Real exchange rates and current account imbalances in the Euro-area

Michael G Arghyrou*
Cardiff Business School

and

Georgios Chortareas**
University of Essex

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Abstract

Global current account imbalances have been one of the focal points of interest for policymakers during the last few years. Less attention has been paid, however, to the growing imbalances within the Euro-area. In the short period since the commencement of the EMU two distinct groups of member state have emerged: those with consistently improving current accounts and those with consistently worsening current accounts. In this paper we consider the dynamics of current account adjustment and the role of real exchange rates in current account determination in the EMU member countries. Monetary union participation, which entails giving up the nominal exchange rate, can make the correction of current account imbalances more cumbersome. While most theoretical models of open economies rely on a causal relationship between real exchange rates and the current account limited, if any, contemporary evidence exist on the empirical validity of this relationship. We find that the above relationship is substantial in size and subject to pronounced non-linear effects. We identify two groups of countries since the abandonment of European national currencies: those with persistent real exchange rate depreciation leading to current account improvement; and those with systematic real appreciation and deteriorating current accounts. These groups largely correspond to those previous research has identified as respectively belonging and not belonging to a European Optimum Currency Area. Our findings validate the theoretical arguments concerning the potential costs of EMU participation and suggest that meeting the nominal convergence criteria has come, in some countries, at the cost of growing current account imbalances. The latter pose policy-response questions for national authorities and the ECB, suggesting that it may be optimal to add to the EMU-accession criteria one referring to the balance of the current account; and highlighting the importance of increasing the flexibility of relative prices to facilitate real exchange rate and current account adjustment.

Keywords: current account, real exchange rate, EMU, nonlinearities

JEL classification: C51; C52; F31; F32; F41

*Economics Section, Cardiff Business School, Cardiff University, Aberconway Building, Colum Drive, Cardiff CF10 3EU, Wales, UK, Tel: +44-(0) 2920875515, Fax: +44-(0) 2920874419, Email: ArghyrouM@cardiff.ac.uk

** Finance Group, Department of Accounting, Finance and Management, and Essex Finance Centre, University of Essex, Wivenhoe Park, Colchester, CO4 3SQ, UK, Tel: +44-(0) 1206 874250, Fax: +44-(0) 1206 873429, Email: gchort@essex.ac.uk

1. INTRODUCTION

The global imbalances, as manifested by the current account positions of some of the major industrial countries, possibly constitute at present the most challenging issue in international macroeconomics. Such imbalances include the US current account deficit against the surpluses of Japan, the emerging Asian economies, the Middle East countries, the Nordic countries, and (to a lesser extend) the Euro-area. The increasingly diverging external positions of the world's major trading blocks has given rise to a growing literature debating their sources and examining their dynamics.[1] Another type of imbalances, however, emerges that has been less intensively scrutinized, namely the current account imbalances within the Euro-area. While the aggregate Euro-area current account is currently close to balance, a number of the Euro-area member states exhibit large current account deficits with a worsening trend. For example, starting from a balanced current account in the mid-1990s, by 2005, and having followed a period of steady deterioration very similar to the one observed in the USA, the current accounts of Portugal and Spain were in deficits equal to 8.4% and 6.2% of GDP respectively. The current accounts of Greece, Italy, and Ireland display a similar pattern. On the other hand, a number of Euro-members display positive current accounts. Such countries include Belgium, Finland, the Netherlands and most notably Germany, whose current account has moved from a deficit of 1.5% of GDP in the mid-1990s to a surplus of 4.3% in 2005.

The focus on the major global (primarily US) imbalances, as well as the treatment of Euro-area largely in aggregate terms, have left the intra-EMU imbalances relatively unexplored. In this paper we consider the dynamics and the sources of the within-the-EMU current account imbalances in the short-to-medium run. To do so one has to choose

[1] For example see Obstfeld and Rogoff (2002, 2005a, 2005b).

the appropriate conceptual framework. In general, three candidate frameworks offer themselves for analyzing current accounts.

First, the "twin deficits" approach that has been popular mainly in analyzing the US imbalance in the 1980s but does not seem to fit the current condition in the EU, that are characterized by strong intra-EMU current account imbalances but moderate fiscal deficits. Participation in the EMU has also eliminated exchange rate risk and as a consequence the Euro-area market for public debt has become substantially more integrated.[2] Moreover, there is no empirical support for the important link interest rate in the "Feldstein chain" on which the twin deficits concept usually relies.

Second, the workhorse approach for assessing current account imbalances, which focuses on the determinants of saving and investment. For example, Bernanke (2005) uses this framework to attribute the current US external imbalances to a global saving glut (see also Masson, 1998; Chinn and Prasad, 2000; IMF, 2005). In the context of the Euro-area, Blanchard and Giavazzi (2002) consider how increased economic integration in the Euro-area may have lead to a decrease in saving and an increase in investment which are reflected in a large current account deficit. This effect can be particularly relevant for the poorer EMU countries that are catching up such as Greece and Portugal. A key assumption that sets the above mechanism in motion, however, is the role of economic integration. Real and financial markets integration, Blanchard and Giavazzi (2002) assert, has an effect both on saving and investment in the Euro-area. Nevertheless, the authors do not provide an explicit measure of economic integration and do not explicitly consider how the creation of the EMU has affected it.

Finally, it is widely accepted in theory that shifts in real exchange rates cause changes in the current account. This result emerges both in the context of traditional

[2] Nevertheless, interest rates on euro-denominated government bonds have not fully converged (see Codogno et al 2003).

approaches (e.g., Friedman, 1953; Mundell, 1962; Fleming, 1962; Dornbusch, 1976; Branson, 1983) as well as in the context of the recent new open economy macroeconomics literature (e.g. Obstfeld and Rogoff, 1995, 1998, 2000). The causal link from real exchange rates to current account balances is also central in the analysis of the Theory of Optimum Currency Areas (TOCA) on the potential costs from joining a monetary union (e.g., Mundell, 1961, McKinnon (1963) and Kenen (1969). The main channel through which real exchange rate shifts cause current account changes is an "expenditure-switching" effect. This is captured by the IS curve in the variations of the traditional Fleming-Mundell model and the relative price change in Friedman (1953). The expenditure-switching effect involves switching of expenditure of both domestic and foreign consumers away from (toward) the home country goods when the home currency appreciates (depreciates) in real terms. In the Obstfeld and Rogoff (1995) Redux model the "expenditure switching" mechanism is valid provided that nominal prices are fixed in the producer country and the exchange rate pass-through is complete. When the home and foreign markets are segmented however and monopolistically competitive firms can engage to "pricing-to-market", the expenditure switching effect is eliminated.[3]

While the role of real exchange rates in determining current account positions constitutes a basic element of the theoretical framework of both traditional and modern approaches to international macroeconomics, and underpins the vast empirical literature on monetary policy reaction functions (see e.g., Clarida et al, 1998), very limited recent empirical evidence have been produced that explicitly focus on this relationship.[4],[5] Given

[3] For a detailed discussion of the expenditure switching effect in the context of new open economy macroeconomic models see Engel (2002)

[4] Earlier influential studies that consider the real exchange rate as the main explanatory variable in estimating current account equations for a number of countries that engaged in currency devaluation include Edwards (1989) and Khan and Knight (1983). More recently Cline (2003) estimates Japan's current account finding that a 1% increase in the yen real exchange rate can affect the current account anywhere between 1.3 to 4.4 billions of dollars. In the same framework a 1% change in the domestic growth rate can affect the current account by 3.4 to 6.3 billions of dollars. Moreover, various analysts have blamed, partially at least, the US current account imbalances on the exchanger rate policies of its trading

the prominent position of the relationship between real exchange rates and current accounts in theoretical models, the lack of empirical evidence on it is surprising, perhaps even more so in context of the EMU. A major feature that distinguishes the within-the Euro-area current account imbalances from those at the global level is the diminished ability of the real exchange rate of individual EMU members to adjust since, following the abolition of national currencies, this task is left only to the relative price levels. Therefore, if a stable relationship between the real exchange rate and the current account is empirically established, the limited ability of national authorities to adjust their real exchange rates may have non-trivial consequences for the external positions of individual EMU member countries. In relation to this, and as we argue later in the paper, it is interesting that the groups of "wining" and "losing" countries, in terms of current account positions, largely correspond to the countries identified prior to the introduction of the euro as respectively belonging and not belonging to a European optimum currency area.

Our focus on the real exchange rate does not mean that we question the validity of the inter-temporal approach, such as the one used by Blanchard and Giavazzi (2002), which has its own merits as it can explain the current account dynamics implied by the catch-up process in the Euro-area. To the extent that full convergence will be achieved in the future the imbalances identified by this approach will be removed. While this line of

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partners (e.g., Bergsten, 2004). Finally, in a recent contribution Obstfeld and Rogoff (2005), in discussing the US current account imbalances suggest that any kind of adjustment requires, as a necessary corollary, sizeable exchange rate shifts. In particular, Obstfeld and Rogoff (2005) develop a three-region economic model to consider the hypothesized reduction in global current account imbalances might impact the major currencies in real terms. Even under relatively benign scenarios of policy actions (letting the Asian exchange rates to float leading to raising U.S. saving) significant exchange rate shifts emerge as a necessary feature of adjustment. For example, their baseline estimate suggests that a halving of the U.S. current account deficit entails nearly a 20% dollar real depreciation against Asian currencies and a slightly smaller depreciation against European currencies.

[5] A number of further prisms exist under which the relationship between (real) exchange rates and current accounts has been examined. A number of studies use atheoretic VAR approaches focusing on the nature of shocks (e.g., Lee and Chinn, 1998; Leonard and Stockman, 2001). Such approaches have been popular in considering whether the exchange rate is a shock absorber or source of shocks. The evidence produced by such studies can be useful in the context of whether one country should join a monetary union (e.g., EMU assessment by HM Treasury). We discus the limitations of the VAR approach for the purpose of our study in the subsequent section.

research is important, we think focusing on the real exchange rate is at least as important for the following reasons. First, our focus is on relative price effects (induced by exchange rate movements) in small open economies, which are price takers in international goods and financial markets. Second, the full convergence prospect, which is implicit in the analysis by Blanchard and Giavazzi (2002), may prove to be a long run process; in the meantime, and for the short-to-medium run, the current account effects of exchange rate shifts may still be important. Third, participating in a monetary union has at least as direct and obvious consequences for the real exchange rate (and its ability to adjust) than the other determinants of saving and investment on which the intertemporal approach focuses on (e.g., output growth, population, credit availability, and so on). Fourth, the current account effects that emerge as a natural corollary of the catch-up process further contribute in deepening the imbalances as we discuss below. Indeed, as pointed out by the TOCA, excessive current account deficits may cause national governments to seek real exchange rate depreciations through deflationary policies, thus derailing the catch-up process.

In this paper we adopt a "back to the basics" approach and consider explicitly the relationship between real exchange rates and current accounts focussing on the countries of the Euro-area. The main finding emerging from our empirical analysis is that this relationship exists for the overwhelming majority of the EMU member-states. Our findings suggest that the current accounts dynamics of the countries that participate in a monetary union may be related to a set of constraints emanating from this very membership. To summarize, our contribution covers at least three different areas: first, by analyzing the current imbalances within the Euro-area we cover a topic that has been overlooked by the literature on global current account imbalances. Second we provide empirical evidence establishing the role of real exchange rates on current account determination, thus validating an important theoretical assumption of open macroeconomics literature for which little empirical evidence exists. Finally, our analysis gives rise to some political economy considerations about the implications of joining a common currency area motivating a reassessment of a number of applied policy issues. These include the implications of the convergence process for current account adjustment under fixed exchanger rates; the implications of growing intra-EMU current account imbalances for the contact of the single monetary policy; and the possibility for extending the criteria for accession to the EMU.

The remainder of the paper is structured as follows: Section 2 presents the data and our empirical findings. Section 3 discusses the latter. Finally, section 4 summarizes.

2. EMPIRICAL ANALSYIS

2.1 Data

Data for the current account balance as a percentage in GDP and trade-weighted real effective exchange rates has been taken by the IMF World Economic Outlook and OECD Main Economic Indicators databases respectively. Current account balances are available on annual frequency only and our series cover the period 1970-2005 (except from Ireland and Portugal for which our sample periods start in 1976 and 1975 respectively). Figure 1 is indicative, presenting the movements of the current account to GDP ratios (*ca*) against the deviation of the logarithm of the real exchange rate against its sample mean (*reerdev*) for each EMU member-state. An increase (reduction) in *reerdev* denotes a real depreciation (appreciation), so our theoretical expectation is that an increase in *reerdev* is associated with an increase in *ca*. Figure 1 suggests that this theoretically expected pattern is likely to be present in the EMU area, although its strength may vary across countries, and, for each country, across different time periods. In the sections that follow we model this relationship using formal econometric models.

2.2 Benchmark linear models of current account adjustment

We start our formal econometric analysis by estimating a benchmark linear model of current account adjustment linking the movements of the current account to those of real effective exchange rates. Given the possibility of endogeneity between the two variables, one may argue that a VAR approach would a priori be preferable to a single-equation framework. The relatively small number of annual observations available at our disposal, however, combined with the relatively high number of parameters to be estimated in a VAR system would restrict the degrees of freedom significantly, thus casting doubt on the reliability of the empirical findings. Such concerns would be more profound in the context of the non-linear analysis that follows in section 2.4 below. A plausible compromise between the need to account for endogeneity on the one hand and economizing on degrees of freedom on the other is the single-equation estimation methodology suggested by Inder (1993). This approach consists in estimating the unrestricted Autoregressive Distributed Lag (ADL) model given by equation (1) below:

$$ca_t = \alpha + \sum_{i-1}^{k} \beta_i ca_{t-i} + \sum_{i=0}^{k} \gamma_i reer_{t-i} + u_t \qquad (1)$$

In equation (1), α is a constant, *ca* is the current account balance to GDP ratio, *reer* is the logarithm of the real effective exchange rate and u_t is a white noise error term. Equation (1) is estimated using OLS adopting a general-to-specific modelling approach. This involves gradual reduction of the *k* terms in (1) until a parsimonious specification, including statistically significant terms only, emerges. The parsimonious ADL is re-parametrised to yield a long-run static solution. As Inder (1993) suggests, this methodology produces precise estimates of long-run parameters and valid *t*-statistics, even in the presence of endogenous explanatory variables, preserving at the same time the maximum number of degrees of freedom allowing for meaningful non-linear analysis later on.

Table 1 presents the results of the estimated parsimonious ADL models.[6] Given the annual frequency of our data, we consider it plausible to include four lagged values for *ca* and *reer* into (1), i.e. set $k = 4$. In line with our expectations, with the exception of Ireland, the sum of the *reer* coefficients is in all countries positive. However, the static long-run equations suggest that the theoretically expected positive link between *ca* and *reer* is statistically significant only in five out eleven equations, two out of which fail the heteroscedasticity and the joint heteroscedasticity/functional form misspecification tests. These generally unsatisfactory results may reflect either a genuine lack of a statistically significant link between *ca* and *reer* in the majority of the EMU countries or biases caused by model misspecification. Such biases may be due to structural breaks and/or the existence of non-linearities in the relationship between *ca* and *reer*. In the sections that follow we test explicitly for the effect of these factors.

2.3 Tests and models of structural breaks in current account adjustment

2.3.1. Tests for structural breaks in current account adjustment

We now test whether the coefficients of the ADL models in Table 1 have been subject to structural breaks during the sample periods covered by our estimations. We test for such breaks using the structural breaks test adopted by Quintos (1995). This involves estimating equation (2) below

$$ca_t = \alpha + \sum_{i=1}^{k} \beta_i ca_{t-i} + \sum_{i=1}^{k} \gamma_i reer_{t-i} + \sum_{i=1}^{k} D_{it} \delta_i ca_{t-i} + \sum_{i=1}^{k} D_{it} \zeta_i reer_{t-i} + \eta D_t + u_t \qquad (2)$$

[6] Some of the equations in Table 1, as well as in subsequent Tables, include intercept dummies taking the value of unity for very unusual observations, zero otherwise. The exclusion of these dummies, defined at the notes accompanying the Tables, does not change the nature of the findings but results in problems of non-normality.

where

$D_{i,t} = 1$ if $t \in (1,..., T)$

$= 0$ if $t \in (T+1, ..., N)$

In equation (2), the terms under the sums refer to lag terms included in the parsimonious ADL models, i.e. to the statistically significant lag terms in equation (1). D_{it} (D_t for the constant term) is defined as a dummy variable taking the value of 1 up to the date of the tested break point (T) and zero afterwards; N is the last sample observation. The test involves estimating (2) for each point in time belonging to ($1,\ldots N$). In each estimation round the sample size remains constant but the definition of D_{it} changes: for the first estimation, the last observation for D_{it} is set to be zero; the rest of the observations are set equal to 1. The estimation is repeated, substituting in each estimation round the values of D_{it} by zero backwards. Hence, for the last estimation round, only the first observation of D_{it} takes the value of 1; all the rest are set to zero. In each estimation round we test the statistical significance of each of the dummy variables δ_i ζ_i and η. The null hypothesis of structural stability is defined separately for each coefficient as H_0: $\delta_i = 0$, H_0: $\zeta_i = 0$ and H_0: $\eta = 0$. Following Quintos (1995), structural breaks are identified endogenously in those dates for which the estimated Wald statistic is higher than the 5% critical value of $\chi^2(1)$. Given that structural breaks cannot fall too close, we follow Quintos (1995) and treat all those falling within three years as representatives of the same structural shift. The exact timing of the break is then selected to be the observation with the highest test value.

Figure 2 plots the sequentially estimated Chi-square tests for each of the coefficients of the ADL models presented in equation (1), against the 5 critical values.[7] With the exception of Portugal, for which no structural breaks are found at all, Figure 2 suggests the existence of at least one statistically significant break for each EMU country. Results are not uniform across countries, however two common findings emerge: First, excluding Belgium, Greece, as well as Ireland and Portugal for which our total samples are more limited, for the remaining seven countries Figure 2 presents strong evidence of a structural break in the second part of the 1970s. These breaks suggest that the oil shocks that took place during that period have had a significant effect on the link between *ca* and *reer* (our analysis in section 2.3.2 below suggests that following these shocks the link has been strengthened). Second, with the exception of Belgium, Figure 2 presents no evidence of structural breaks following 1999. This suggests that the relationship between the two variables has remained unaffected by the introduction of the single currency.[8] Generally, this is also the case for the introduction of the national convergence programmes aiming towards EMU participation, as with the exception of Belgium, France, the Netherlands and Spain, the late 1980s and the first part of the 1990s seem to have been a period of structural stability. By contrast, for a number of countries (Belgium, Finland, Greece, Ireland, Italy and Spain) we obtain evidence of structural instability during the first half of the 1980s. This can be linked to country-specific economic events for which there exists evidence according to which they have influenced a wider spectrum of economic variables (see, for example, Arghyrou and Luintel, 2007).[9]

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[7] Figure 2 reports values of the sequential Chi-square tests estimated for those years for which all parameters entering equation (3) are linearly independent. As a result, the sample periods presented vary slightly across countries.

[8] We discuss the significance of this finding in section 3 below.

[9] For example, the Greek structural break found in 1981 can be linked to the major shift in the direction of economic policy towards fiscal expansion initiated during that year. On the other hand, the structural breaks found for Belgium, Ireland, Italy and the Netherlands during the first part of the 1980s coincides with the introduction of economic policies in those countries aiming towards macroeconomic stabilisation.

However, as we will see immediately below, the majority of these breaks did not have a significant impact on the *ca-reer* relationship.

2.3.2. Current account models accounting for structural breaks

We now re-examine the statistical significance of the link between *ca* and *reer* accounting for the long-run effects of the structural breaks identified in the previous section. Assuming J statistically significant structural breaks for each of the statistically significant right-hand side terms in equation (1), the ADL model augmented for structural breaks is given by equation (3) below:

$$ca_t = \alpha + \sum_{i=1}^{k} \beta_i ca_{t-i} + \sum_{i=1}^{k} \gamma_i reer_{t-i} + \sum_{i=1}^{k}\sum_{j=1}^{J} d_{ji} D_{i\,t} ca_{t-i} + \sum_{i=1}^{k}\sum_{j=1}^{J} z_{ji} D_{ji} reer_{t-i} + \sum_{j=1}^{J} \eta_j D_t + u_t$$

(3)

In equation (3), we define T_j as the date at which the jth (in a total of J) structural break for each of the coefficients of the parsimonious equation (1) has been found to occur. D_{it} is then defined equal to 0 if $t \in (1,..., T_j)$. If on the other hand $t \in (T_j+1, ..., N)$, $D_{i,t}$ is respectively defined to equal ca_{t-i}, $reer_{t-i}$ or a, according to the variable which has been found to be subject to a structural break at period T_j. Equation (3) is estimated using the previously described general-to-specific approach. The parsimonious specification emerging from this general-to-specific approach picks up the long-run effect of structural breaks on each of the coefficients of the models presented in Table 1, thus yielding a specification which accounts for the structural breaks that have had a statistically significant long-run effect on the process of current account adjustment.

Table 2 presents the results of the parsimonious specifications obtained by estimating equation (3). To simplify the analysis, this has been estimated for the period

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The same can also be said for the structural break identified for Spain in 1985, a year which also coincides following the identified structural breaks of the 1970s. For Portugal, for which no structural breaks were found at all, Table 2 reproduces the findings of Table 1. For the remaining ten countries, in six cases (Austria, Finland, France, Germany, Greece and Italy) no further structural breaks additional to those of the 1970s were found to be statistically significant. For Belgium, Ireland, Netherlands and Spain we obtained at least one additional statistically significant structural break; however only in the case of the Netherlands there was an additional structural break relating to a *reer* coefficient.

Accounting for structural breaks produces significant evidence in favour of the theoretically expected positive relation between *ca* and *reer* in the EMU area. For all countries, except from France and Ireland, the re-parameterised long-run static equations reported in Table 2 yields a statistically significant positive coefficient for *reer.* In addition, for the Netherlands, for which an additional structural break affecting the *reer* terms was found, the sum of the structural dummy *reer* coefficients is positive, which suggests that the additional break has strengthened the positive link between *ca* and *reer*. The static (re-parametrised) equations suggest that the long-run elasticity of the *ca* to changes in *reer* is generally high, typically taking values within the 0.7 to 0.8 interval. This figure is even higher in the case of Germany but lower (although still highly significant) in three South European EMU members (Greece, Italy and Italy). Finally, accounting for structural breaks improves significantly the explanatory power of the estimated models, as the equations presented in Table 2 produce a significantly lower regression standard error compared to those presented in Table 1.

with the accession of that country to the EU.

2.4. Tests and models of non-linear current account adjustment

2.4.1. Tests of non-linear current account adjustment

We now test whether we can improve further upon the models accounting for structural breaks presented in Table 2 by modelling any possible non-linearities existing in the relationship between *ca* and *reer*. To that end, we first test the hypothesis of non-linear current account adjustment following the procedure proposed by Saikonnen and Luukkonen (1988), Luukkonen et al (1988), Granger and Teräsvirta (1993) and Teräsvirta (1994). This involves estimating equation (4) below:

$$ca_t = \gamma_{00} + \sum_{j=1}^{\phi}\left(\gamma_{0j} ca_{t-j} + \gamma_{1j} ca_{t-j} ca_{t-d} + \gamma_{2j} ca_{t-j} ca_{t-d}^2 + \gamma_{3j} ca_{t-j} ca_{t-d}^3\right) + \\ + \gamma_4\, ca_{t-d}^2 + \gamma_5\, ca_{t-d}^3 + v_t \qquad (4)$$

where ϕ is the order of the autoregressive parameter $\gamma_i (i = 0,..,3)$; d is the delay parameter of the transition function; and v_t is a random error term. The order of ϕ is determined through the partial autocorrelation function of $\hat{u}_t$.[10] Equation (4) is estimated for all plausible values of *d*. Given the annual frequency of our data we consider values of *d* up to 4. For each value of *d*, the null of linear current account adjustment, described by $H_0{:}\gamma_{1j} = \gamma_{2j} = \gamma_{3j} = \gamma_4 = \gamma_5 = 0$, $j = (1,2...\phi)$, is tested against the alternative of general non-linear adjustment by employing an LM-type test denoted by LM^G. A statistically significant LM^G implies the rejection of the null; the optimum value of *d* is determined by the highest LM^G score. Provided that LM^G is significant, further tests can be undertaken to determine the exact form of non-linearity (logistic versus quadratic). To do so, we first test the null of linear or non-linear quadratic adjustment, defined as H_0: $\gamma_{3j} = \gamma$

[10] Granger and Teräsvirta (1993) and Teräsvirta (1994) advise against choosing ϕ using information criteria, which may induce a downward bias.

$_5 = 0; j \in (1,2...\phi)$, against the alternative of logistic non-linear adjustment. We denote the LM score testing these hypotheses as LM^L. A significant LM^L implies an adjustment process of logistic non-linear type and terminates the testing process. If LM^L is insignificant, we compute a third statistic, LM^Q, which tests the null of linearity H_0: $\gamma_{1j} = \gamma_{2j} = \gamma_4 = 0 \mid \gamma_{3j} = \gamma_5 = 0; j \in (1,2...\phi)$, against the alternative of quadratic non-linear adjustment. Given an insignificant LM^L, a significant LM^Q implies quadratic non-linearity.

Table 3 presents the results of our non-linearity tests for the whole of the sample periods available. For three countries (Greece, Italy and Portugal) linearity is not rejected at any level of statistical significance. For the remaining nine countries, in five cases the LM^G test rejects linearity in favour of general non-linearity at the 5% level or better, whereas in the remaining three countries linearity is rejected at the 6% level.[11] With regards to the form of non-linearity, for six countries the LM^L test is statistically significant, thus suggesting non-linear current account adjustment of the logistic type. For the remaining two countries, both the LM^L and the LM^Q test are insignificant, leaving the question of the exact form of non-linearity unclear. This, however, is determined by the formal non-linear models presented immediately below.

2.4.2. Models of non-linear current account adjustment

Our findings in the previous section motivate investigation of the hypothesis that the non-linearities identified for the movements of the current account are a reflection of non-linearity in the relationship linking *ca* and *reer*. We test this hypothesis by estimating a formal model of non-linear current account adjustment for each of the countries for which the linearity hypothesis was rejected in Table 3. Given that the non-

[11] For two out of these three countries, Finland and the Netherlands, when the sample is restricted to the period following the structural breaks of the 1970s, the LM^G statistic becomes significant at the 5 per cent level.

linearity LM-tests presented above favoured non-linear adjustment of the logistic type, we estimate the Logistic Smooth Threshold Error Correction Model (L-STECM) analysed by van Dijk (2002).[12] This is described by equations (5) to (8) below:

$$ca_t = \theta_t M_{1t} + (1-\theta_t) M_{2t} + \varepsilon_t \tag{5}$$

$$M_{Lt} = \alpha_1 + \sum_{i=1}^{k} \beta_{1i} ca_{t-i} + \sum_{i=0}^{k} \gamma_{1i} reer_{t-i} + \Phi_1 X_1 + u_{1t} \tag{6}$$

$$M_{Ut} = \alpha_2 + \sum_{i=1}^{k} \beta_{2i} ca_{t-i} + \sum_{i=0}^{k} \gamma_{2i} reer_{t-i} + \Phi_2 X_2 + u_{2t} \tag{7}$$

$$\theta_t = pr\ \{\tau \geq z_{t-d}\} = 1 - \frac{1}{1+e^{-\sigma[z_{t-d}-\tau]}} \tag{8}$$

The L-STECM distinguishes between a lower (M_L) and an upper regime (M_U) for the movements of the current account. These regimes are defined according to whether the transition variable z_{t-d} takes values respectively below and above a critical threshold τ. The transition variable z_{t-d} is the lagged value of a variable relevant to current account determination, which we define to be the deviation of the real effective exchange rate from its sample mean. [13] From this point of view, z can be interpreted as the deviation of the REER from its Purchasing Power Parity (PPP)-consistent value, in which case positive (negative) values of z_{t-d} denote competitiveness gains (losses) that are theoretically expected to be associated with current account improvement (deterioration).

[12] We also attempted to model non-linear current account adjustment using Quadratic Logistic Smooth Error Correction Model (QL-STECM). The QL-STECM involves an inner and an outer current account adjustment regime, respectively corresponding to adjustment within and outside a band defined in turn by two critical threshold values of the transition variable. The results of these experiments were unsuccessful as in most of the cases we could not obtain model convergence. For the small number of models for which convergence was obtained, the models' fit was inferior to the one of the L-STECM models presented below.

[13] The results of the non-linear models that follow remain totally unaffected if the transition variable z_{t-d} is defined to be the level of the real effective exchange rate (i.e. the series *reer* itself). However, we have preferred to define the transition variable as the deviation of *reer* from its sample mean as we found it more intuitive to associate positive values of this deviation with competitiveness gains and negative values with competitiveness losses.

Therefore, our L-STECM distinguishes between one kind of *ca* response applying when the economy's international competitiveness improves relative to the critical threshold against another type of response applying to periods when international competitiveness declines below the critical value. Given the annual frequency of our data, we set d=1.[14] M_L and M_U are given by equations (6) and (7). These are linear current account models similar to the one described by equation (1), adjusted for the structural breaks the β and γ parameters have been subject to as identified in section 2.3. The breaks are captured through the inclusion of the terms $\Phi_i X_i$ (i=1,2) where Φ_i denotes an $(1\times n)$ vector of parameters and X_i an $(n\times 1)$ vector of statistically significant variables accounting for the statistically significant structural breaks. Equation (5) models actual current account movements as a weighted average of M_L and M_U with the regime weight θ modelled in equation by (8) as the probability that the transition variable z_{t-d} is below τ, where the parameter σ denotes the speed of transition between the two regimes.[15]

We estimate the L-STECM models for the same samples used in Table 2, i.e. for the period following the structural breaks of the 1970s. The results are reported in Table 4. For the three countries for which linearity was not rejected in Table 3 (Greece, Italy and Portugal), Table 4 reproduces the results of the linear models accounting for structural breaks in Table 2. For the remaining eight countries, the main result emerging from the L-STECM models is the confirmation of the theoretically expected positive link between the movements of the current account and the real exchange rate: with one single exception, all *reer* terms for all eight countries in both regimes (i.e. in 15 out 16 estimated regimes) are statistically significant with a positive sign.

[14] We experimented with alternative values of d, however we could not get convergence for the L-STECM models presented below.

Having said that, Table 4 also reveals elements of heterogeneity across countries. In four countries (Austria, Belgium, France and the Netherlands), the value of the critical regime threshold τ is estimated very close to zero whereas for the remaining four countries it is evenly split between moderately positive (Germany and Ireland) and moderately negative (Finland and Spain) values. Concerning the strength of the relationship between *ca* and *reer*, in four countries (Austria, Belgium, Germany and Ireland) the sum of the coefficients of the *reer* terms is higher, so the strength of the link is stronger, in the upper regime (in the case of Ireland, no link is found in the lower regime); for three countries (Finland, the Netherlands and Spain) the link is stronger in the lower rather than the upper regime; finally, France is the only country for which a negative link between *ca* and *reer* is found in one of the two regimes (upper); in the lower regime however, a positive link exists. Countries also differ with regards to the frequency of occurrence of each of the two regimes: For Austria, Germany and Ireland, the lower regime dominant; for Belgium, France and Spain the upper regime occurs more frequently; finally, for the Netherlands and Finland observations are almost split between the two regimes, although for Finland the upper regime applies since the early 1990s.

Finally, the econometric properties of the L-STECM models reported in Table 4 are superior to those of the linear models reported in Tables 1 and 2, as they pass all misspecification tests and typically result in an improvement of the models' fit, manifested by a reduction (in some cases of substantial proportion) in the estimated regression standard errors. Overall, with the exceptions of France and Ireland (for which the majority of the observations respectively are in the upper and lower regime where a positive link between *ca* and *reer* was not found), the L-STECM models reported in

[15] In practise, the parameter σ is usually estimated very imprecisely as the likelihood function in (8) is very insensitive to this parameter. This is also the case for our estimations. For a detailed discussion on this point, see van Dijk et al., 2002.

Table 4 confirm the main findings obtained in Table 3, according to which a positive relationship between the movements of the current account and the real effective exchange rate for the vast majority of the EMU member-states.

3. DISCUSSION OF EMPIRICAL RESULTS

The main findings of the above analysis can now be summarised as follows: In consistence with the predictions of mainstream theoretical models of open economies, a positive relationship exists between the movements of the real effective exchange rates and the current account in the overwhelming majority of the EMU-member states. Furthermore, over the past four decades this relationship has been subject to structural breaks and, in the majority of the cases, is non-linear. The existence of a positive relationship between the current account and the real exchange rate has important policy implications for the individual EMU member states, the conduct of the single monetary policy on behalf of the ECB and the proposed future enlargement of the Euro-zone with the newly-accession EU members.

Identifying the determinants and understanding the dynamics of current account imbalances within the Euro-area has a direct implication to the question of whether such imbalances are a reason for concern. To the extent, for example, that the current account deficits reflect faster productivity growth in the process of income convergence within the EMU they should be treated as an unavoidable collateral effect. Indeed this is the way that such imbalances are treated as non-alarming by many authoritative texts (e.g., Blanchard and Giavazzi 2002, European Commission 2005). A variation of this approach is to focus on the capital account implications of high productivity growth which raises the rate of return on capital and induces a capital flow that finances an investment boom.

The above type of analysis is based on absolutely valid arguments. What we want to emphasize, however, here is the interaction of developments at the sphere of real economy and the implications of the exchange rate regime. Consider the Euro-area countries with persistent current account deficits, such as Greece, Portugal and Spain. While current account adjustment requires the real exchange rate to depreciate, the convergence process suggests further appreciation through rising home prices. If the convergence process is monotonic, as assumed to be in the analysis by Blanchard and Giavazzi (2002), then the countries that faced deficits consistent with their stage of development relative to their partners at the time of the EMU inception should see these deficits shrinking monotonically over time. In that case the constraint implied by the reduced ability of the real exchange rate to adjust will not be felt.

It seems, however, that the to-date EMU experience is not supportive to the analysis by Blanchard and Giavazzi. Table 5 presents data on average growth rates and current account balances during a six-year window prior to and following the introduction of the Euro (1993-1998 and 1999-2005 respectively). We observe that countries with persistent current account deficits during the pre-EMU window, such as Greece, Portugal and Spain have experienced significant current account deterioration following the introduction of the Euro. A similar pattern is observed for Ireland, Italy and the Netherlands. In four out of these six countries GDP growth has declined during the post-EMU window whereas in the remaining two (Greece and Spain), the post-EMU trend is generally for higher deficit and lower growth. Declining growth rates along with a deepening current account deficit do not seem to be in line with the convergence/catch-up hypothesis.

Rather, current account developments in the EMU area since 1999 seem to be more in tune with the predictions of the TOCA, according to which countries with growth rates higher than the union's average are likely, due to the loss of monetary independence, to face inflationary pressures, declining competitiveness and increased current account deficits. Panel (a) in Figure 3 depicts the average growth rates against average inflation rates during the post-EMU window 1999-2005. We observe a clear positive trend, suggesting that fast growing EMU states experience higher inflation rates.

Panel (b) plots average inflation rates during the post-EMU window against the percentage appreciation/depreciation of the real exchange rate during the same period relative to the pre-EMU window 1993-1998. The latter is measured by taking the difference of the average value of the real exchange, centered on its sample mean between the two windows. A clear negative pattern emerges, suggesting that high inflation countries experience real exchange rate appreciation and, consequently, a loss in competitiveness.

Finally, panel (c), plots the proportion of real exchange rate appreciation/depreciation against the change in the average value of the current account balance between the pre- and post-EMU windows. In consistence with the findings of our econometric analysis in section 2 above, we observe a clear positive pattern, where on the one hand all countries experiencing competitiveness losses due to real exchange rate appreciation facing a deterioration of their average current account position; and on the other countries experiencing competitiveness gains due to real exchange rate appreciation generally face an improvement in their current account position.

Overall, Figure 3 suggests that the EMU tends to become polarized between two sets of countries, those with systematic real appreciation and deteriorating current accounts; and those that have been experiencing real exchange rate depreciation generally leading to current account improvement. The first group, represented in the bottom-left quadrant of Figure 3(c) includes Greece, Italy, Ireland, the Netherlands Portugal and Spain; the second group, mainly in the top-right quadrant of Figure 3(c) includes Austria, Belgium, Finland, France and Germany.

Very interestingly, these groups largely correspond to the group of countries previous researchers as respectively being outside and inside a European Optimum Currency Area (see, among others, Bayoumi and Eichengreen (1997) and the references therein).

Prolonged current account imbalances is not a desirable feature even for those willing to accept them as unavoidable "collateral damage" in the process of full Euro-area convergence. The current account deficits of countries such as Greece, Portugal and Spain have assumed historically record levels, well beyond those that preceded nominal devaluations of the currencies of these countries prior to the introduction of the single currency. Taking the EMU as an unquestionable reality, at least two practical policy suggestions emerge.

The first relates to the future enlargement of the EMU and has to do with getting the initial conditions of EMU entry for the prospective new members right. The experience of the current periphery EMU members, with which the newly-accession EU countries share similarities in terms of ongoing income catch-up, shows that joining the Euro with a fragile current account may result in persistent current account imbalances potentially leading to substantial slowing-down the catch-up process, as manifested by the experience of Portugal. But for the contact of the single monetary policy on behalf of the ECB as well, the existence of a large number of countries with large current account deficits may pose serious policy dilemmas. This issue is closely related to that of current account sustainability and involves the possibility of excessive borrowing by the high-deficit countries in the expectation of real income convergence. With the disciplinary effect of the exchange rate absent this borrowing may reach unsustainable levels. This risk is analogous to the one due to the existence of excessive high budget deficits and may, in extremis jeopardize the price-stability objective of the ECB.

It is true that the EC Treaty recognizes the importance of this issue, as Article 121 (1) explicitly instructs the European Commission and the ECB to take the pre-ins' current account developments into consideration when assessing their convergence. The convergence reports have little binding power, however, which is by no means comparable to that of the Maastricht criteria. Therefore, to avoid further polarisation of the EMU similar to the one currently observed, it might be preferable to upgrade this instruction into a formal EMU entry requirement, where prospective EMU members should aim to have a current account close to balance at the time of joining or be allowed, for a reasonable period prior to joining, to run current account deficits equal to a positive growth differential against the EMU average, in case such a differential is indeed observed.

The second implication relates to the existing EMU members; its crux is that the faster the convergence process within the Euro-area is achieved the faster the existing imbalances can be removed. This is not a great consolation in the short run, however, without full convergence among the current members serious risks for national authorities and the ECB, such as those discussed above, exist. Given the loss of monetary independence as an instrument of managing real exchange rates, and taking participation in the EMU as an unquestionable reality, the task of securing current account adjustment is left to the ratio of relative prices. This implies an increased importance of flexibility for national price levels and highlights the necessity of structural reforms to promote such flexibility.

Finally, even if the presence of substantial current account imbalances within the euro is not a case of concern by itself, the possibility of global imbalances adjustment and its potential repercussion in the Euro-area are quite alarming. For example, under one of the global adjustment scenarios considered by Obstfeld and Rogoff (2005) Europe may end up bearing "the brunt of this policy, ending up with a current account deficit even larger than that of the United States today, while at the same time suffering a huge loss of net foreign assets" (p. 111). This scenario simply involves Asia sticking to its dollar peg and a closing of the US current account gap through an increase in the US saving rate. Such scenarios become more worrying if one considers the net foreign asset positions of the Euro-area countries, which appear even more polarized along the lines of the same group of countries. With a highly polarized Euro-area in terms of current account positions the implications of a significant deterioration of the aggregate Euro-area current account position can be quite unpredictable.

4. SUMMARY

This paper has modelled current account adjustment in the EMU area and used the results to discuss the implications of a kind of current account imbalances overlooked by the existing literature, namely the imbalances existing within the EMU area. We adopt a "back-to-the-basics" modelling approach, whereupon changes in current account are modelled on real exchange rate shifts: this causal link is a standard feature of all mainstream models of international macroeconomics, however very little, if any, evidence establishing its empirical validity exists. Our empirical findings show that a positive relationship exists between the movements of the real effective exchange rates and the current account in the overwhelming majority of the EMU-member states. Over the past four decades this relationship has been subject to structural breaks and, in the majority of the cases, is non-linear. Furthermore, we identify two groups of countries since the abandonment of European national currencies: those with persistent real exchange rate depreciation leading to current account improvement; and those with systematic real appreciation and deteriorating current accounts. These groups largely correspond to those previous research has identified as respectively belonging and not belonging to a European Optimum Currency Area.

Overall, our findings validate the theoretical arguments concerning the potential costs of EMU participation and suggest that meeting the nominal convergence criteria has come, in some countries, at the cost of growing current account imbalances leading to a polarization of current account balances within the EMU. The latter pose policy-response questions for national authorities and the ECB, suggesting that it may be optimal to add to the EMU-accession criteria one referring to the balance of the current account; and highlighting the importance of promoting structural reforms increasing the flexibility of real exchange rates through promoting the flexibility of the ratio of relative prices.

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Table 1

Base-line linear current account models

	Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain
Sample	1971-2005	1972-2005	1971-2005	1972-2005	1971-2005	1973-2005	1976-2005	1975-2005	1973-2005	1979-2004	1973-2005
con	-0.005 (0.002)*	0.013 (0.005)*	0.018 (0.006)*	0.001 (0.004)	0.011 (0.003)*	-0.014 (0.004)**	-0.013 (0.006)*	0.002 (0.002)	0.027 (0.010)*	-0.029 (0.007)**	-0.008 (0.003)**
ca_{t-1}	0.471 (0.123)**	0.792 (0.086)**	0.704 (0.101)**	0.730 (0.131)**	0.865 (0.083)**	0.558 (0.119)**	0.564 (0.113)*	0.543 (0.103)**	0.770 (0.124)**	0.752 (0.106)**	0.763 (0.120)**
ca_{t-2}							0.255 (0.106)*			-0.217 (0.103)*	
ca_{t-3}									-0.316 (0.105)**		-0.372 (0.117)**
$reer_t$			0.220 (0.080)*				-0.274 (0.106)*		0.605 (0.200)**		0.167 (0.069)*
$reer_{t-1}$	0.083 (0.070)**			0.260 (0.106)*	0.200 (0.065)**			0.255 (0.057)**	-0.452 (0.206)*		
$reer_{t-2}$		0.234 (0.095)*		-0.217 (0.109)*				-0.200 (0.053)**		0.546 (0.213)*	
$reer_{t-3}$						0.211 (0.087)*				-0.742 (0.355)*	
$reer_{t-4}$										0.574 (0.231)*	
Regression Standard Error	0.01063	0.01268	0.01680	0.00793	0.00877	0.01362	0.01498	0.00869	0.01560	0.01715	0.01203
R^2	0.51	0.84	0.84	0.59	0.81	0.64	0.91	0.74	0.67	0.90	0.67
AR	0.75	0.86	0.34	0.59	0.15	0.25	0.39	0.83	0.94	0.28	0.15
ARCH	0.98	0.14	0.01*	0.98	0.88	0.94	0.48	0.98	0.65	0.90	0.67
Norm	0.11	0.34	0.84	0.46	0.97	0.41	0.18	0.22	0.59	0.78	0.19
Hetero	0.08	0.02*	0.04*	0.40	0.21	0.27	0.92	0.81	0.56	0.91	0.56
Hetero-X	0.02*	0.05*	0.03*	0.80	0.31	0.22	n.a	0.32	0.91	n.a.	0.40
RESET	0.48	0.33	0.83	0.07	0.47	0.87	0.98	0.24	0.93	0.35	0.77
Static long-run equation											
con	-0.009 (0.003)*	0.064 (0.020)**	0.060 (0.018)**	0.005 (0.013)	0.078 (0.045)	-0.032 (0.006)**	-0.073 (0.033)*	0.004 (0.004)	0.049 (0.013)**	-0.062 (0.010)**	-0.014 (0.004)**
reer	0.157 (0.128)	1.125 (0.447)*	0.745 (0.200)**	0.159 (0.304)	1.479 (0.958)	0.478 (0.198)*	-1.508 (0.706)*	0.121 (0.118)	0.280 (0.271)	0.815 (0.195)**	0.274 (0.112)*

NOTES: Numbers in parentheses are standard errors; AR is the Lagrange Multiplier F-test for second order residual serial correlation; ARCH is the Autoregressive Conditional Heteroskedasticity F-test; Norm is the Normality Chi-square Bera-Jarque test for residual non-normality; Hetero is an F-test for heteroskedasticity; Hetero-X is a Chi-square joint test for heteroscedasticity and general misspecification; RESET is an F-test for functional form. The reported unit root t-test tests for stationarity of the residuals of the ADL model (see text); * and ** respectively denote statistical significance at the 5 and 1 per cent level. Some equations include intercept dummies taking the value of unity for very unusual observations, zero otherwise. The exclusion of these dummies does not change the nature of the results but results in problems of non-normality. The country and years to which these dummies refer to have as follows: Austria 1980; Germany 1991; Greece 1980; Ireland 1979; Italy 1980; and Portugal 1981.

Table 2

Linear current account models accounting for structural breaks

	Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain
Sample	1979-2005	1972-2005	1977-2005	1977-2005	1975-2005	1973-2005	1976-2005	1977-2005	1976-2005	1979-2004	1975-2005
con	0.000 (0.003)	0.016 (0.003)**	0.027 (0.006)**	0.000 (0.003)	0.012 (0.002)**	-0.014 (0.004)**	-0.003 (0.006)	0.003 (0.002)	0.032 (0.006)**	-0.029 (0.007)**	-0.006 (0.003)*
ca_{t-1}	0.558 (0.121)**	0.567 (0.088)**	0.584 (0.098)**	0.839 (0.132)**	0.838 (0.079)**	0.558 (0.119)**	0.627 (0.097)**	0.667 (0.088)**	0.390 (0.057)**	0.752 (0.106)**	0.601 (0.104)**
ca_{t-2}							0.439 (0.104)**			-0.217 (0.103)*	
ca_{t-3}											-0.381 (0.092)
$reer_t$			0.301 (0.072)**				-0.077 (0.106)		0.453 (0.082)**		0.195 (0.053)**
$reer_{t-1}$	0.335 (0.118)**			-0.018 (0.090)	0.263 (0.0671)**			0.248 (0.045)**			
$reer_{t-2}$		0.351 (0.067)**								0.546 (0.213)*	
$reer_{t-3}$						0.211 (0.087)*		-0.143 (0.042)**		-0.742 (0.355)*	
$reer_{t-4}$										0.574 (0.231)*	
D1993		0.026 (0.005)**									
$D1982ca_{t-2}$							-0.361 (0.106)**				
$D1992ca_{t-3}$									-0.686 (0.102)**		
$D1995ca_{t-1}$											0.503 (0.127)**
$D2000ca_{t-1}$		-0.476 (0.092)**									
$D1981reer_{t-1}$									-0.789 (0.069)**		
$D1985reer_t$									0.706 (0.073)**		
$D1987reer_{t-2}$											
$D1992reer_t$									0.580 (0.097)**		
$D1993reer_{t-2}$											
Regression Standard Error	0.00918	0.00860	0.01351	0.00733	0.00827	0.01362	0.01255	0.00639	0.00653	0.01715	0.00872
R^2	0.67	0.93	0.89	0.67	0.85	0.64	0.94	0.87	0.96	0.90	0.83

AR	0.32	0.40	0.78	0.87	0.25	0.25	0.74	0.65	0.69	0.28	0.24
ARCH	0.90	0.22	0.88	0.99	0.85	0.94	0.50	0.45	0.44	0.90	0.11
Norm	0.11	0.30	0.88	0.85	0.58	0.41	0.08	0.70	0.25	0.78	0.26
Hetero	0.11	0.88	0.22	0.70	0.69	0.27	0.99	0.44	0.86	0.91	0.85
Hetero-X	0.02*	0.82	0.30	0.74	0.55	0.22	n.a.	n.a.	n.a	n.a.	0.94
RESET	0.02*	0.39	0.90	0.51	0.80	0.87	0.23	0.51	0.74	0.35	0.65
Static long-run equation											
	Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain
con	0.000 (0.006)	0.037 (0.008)**	0.066 (0.011)**	-0.002 (0.024)	0.077 (0.035)*	-0.032 (0.005)**	0.043 (0.135)	0.008 (0.005)	0.052 (0.007)**	-0.062 (0.010)**	-0.007 (0.003)*
$reer_t$	0.758 (0.346)*	0.811 (0.163)**	0.722 (0.118)**	-0.111 (0.613)	1.623 (0.815)*	0.478 (0.022)*	1.162 (2.818)	0.314 (0.132)*	0.743 (0.119)**	0.815 (0.195)**	0.250 (0.076)**
D1979							0.987 (1.413)				
D1984									0.046 (0.012)**		
D1992									0.067 (0.016)**		
D1993		0.060 (0.009)**									
$D1982ca_{t-2}$							5.465 (6.313)				
$D1992ca_{t-3}$									-1.125 (0.187)**		
$D1995ca_{t-1}$											0.646 (0.135)**
$D2000ca_{t-1}$		-1.100 (0.310)**									
$D1981reer_{t-1}$									-1.293 (0.143)**		
$D1985reer_t$									1.157 (0.152)**		
$D1987reer_{t-2}$											
$D1992reer_t$									0.951 (0.017)**		
$D1993reer_{t-2}$											

NOTES: Numbers in parentheses are standard errors; AR is the Lagrange Multiplier F-test for second order residual serial correlation; ARCH is the Autoregressive Conditional Heteroskedasticity F-test; Norm is the Normality Chi-square Bera-Jarque test for residual non-normality; Hetero is an F-test for heteroskedasticity; Hetero-X is a Chi-square joint test for heteroscedasticity and general misspecification; RESET is an F-test for functional form. The reported unit root t-test tests for stationarity of the residuals of the ADL model (see text); * and ** respectively denote statistical significance at the 5 and 1 per cent level. Some equations include intercept dummies taking the value of unity for very unusual observations, zero otherwise. The exclusion of these dummies does not change the nature of the results but results in problems of non-normality. The country and years to which these dummies refer to have as follows: Austria 1980; Germany 1991; Greece 1980; Ireland 1979; Italy 1980 and 1993; Netherlands 1984 and 1992; and Portugal 1981

Table 3

Tests for non-linear current-account adjustment

	ϕ	d	LM^G	LM^L	LM^Q
Austria	1	1	2.71 [0.06]$^+$	3.47 [0.04]*	N/A
Belgium	1	1	3.66 [0.02]*	4.15 [0.03]*	N/A
Finland	1	3	2.79 [0.06]$^+$	0.79 [0.47]	1.88 [0.16]
France	1	1	3.12 [0.04]*	3.40 [0.04]*	N/A
Germany	4	3	3.74 [0.01]**	3.57 [0.03]*	N/A
Greece	1	1	1.25 [0.31]	N/A	N/A
Ireland	4	1	2.68 [0.04]*	1.54 [0.25]	0.60 [0.75]
Italy	1	1	1.60 [0.20]	N/A	N/A
Netherlands	2	4	2.26 [0.06]$^+$	3.35 [0.04]*	N/A
Portugal	1	3	0.52 [0.76]	N/A	N/A
Spain	2	3	2.89 [0.02]*	6.52 [0.00]**	N/A

NOTES: Numbers in square brackets denote p-values; LM^G is a general test of non-linearity testing the null of linear adjustment against the alternative of non-linear adjustment; LM^L tests the null of either linear or quadratic adjustment against the alternative of non-linear logistic adjustment. Conditional upon the rejection of the hypothesis of non-linear logistic adjustment, LM^Q tests the null of linear adjustment against the alternative of non-linear quadratic adjustment. +, *, ** denote significance at the 10%, 5% and 1% level respectively.

Table 4

Non-linear current account models

	Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain
	1979-2005	1972-2005	1977-2005	1977-2005	1975-2005	1973-2005	1976-2005	1977-2005	1976-2005	1979-2004	1975-2005
M_L											
con	0.005 (0.004)	0.022 (0.009)*	0.090 (0.027)**	0.016 (0.011)	0.016 (0.003)**	-0.014 (0.004)**	0.000 (0.002)	0.003 (0.002)	0.029 (0.010)	-0.029 (0.007)**	-0.005 (0.010)
ca_{t-1}	0.723 (0.159)**	0.409 (0.152)*		1.645 (0.464)**	0.914 (0.086)**	0.558 (0.119)**	0.700 (0.069)**	0.667 (0.088)**	0.848 (0.105)**	0.752 (0.106)**	
ca_{t-2}										-0.217 (0.103)*	
ca_{t-3}			-0.402 (0.178)*								
$reer_t$									0.471 (0.199)*		0.372 (0.145)*
$reer_{t-1}$	0.450 (0.191)*		0.937 (0.198)**		0.328 (0.068)**			0.248 (0.045)**			
$reer_{t-2}$		0.492 (0.143)**								0.546 (0.213)*	
$reer_{t-3}$				0.729 (0.281)*		0.211 (0.087)*		-0.143 (0.042)**		-0.742 (0.355)*	
$reer_{t-4}$				-0.405 (0.187)*						0.574 (0.231)*	
D93		0.031 (0.008)**									
$D95ca_{t-1}$											0.767 (0.161)**
$D81reer_{t-2}$									-0.334 (0.141)*		
$D85reer_{t-1}$									0.235 (0.091)*		
$D92reer_{t-4}$									0.938 (0.287)**		
M_U						N/A		N/A		N/A	
con	-0.025 (0.010)*	0.011 (0.003)**	0.029 (0.010)*	-0.007 (0.003)*	0.016 (0.003)**		0.000 (0.002)		0.005 (0.007)		-0.005 (0.002)*
ca_{t-1}	0.419 (0.156)*	0.655 (0.120)**	0.614 (0.159)**	0.808 (0.116)**	0.624 (0.148)**				0.449 (0.135)**		0.612 (0.110)**
ca_{t-3}											-0.370 (0.089)**
$reer_t$							7.036 (0.485)**				
$reer_{t-1}$	2.325 (0.832)*		0.477 (0.211)*		0.782 (0.392)*						0.254 (0.089)**
$reer_{t-3}$				-0.208 (0.083)*							
D93		0.041									

		(0.008)**									
D82ca$_{t-2}$							0.851 (0.152)**				
D95ca$_{t-1}$											0.467 (0.149)**
D2000ca$_{t-1}$		-0.659 (0.115)**									
D81reer$_{t-2}$									-0.552 (0.220)*		
D82reer$_{t}$							-6.831 (0.511)**				
D85reer$_{t}$									0.545 (0.117)**		
D92reer$_{t-2}$									0.946 (0.233)**		
D93reer$_{t-2}$		0.770 (0.233)**									
τ	0.0033 (0.0001)**	0.0014 (0.0004)**	-0.0151 (0.0044)**	-0.0065 (0.0021)**	0.0141 (0.0028**	N/A	0.0184 (0.0089)*	N/A	0.0060 (0.0012)**	N/A	-0.0282 (0.0008)**
Regression S.E.	0.00842	0.00704	0.01310	0.00597	0.00774	0.01362	0.01019	0.00639	0.00603	0.01715	0.00757
AR	0.13	0.30	0.86	0.50	0.25	0.25	0.43	0.65	0.15	0.28	0.34
ARCH	0.95	0.38	0.41	0.72	0.54	0.94	0.56	0.45	0.38	0.90	0.84
Norm	0.64	0.67	0.71	0.22	0.79	0.41	0.87	0.70	0.95	0.78	0.61
Hetero	0.98	0.99	0.98	0.80	0.87	0.27	0.99	0.44	N/A	0.91	0.99

NOTES: Numbers in parentheses are standard errors; The results reported for the countries for which linearity was not rejected in Table 3 (Greece, Italy and Portugal) reproduce the results reported in Table 2 for these countries. AR is the Lagrange Multiplier F-test for second order residual serial correlation; ARCH is the Autoregressive Conditional Heteroskedasticity F-test; Norm is the Normality Chi-square Bera-Jarque test for residual non-normality; Hetero is an F-test for heteroskedasticity. * and ** respectively denote statistical significance at the 5 and 1 per cent level. Some equations include intercept dummies taking the value of unity for very unusual observations, zero otherwise. The exclusion of these dummies does not change the nature of the results but results in problems of non-normality. The country and years to which these dummies refer to have as follows: Austria 1980; Germany 1991; Greece 1980; Ireland 1981 and 1993; Italy 1980 and 1993; Netherlands 1981; and Portugal 1981.

Table 5

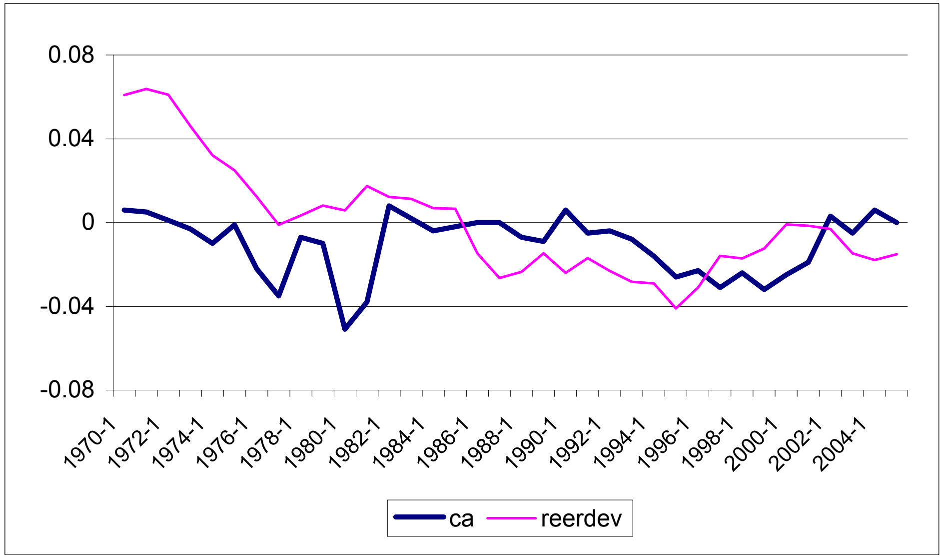
GDP growth and current account balance in the EMU area

	Average GDP growth rate					Average Current Account Balance (% in GDP)				
	Pre-EMU 1993-98	Post-EMU 1999-2005	Difference Post-Pre	Early EMU 1999-2002	Recent EMU 2003-2005	Pre-EMU 1993-98	Post-EMU 1999-2005	Difference Post-Pre	Early EMU 1999-2002	Recent EMU 2003-2005
Austria	2.2	2.0	-0.1	2.5	1.7	-2.1	-1.0	1.1	-1.8	0.0
Belgium	1.9	2.0	0.1	2.6	1.5	5.4	4.8	-0.6	5.4	4.0
Finland	3.7	2.8	-0.9	3.1	2.5	3.2	5.5	2.4	6.8	3.8
France	1.6	2.2	0.6	3.1	1.4	1.4	0.8	-0.6	1.7	-0.4
Germany	1.4	1.2	-0.2	2.1	0.6	-0.9	1.4	2.3	-0.1	3.4
Greece	3.5	4.0	0.5	4.3	3.7	-4.3	-5.1	-0.8	-6.0	-3.9
Ireland	7.5	6.6	-0.9	8.7	5.0	2.8	-0.6	-3.4	-0.5	-0.7
Italy	1.5	1.2	-0.3	2.2	0.5	2.0	-0.7	-2.7	-0.2	-1.3
Netherlands	3.0	1.6	-1.3	3.0	0.6	5.1	3.2	-1.9	2.8	3.7
Portugal	2.5	1.4	-1.1	3.0	0.2	-3.1	-8.3	-5.2	-9.1	-7.1
Spain	2.5	3.6	1.2	4.5	3.0	-0.7	-4.2	-3.5	-3.5	-5.0

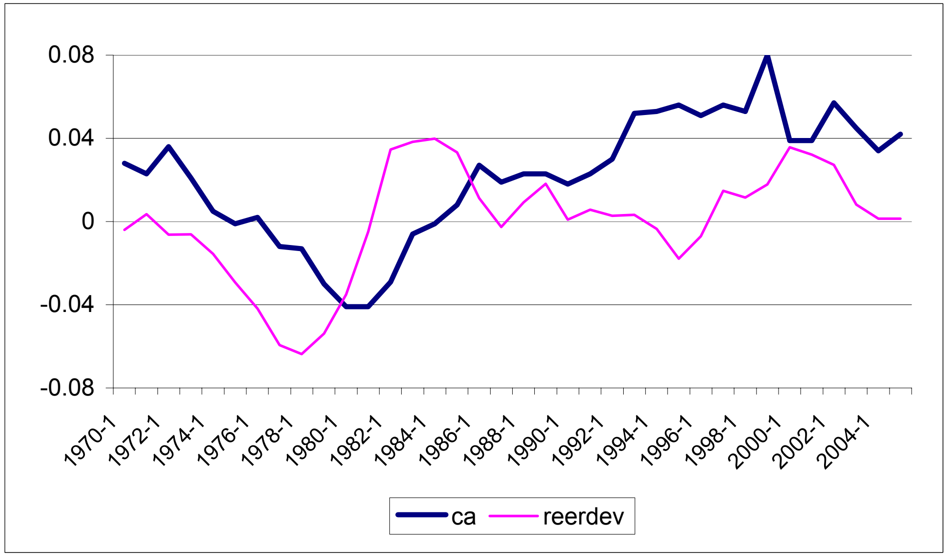
Note: Greece joined the EMU in January 2001; As a result, the pre- and post-EMU windows for that country are respectively defined as 1996-2000 and 2001-2005; the early EMU period is defined as 2001-2003; and the recent EMU is defined as 2004-2005.

Figure 1: Current account balance (% in GDP) and real effective exchange rate (deviation from sample mean)

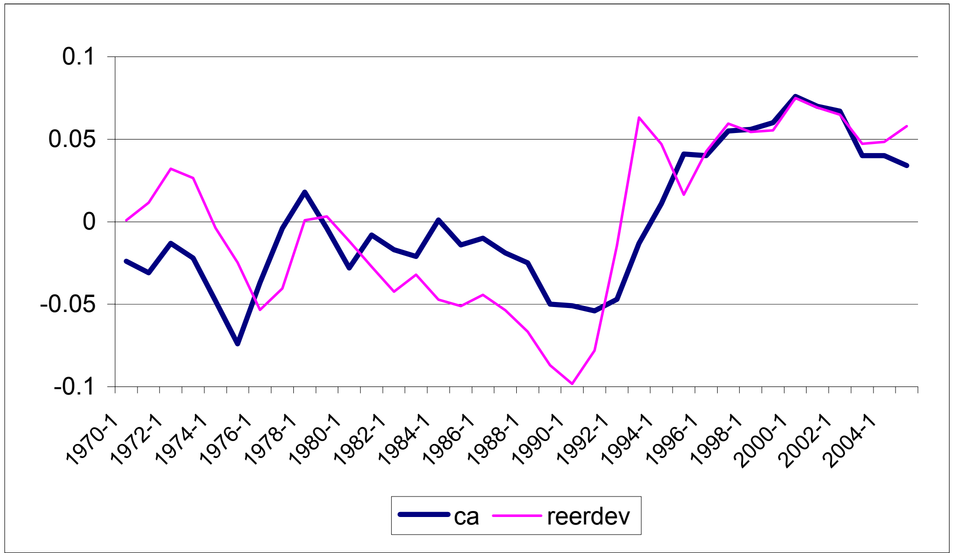
Austria



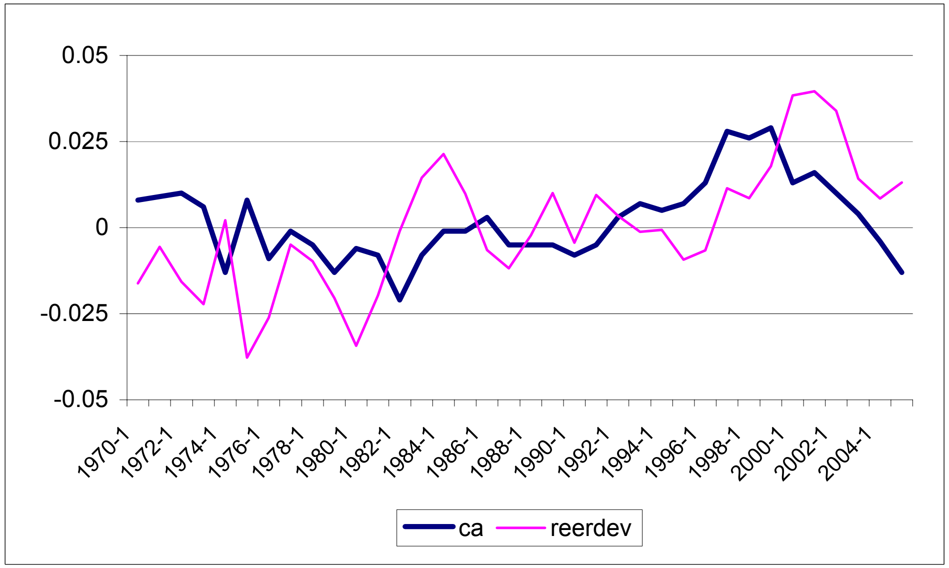
Belgium



Finland

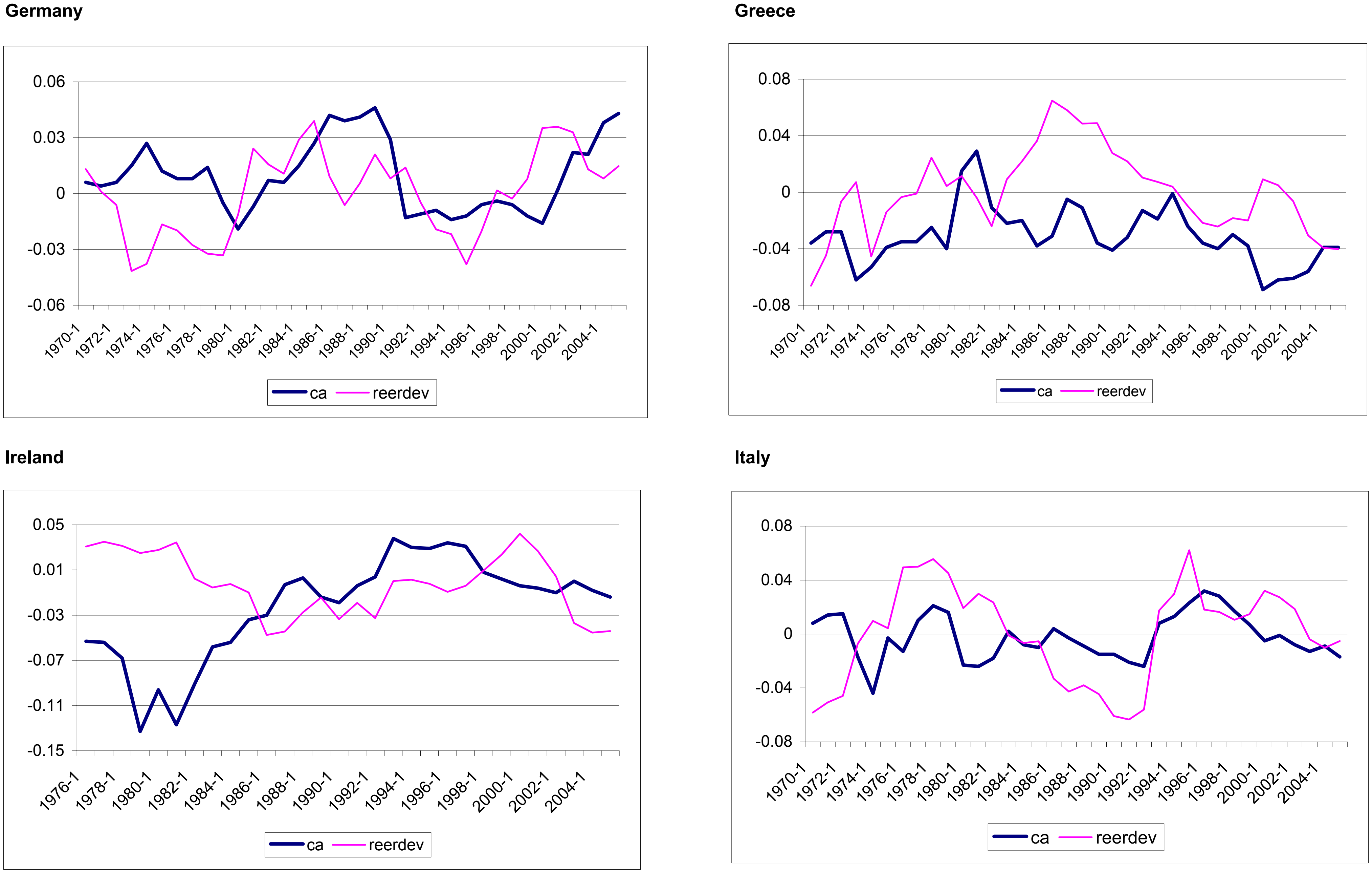


France



Source: OECD Main Economic Indicators

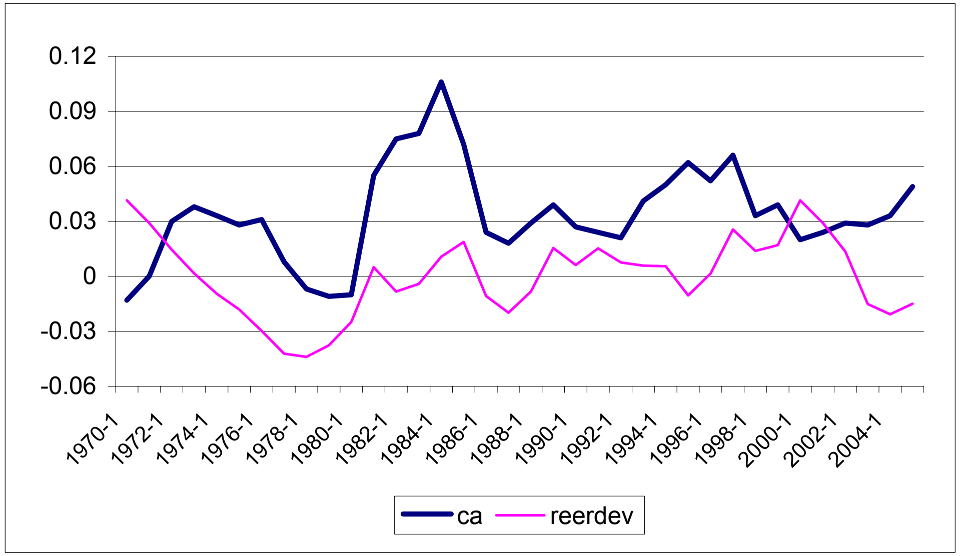
Figure 1: Current account balance (% in GDP) and real effective exchange rate (deviation from sample mean)



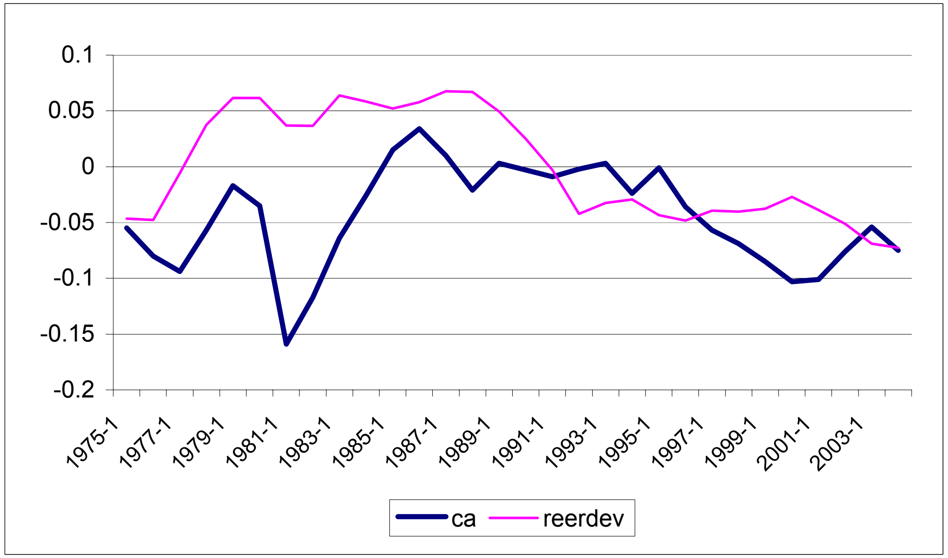
Source: OECD Main Economic Indicators

Figure 1: Current account balance (% in GDP) and real effective exchange rate (deviation from sample mean)

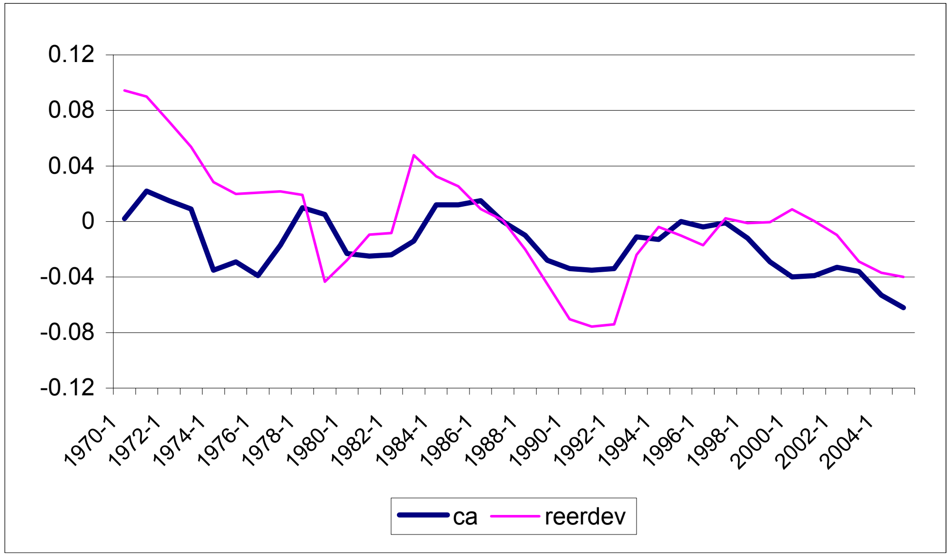
The Netherlands



Portugal



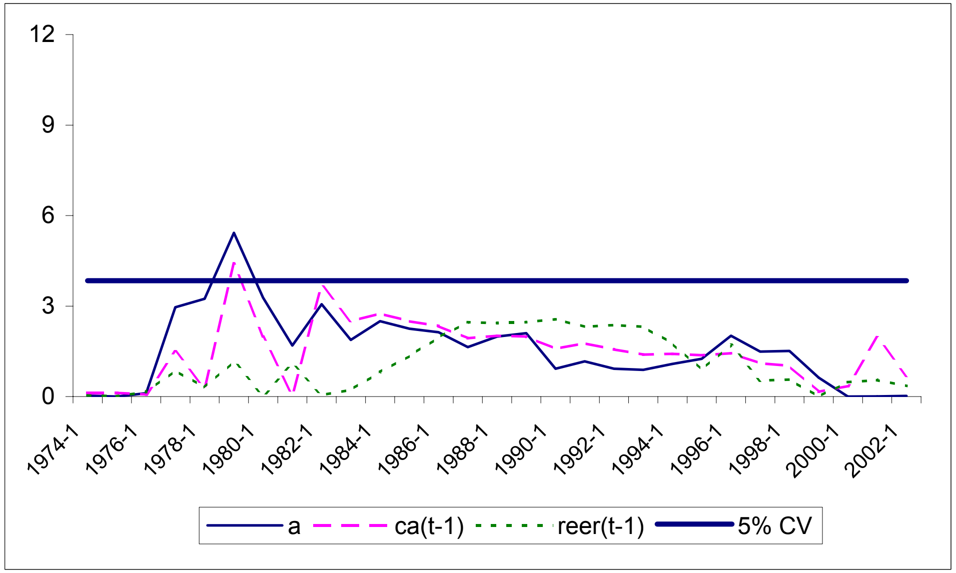
Spain



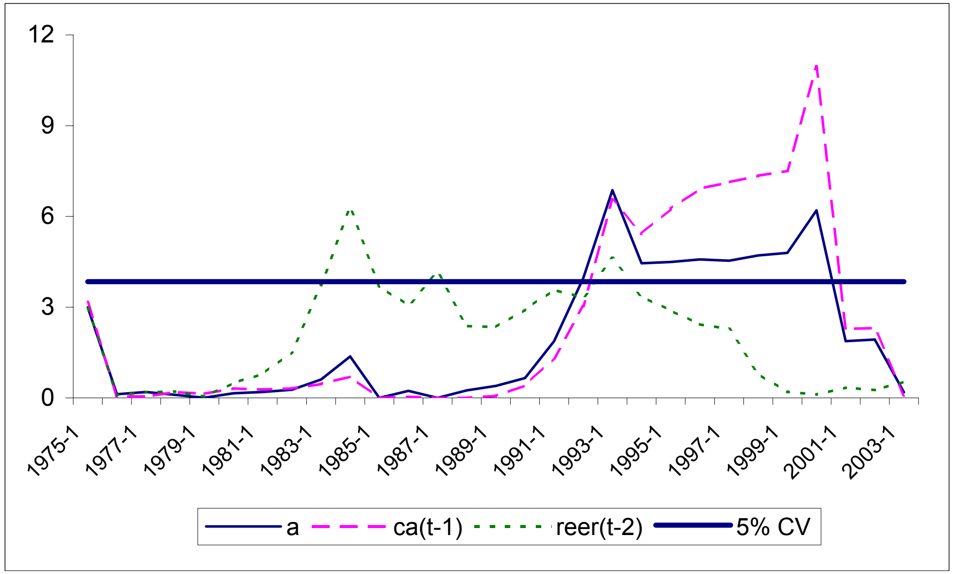
Source: OECD Main Economic Indicators

Figure 2: Sequential Chi-square tests for structural breaks

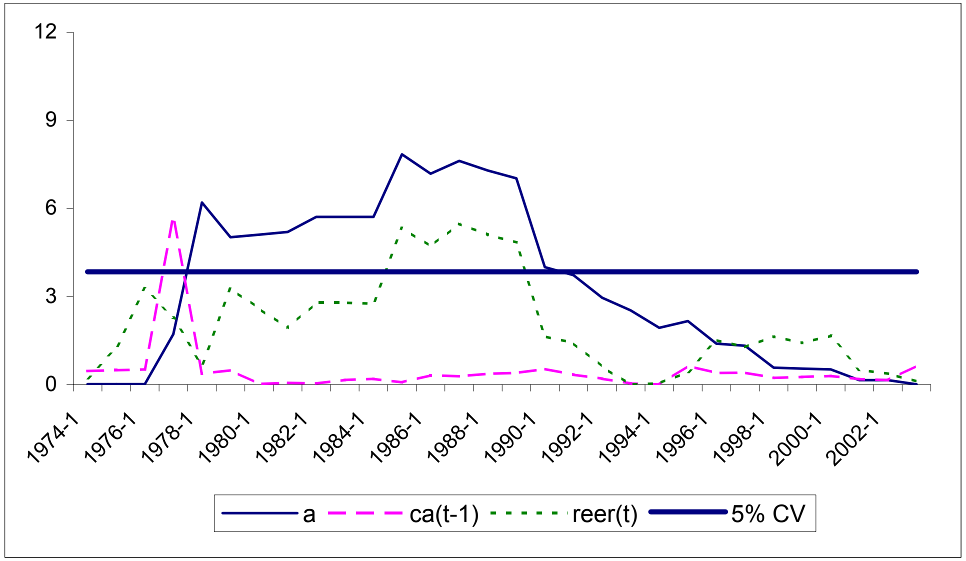
Austria



Belgium



Finland



France

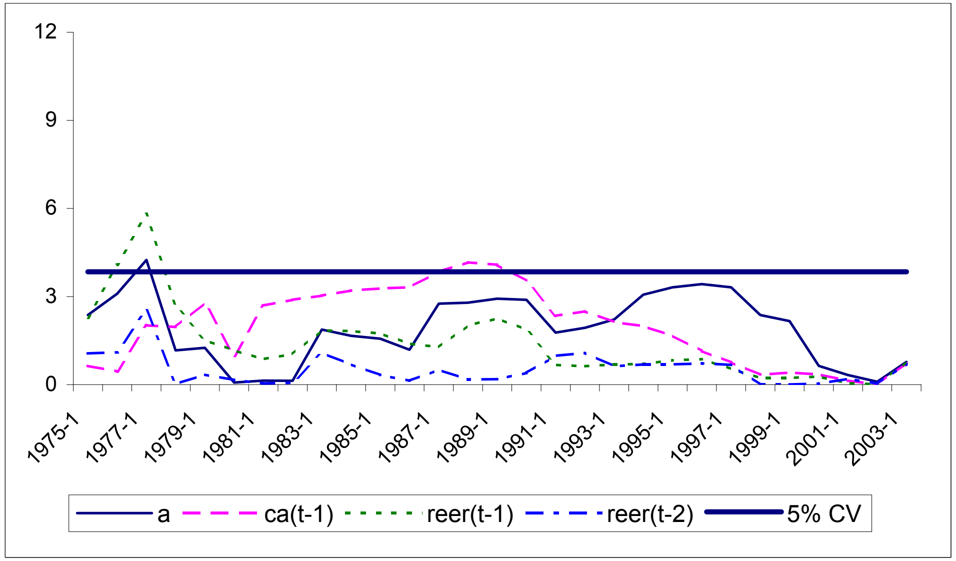
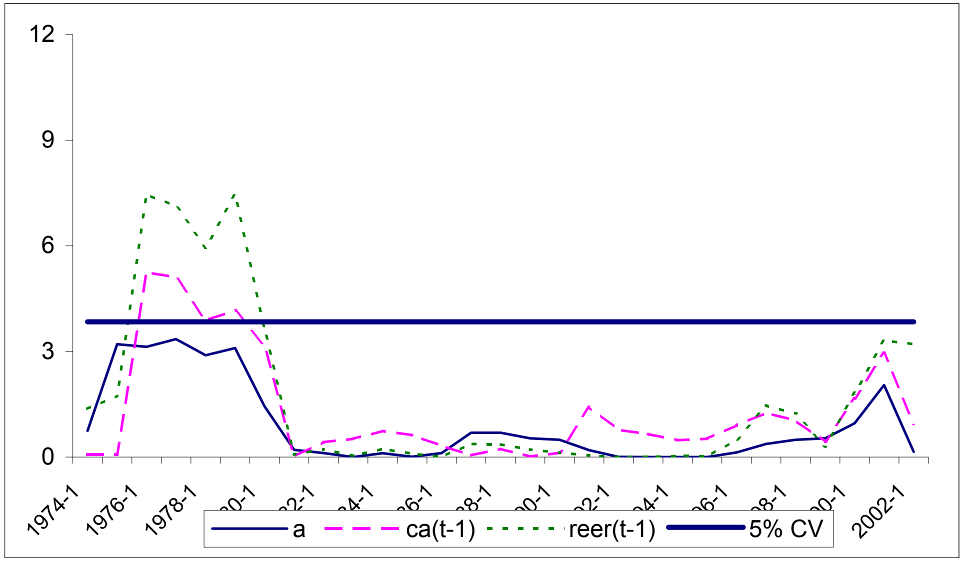
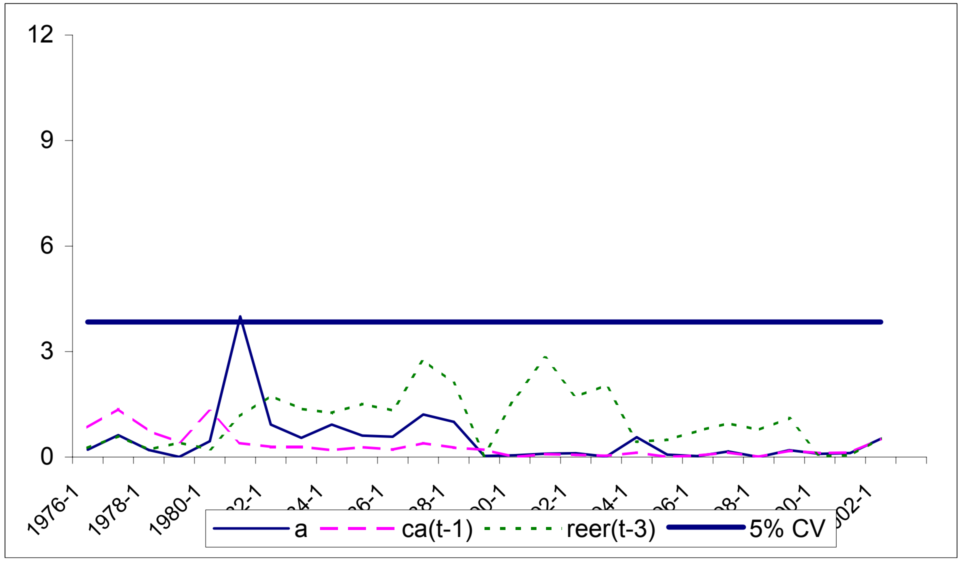


Figure 2: Sequential Chi-square tests for structural breaks (continued)

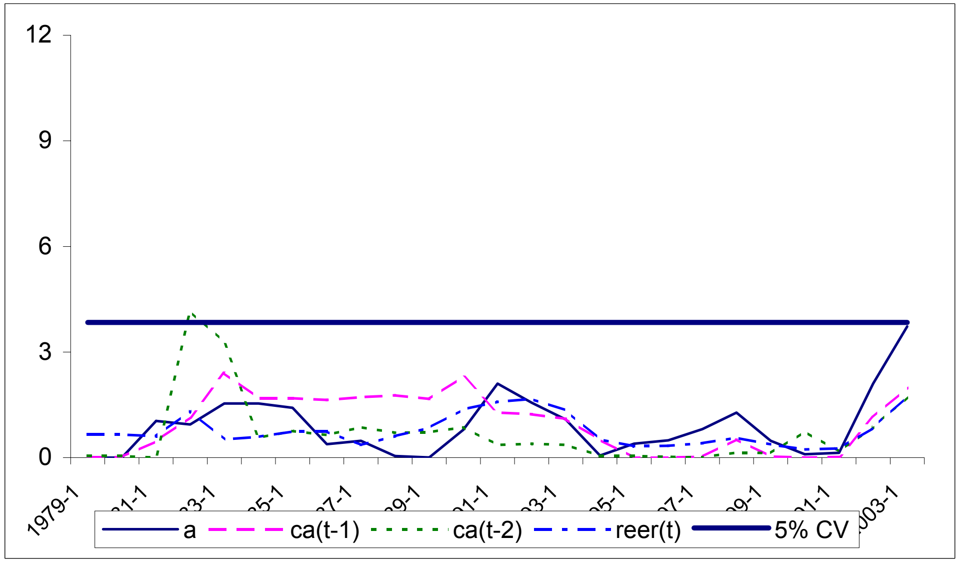
Germany



Greece



Ireland



Italy

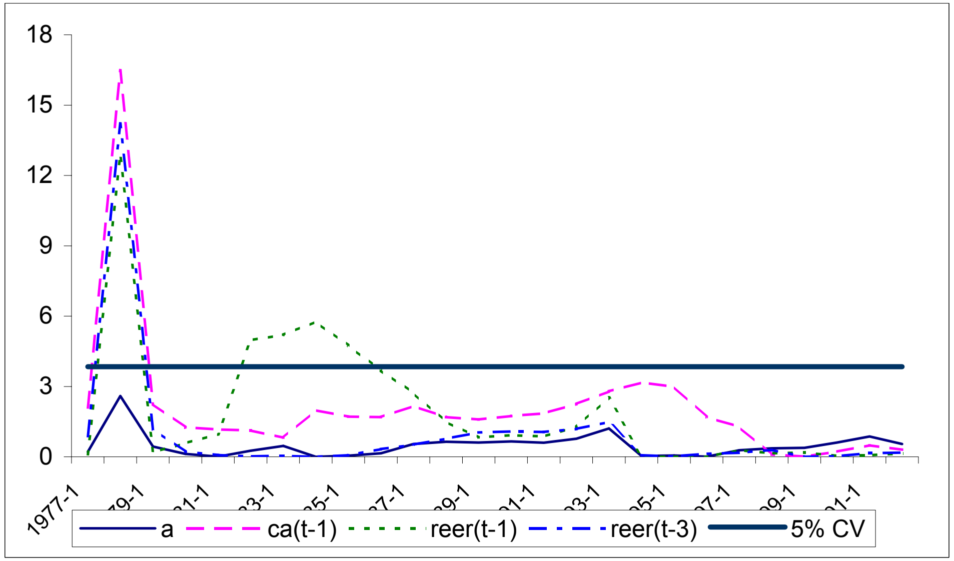
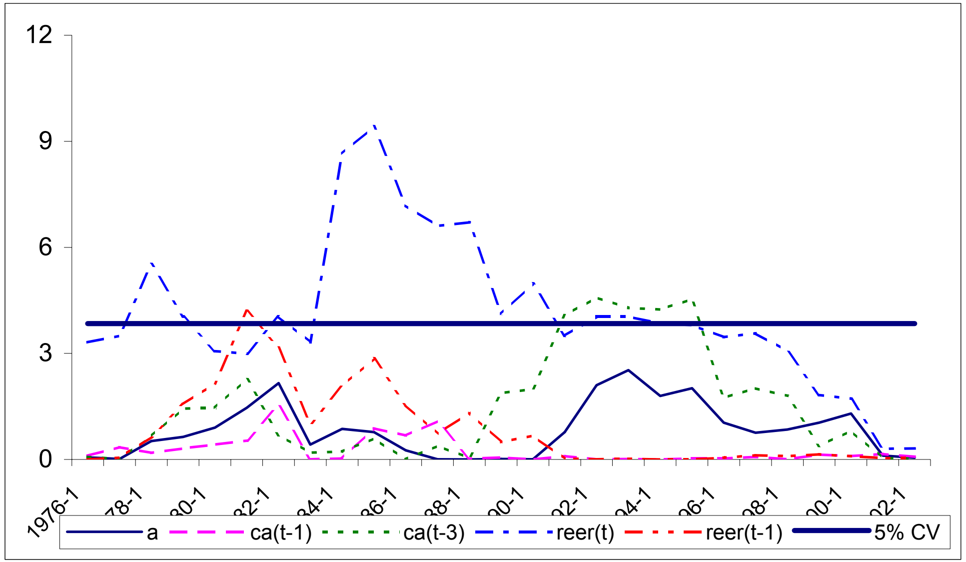
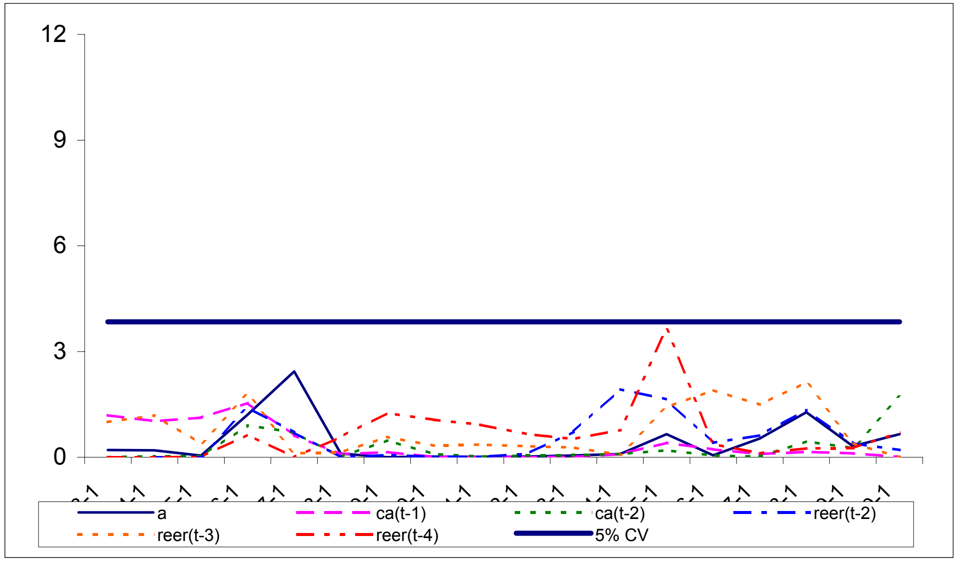


Figure 2: Sequential Chi-square tests for structural breaks (continued)

The Netherlands



Portugal



Spain

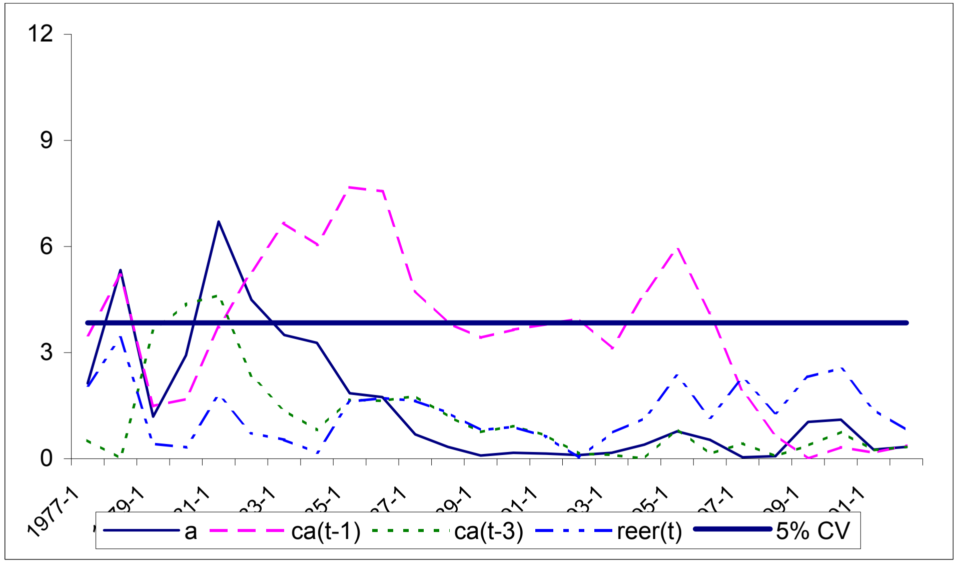


Figure 3(a): Average inflation and GDP growth in EMU area

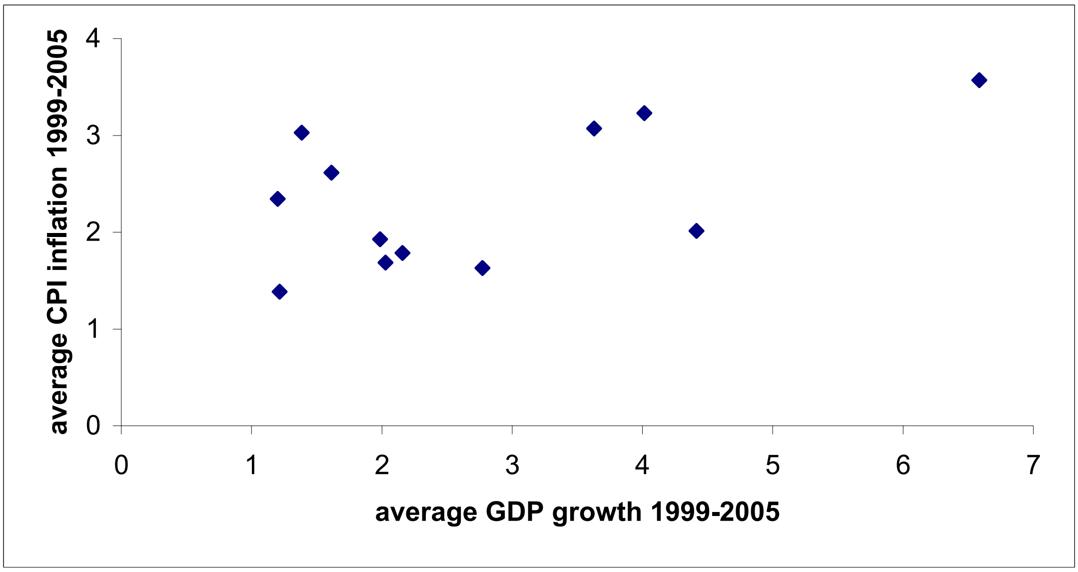


Figure 3(b): Average inflation and real exchange rate movements

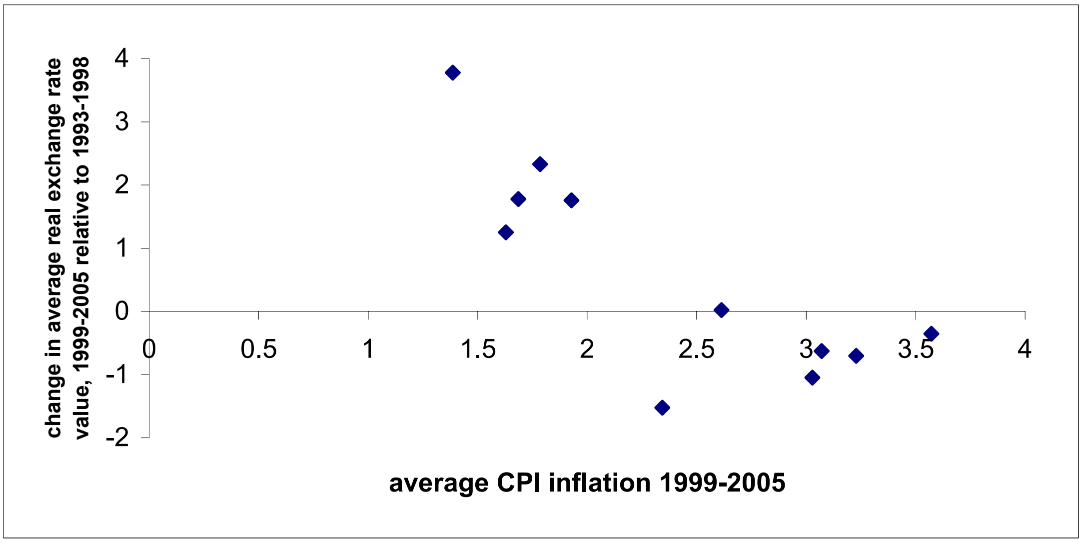


Figure 3(c): Real exchange rate movements and changes in current account