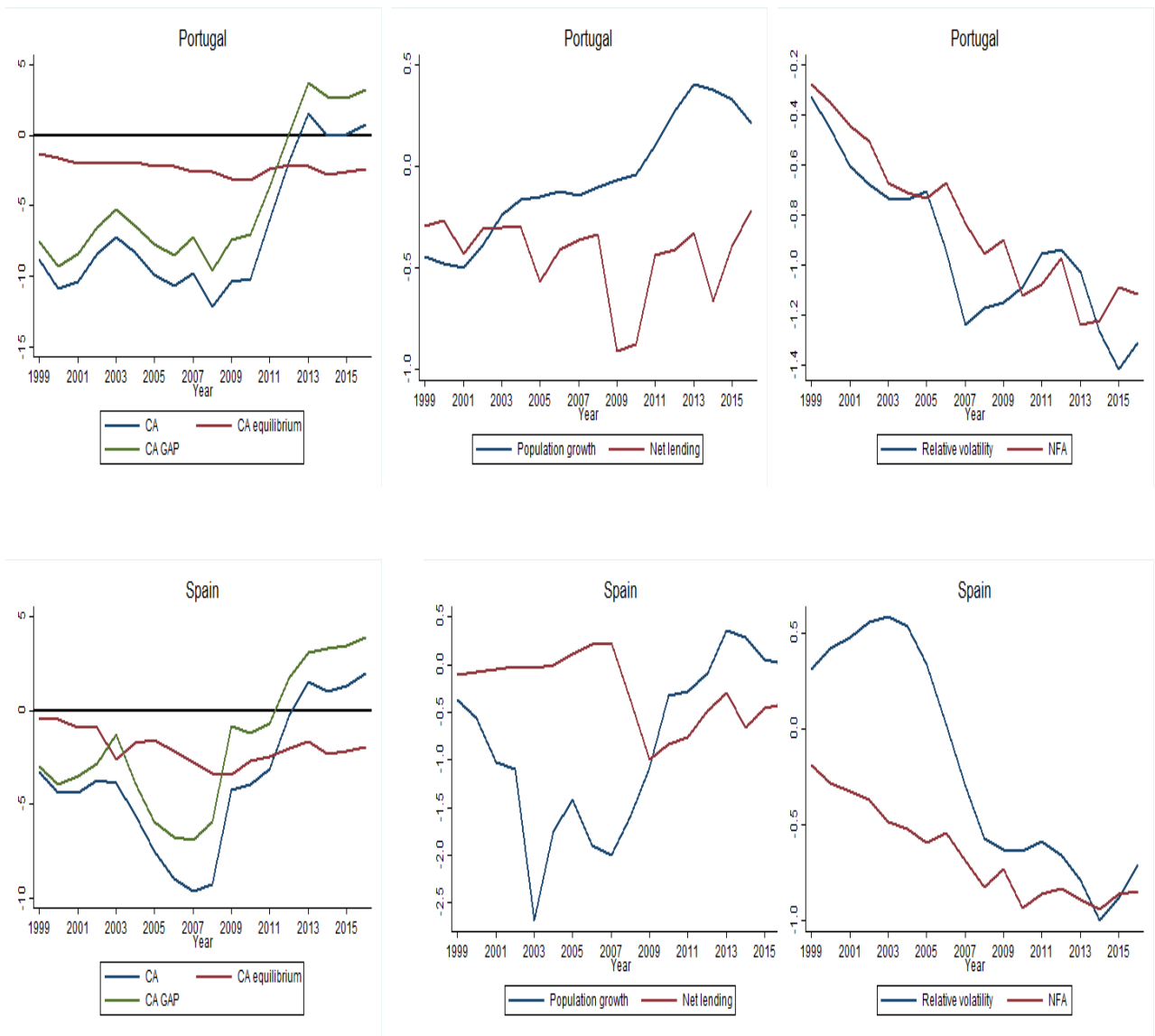


Figure 7— Continued.



Figure 7— Continued.



**Figure 7— Continued.**

**Note:** CA (resp. CA equilibrium) is the observed (resp. equilibrium) current account. CA GAP denotes the current account imbalances computed as the difference between the observed and equilibrium current account.