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Current-account adjustments and exchange-rate misalignments♦

Blaise Gnimassoun* **and Valérie Mignon****

Abstract

This paper aims at studying current-account imbalances by paying a particular attention to exchange-rate misalignments. We rely on a nonlinear model linking the persistence of current-account imbalances to the deviation of the exchange rate to its equilibrium value. Estimating a panel smooth transition regression model on a sample of 22 industrialized countries, we show that persistence of current-account imbalances strongly depends on currency misalignments. More specifically, while there is no persistence in cases of currency undervaluation or weak overvaluation, persistence tends to augment for overvaluations higher than 11%. In addition, whereas disequilibria are persistent even for very low overvaluations in the euro area, persistence is observed only for overvaluations higher than 14% for non-eurozone members.

JEL classification: F32, F31, C33.

Keywords: current-account imbalances, current-account persistence, exchange-rate misalignments, panel smooth transition regression models.

1. Introduction

The magnitude of current-account imbalances and, especially, their persistence in several industrialized countries have become a key issue. While the U.S. current deficit represented on average only 1.6% and 1.7% of GDP during the 1990 and 1980 decades, the United States has surpassed the $ 600 billion current deficit over the 2004-2008 period, reaching almost 6% of U.S. GDP. This pattern is also observed for some euro area countries such as Spain, Portugal and Greece which have reached respectively current-account deficits of 8%, 10% and 11% of GDP. At the same time, other countries such as Germany, the Netherlands, Norway and Switzerland recorded current-account surpluses, exceeding 10% of GDP for Norway and Switzerland.

Within this context of global imbalances, several theoretical and empirical contributions have been devoted to the study of current-account imbalances' sustainability and the adjustment mechanisms towards equilibrium.[1] Most of the empirical studies on current-account adjustment indicate that such process takes place through major correction in the exchange rate, without having however established upstream an empirical link between currency misalignments and

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[1] See references in Section 2.

current-account imbalances (Freund, 2005; Debelle and Galati, 2005; Obstfeld and Rogoff, 2005).[2] If the current account - real exchange rate nexus is well established from a theoretical viewpoint (Mundell, 1961; Dornbusch and Fischer, 1980; Rodriguez, 1980; Branson, 1981), very few empirical studies have investigated this relationship (see Arghyrou and Chortareas, 2008). More surprisingly, to our best knowledge, no empirical contribution has focused on the relationship between exchange-rate misalignments—i.e., the difference between the observed exchange rate and its equilibrium value—and persistence of current-account imbalances. In addition, the literature that attempts to address this issue is confined to the link between the current account and the real exchange rate, without actually paying attention to exchange-rate misalignments or current-account gaps (see for example Belke and Dreger, 2011). Arghyrou and Chortareas (2008) were the first to investigate the link between real effective exchange rates and current-account adjustment for euro area countries. They show that the real exchange rate and the current account exhibit a significant relationship which is subject to nonlinearity. They mention that these findings should however be interpreted with caution since both the current account and the real exchange rate are endogenous variables that notably depend on productivity shocks. Consequently, a thorough examination of the current account - real exchange rate nexus requires to control *ex ante* each of the two variables by its fundamentals, such as productivity shocks. This highlights the interest and the relevance of investigating the relationship between exchange-rate misalignments and the gap between the observed current account and its equilibrium level calculated from its traditional determinants. Such investigation constitutes the core of our contribution.

Examining the link between exchange-rate misalignments and current-account imbalances is of crucial importance for two main reasons. First, if current-account imbalances receive a lot of attention in the perspective of global imbalances reduction, current-account surpluses or deficits become truly problematic only when the current account diverges from its fundamental level. Indeed, as long as the evolution of the current account reflects that of its economic fundamentals, current-account surpluses or deficits are natural phenomena that do not require a particular adjustment—or, at least, the correction is done naturally without important economic costs. However, when the gap between the current account and its equilibrium level becomes persistent, reversion to equilibrium often requires important costs from an economic viewpoint. This is particularly acute when countries form a monetary union, since adjustment by (nominal) exchange rates is not operational. Consequently, by arguing that correction of current-account imbalances requires a realignment of exchange rates, previous literature (Mussa, 2005; Freund and Warnock, 2007; Edwards 2007; Méjean et al., 2011) implicitly assumes that exchange-rate misalignments are the main cause of current disequilibria. Second, there is no consensus in the literature regarding whether current-account imbalances mainly result from currency misalignments. Indeed, as Blanchard and Giavazzi (2002), Stevens (2011) argues that the causes of current-account imbalances should rather be sought in the disequilibrium between savings and

[2]Edwards (2005) provides a review of empirical studies dealing with the "required" dollar adjustment to correct the U.S. current account imbalance.

investment, instead of focusing on exchange-rate misalignments. On the contrary, the study by Arghyrou and Chortareas (2008) highlights the relevance of exchange rates in explaining current-account imbalances.

Contributing to this strand of the literature and within this context of global imbalances, our aim in this paper is to study the persistence of current-account disequilibria, as well as the adjustment mechanism towards equilibrium by paying a particular attention to the impact of exchange-rate misalignments. More specifically, we investigate whether the persistence of the gap between the observed current-account position and its equilibrium value depends on the deviation of the exchange rate to its equilibrium. To this end, we consider a panel of 22 industrialized countries over the period ranging from 1980 to 2011. Our contribution in this paper is threefold. First, we specifically account for the structural determinants of the current-account position by estimating a relationship linking the current account to its key fundamentals. This allows us to derive more reliable current-account equilibrium (or fundamental) values than those based on usual Hodrick-Prescott filtered series. Second, while many other contributions consider only the reversal phases of the current account and rely on probit specifications (see Section 2), we specifically model the adjustment process of the current account through a panel nonlinear specification. We consider panel smooth transition regression models that allow us to investigate whether the size and the sign of the exchange-rate deviation to its equilibrium value impacts the degree of persistence of current-account imbalances. Third, we analyze whether the relationship between current-account imbalances and currency misalignments differs depending on whether countries belong or not to a monetary union by considering two sub-samples of countries—distinguishing between eurozone members and the other economies.

Our main findings are the following. First, persistence of current-account imbalances strongly depends on currency misalignments. More specifically, while there is no persistence in cases of currency undervaluation or weak overvaluation, persistence tends to augment for overvaluations higher than 11%. Second, belonging or not to a monetary union impacts the conclusions. Indeed, whereas disequilibria tend to be persistent even for very low exchange-rate overvaluations in the euro area, this is not the case for non eurozone members. For the latter, persistence is observed for overvaluations higher than 14%.

The rest of the paper is organized as follows. Section 2 briefly reviews the literature. Section 3 details our methodology. Data and estimation of equilibrium values are presented in Section 4. Section 5 displays our estimation results and Section 6 concludes.

2. A brief review of the literature

Several theoretical and empirical contributions have focused on current-account imbalances' sustainability and the adjustment mechanisms towards equilibrium.[3] Most of those studies find that the adjustment of the current account is associated with a slowdown in economic growth and a real depreciation of the exchange rate. Indeed, using a dataset including 25 adjustment episodes from 1980 to 1997, Freund (2005) shows that there is a threshold level of current-account deficit that is consistent with its sustainability: current-account reversals typically start when the current-account deficit reaches 5% of GDP, leading to a significant decline in output growth and a real depreciation of the currency around 10 to 20%. Examining episodes of current-account adjustment in developed countries, Debelle and Galati (2005) also find that current-account reversals are associated with a notable slowdown in domestic growth and large exchange rate depreciation. Accounting for the influence of financial variables, Croke et al. (2005) show that some phases of current-account adjustments lead to a substantial decline in economic growth without necessarily being associated with a sharp depreciation of the exchange rate. By contrast, the episodes of current-account adjustments that have not leaded to a decline in GDP growth have often resulted in a significant depreciation of the exchange rate. Focusing on the U.S. deficit using a general equilibrium model, Obstfeld and Rogoff (2005, 2007) show that a reversal of the U.S. current account would result in a significant depreciation of the U.S. real effective exchange rate, leading to severe consequences for economic growth.

Some studies also pay a particular attention to the speed of the adjustment process of the current account towards equilibrium.[4] Freund and Warnock (2007) show that large deficits take more time to adjust than small ones, and are associated with a significant slowdown in GDP growth with a greater impact in countries where exchange-rate movements are limited. Besides, they find that deficits resulting from investment growth are less painful in terms of exchange-rate adjustment than deficits driven by consumption. Relying on threshold autoregressive models for the G7 countries, Clarida et al. (2007) highlight that the adjustment speed of the current account is slow, especially when some threshold levels of deficit are reached. They also underline that exchange rates tend to depreciate in phases of current-account deficits, and appreciate during current-account surplus episodes. Edwards (2007) provides a scenario for the correction of global imbalances through a realignment of global economic growth, with Japan and the eurozone growing faster and the U.S. moderating its growth. He finds that such adjustment could only make a modest contribution towards the resolution of global imbalances, putting forward that significant exchange-rate movements are needed. Focusing on eurozone countries, Arghyrou and Chortareas (2008) rely on logistic smooth threshold error correction specifications and show that the relationship between real exchange rates and current accounts is substantial in size and subject to important nonlinear effects. Using a probit specification to model the probability of

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[3] In this section, we mainly focus on developed countries. Regarding developing countries, the reader can refer to Milesi-Ferretti and Razin (1998) or Edwards (2004).

[4] For a recent study regarding the adjustment of large current-account imbalances that preceded the global financial crisis, see the very interesting contribution by Lane and Milesi-Ferretti (2012).

reversals versus non-reversals, De Haan et al. (2008) show that a deeper current-account deficit, absence of spare capacity in the economy, and a beginning real depreciation significantly increase the predictive power of an upcoming reversal of the current account. In addition, the exchange-rate regime matters since the reversal of a large current-account deficit is less probable under a peg or moving band regime than under crawling peg. They also find that current-account adjustments lead to recessions and severe currency devaluations in half of the reversal cases. Using a similar approach, Pancaro (2013) highlights as well the importance of the exchange-rate regime on the current-account adjustment. Real exchange rate depreciation is a significant trigger only under flexible regimes, and the adjustments of current-account imbalances are not *per se* harmful to economic activity, neither in the whole sample of 22 industrialized countries, nor in the sub-sample containing economies with fixed exchange-rate regimes.[5]

3. Methodology

To investigate whether the persistence of current-account imbalances nonlinearly depends on the deviation of the exchange rate from its equilibrium value, we rely on the panel smooth transition regression (PSTR) methodology introduced by González et al. (2005). According to this specification, the observations are divided in—say—two regimes, with estimated coefficients that vary depending on the considered regime. The change in the estimated value of coefficients is smooth and gradual, since PSTR models are regime-switching processes in which the transition from one state to the other is smooth rather than discrete.

Let $\left\{CA_{i,t}^{gap}, Mis_{i,t}; t=1,...,T; i=1,...,N\right\}$ be a balanced panel with t denoting time and i the country. $CA_{i,t}^{gap}$ is our dependent variable, namely the gap between the observed current account and its equilibrium value—the latter being derived from the estimation of a model including current account's key determinants (see Section 4). $Mis_{i,t}$ denotes the misalignment series, given by the deviation of the observed real effective exchange rate to its equilibrium value—the latter being derived from the Behavioral Equilibrium Exchange Rate (BEER) methodology (see Section 4). $Mis_{i,t}$ acts as the transition variable in our PSTR specification, which is given by:

$$CA_{i,t}^{gap} = \alpha_i + \beta_0 CA_{i,t-1}^{gap} + \beta_1 CA_{i,t-1}^{gap} \times F\left(Mis_{i,t}; \gamma, c\right) + \varepsilon_{i,t} \qquad (1)$$

where α_i denotes the country-fixed effects and $\varepsilon_{i,t}$ is an independent and identically distributed (i.i.d.) error term. This specification hence allows us to investigate whether the persistence of current-account imbalances varies according to the sign and size of exchange-rate misalignments. The transition function F is normalized and bounded between 0 and 1, and is given by (González et al., 2005):

[5] Considering 170 countries over the 1971-2005 period, Chinn and Wei (2008) do not find clear empirical evidence to support Friedman (1953)'s hypothesis according to which a flexible exchange-rate regime would facilitate the current-account adjustment. According to Ghosh et al. (2013), these results are due to the inability of existing regime classifications to capture exchange-rate flexibility relevant to external adjustment. Using a trade-weighted bilateral exchange-rate volatility measure, they obtain results that are consistent with Friedman's hypothesis.

$$F\left(Mis_{i,t};\gamma,c\right)=\left[1+\exp\left(-\gamma\prod_{j=1}^{m}\left(Mis_{i,t}-c_j\right)\right)\right]^{-1} \qquad (2)$$

$\gamma(\gamma > 0)$ stands for the slope parameter, and c_j, $j = 1, \ldots, m$, are the threshold parameters satisfying $c_1 \le c_2 \le \ldots \le c_m$. The two most common cases in practice correspond to $m = 1$ (logistic) and $m = 2$ (logistic quadratic). In the case of a logistic function, the dynamics is asymmetric and the two regimes are associated with small and large values of exchange-rate misalignments relative to the threshold. In the case of a logistic quadratic function, the dynamics is symmetric across the two regimes, but the intermediate regime follows a different pattern compared to that in the extremes.

We follow the three-step methodology proposed by González et al. (2005) to apply PSTR models.[6] The aim of the first, identification step is twofold: (1) testing for homogeneity against the PSTR alternative; and (2) selecting (i) between the logistic and logistic quadratic specification for the transition function, and (ii) the transition variable. In the second, estimation step, nonlinear least squares are used to obtain the parameter estimates, once the data have been demeaned (Hansen, 1999; González et al., 2005). In the third, evaluation step, various misspecification tests are implemented to check the validity of the estimated PSTR model and determine the number of regimes.

4. Data and equilibrium values

We rely on a panel of 22 countries[7], including: (i) 11 eurozone members, namely Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain; and (ii) 11 non-eurozone countries: Australia, Canada, Denmark, Iceland, Japan, New Zealand, Norway, Sweden, Switzerland, United Kingdom, and the United States. Data are annual, spanning the period from 1980 to 2011.

4.1. Medium-term current-account estimation

Our dependent variable, denoted as $CA_{i,t}^{gap}$, is defined as follows:

$$CA_{i,t}^{gap} = CA_{i,t} - \hat{CA}_{i,t} \qquad (3)$$

[6]For details regarding the methodology, the reader is referred to the original contributions by Hansen (1999) and González et al. (2005).

[7] We have initially considered the 31 high-income OECD countries (according to the World Bank) and selected the 22 countries for which data were available over the whole period under study. Thus, our 22 countries are among the most developed economies, allowing us (i) to deal with a relative homogenous sample, and (ii) to distinguish between countries belonging to a monetary union and the others.

where $CA_{i,t}$ stands for the observed current account (in percentage of GDP) and $\hat{CA}_{i,t}$ denotes its estimated equilibrium value. The latter is given by the estimation of the following specification:

$$CA_{i,t} = a_i + \sum_{j=1}^{n} b^j Z_{i,t}^j + \mu_{i,t} \quad (4)$$

with n denoting the number of explanatory variables $Z_{i,t}$, $\mu_{i,t}$ being an i.i.d. error term, and a_i standing for country-fixed effects. Following the literature on current-account medium-term determinants (Lane and Milesi-Ferretti, 2012), we consider various explanatory variables of the current account: (i) the relative fiscal balance (*rdef*) expressed as a ratio to GDP, (ii) the lagged net foreign asset position (*nfa*) expressed as percentage of GDP, (iii) the relative level of PPP-adjusted GDP per capita (*prod*), (iv) the relative GDP growth rate (*rgrw*), (v) the aging rate (*raging*) defined as the expected change in the old-age dependency ratio in the future (constructed as the difference between the age dependency ratio in year *t+20* and the same ratio in year *t*, the *t+20* estimate being based on United Nations' population projections), (vi) the old-age dependency ratio (*rold*) defined as the ratio of the population aged 65 and older to the working-age population, (vii) the population growth rate (*popg*), (viii) a proxy of financial deepening (*m2*) given by the M2 to GDP ratio, (ix) the degree of openness (*open*) given by the ratio of exports plus imports of goods and services to GDP, (x) terms of trade (*tot*), and (xi) the oil balance (*oilb*) expressed as percentage of GDP. Data sources for each series are presented in Table A1 in Appendix.

All variables but *nfa*, *m2*, *open*, *tot* and *oilb* are expressed in relative terms, since only idiosyncratic shifts in fundamentals should affect the current account (see Lane and Milesi-Ferretti, 2012). To this end, they are measured relative to a weighted average of country *i*'s trading partners. The weights are the same as those used by the Bank for International Settlements (BIS) for the calculation of real effective exchange rates considered in the present study. This allows us to have consistency in the way of calculating the variables expressed in relative terms, including the real effective exchange rate.

Tables A2 and A3 in Appendix report the estimation results of Equation (4). In Table A2, all series are considered as 4-year averages to smooth business-cycle fluctuations.[8] Given that this reduces automatically the number of observations, we also estimate Equation (4) without averaging the data as a robustness check. The corresponding results are displayed in Table A3.

The different specifications explain nearly 70% of current-account variance—an explanatory power which is significantly higher than what is usually obtained in previous panel data empirical studies reviewed in Section 2. Figure A1 in Appendix illustrates the accuracy of our estimations by scattering the observed current account against its estimated, equilibrium value. Although slight differences can be highlighted, the two types of regressions—based on averaged data and

[8] In using averaged data, we follow the existing literature on the medium-term current account (see references in Section 2). Note however that this seems to be more relevant for developing or emerging countries for which measurement errors are also at play, in addition to short-run fluctuations.

on annual data—give very similar results. In addition, our estimates are robust to the retained specification. Indeed, as shown in Table A4 in Appendix, correlations between current-account gaps calculated from different specifications are larger than 96% for both types of regressions, illustrating the robustness of our estimations.

Several interesting findings can be highlighted from our results. Fiscal policy, the net foreign asset position, demographic factors such as population growth and aging rate, trade openness and oil balance exert robust significant effects on the current-account dynamics in our advanced countries. The terms of trade and financial deepening also significantly affect the current account, but to a lesser extent. In addition, the positive link established between the fiscal balance and current account simply means that an improvement in the former tends to ameliorate the latter in the same way that deterioration in the fiscal balance would be detrimental for the current account. This finding is consistent with the predictions of several theoretical specifications including among others Blanchard (1985)'s finite-horizon model and overlapping generation models (Obstfeld and Rogoff, 1996), stating that deteriorations in the fiscal balance tend to have the same effect on the current account to the extent that they involve a redistribution of income from future to present generations.

The positive net foreign assets' (NFA) effect on the current account was also expected given that an improvement in the net foreign asset position leads to an increase in net investment income, which is a direct component of the current account. Regarding demographic factors, two opposite effects are at play in our panel of advanced countries. The aging rate positively affects the current account because it is associated with a higher level of savings (Lane and Milesi-Ferretti, 2012), while population growth contributes to the deterioration of the current account due in particular to the lack of savings among the very young population. The oil balance—that captures countries' dependence to the evolution of oil prices—is also positively correlated with the current account, indicating that the more countries deficient in oil are, the more the deficit in the current account. Finally, the positive link between current account and openness is justified to the extent that it could reflect the choice of countries' tariff policy with regard to international trade. Indeed, the ability of the most open economies to generate foreign exchange earnings through exports could signal a greater ability to service external debt (Chinn and Prasad, 2003).

Regarding previous empirical studies, our findings are close to those of Lane and Milesi-Ferretti (2012). Indeed, relying on a similar panel of developed countries, they find that the fiscal balance significantly explains the current account with a positive estimated coefficient of 0.27. This is also the case for the aging rate, lagged NFA and oil balance, with respective estimated coefficients of 0.22, 0.05 and 0.26. Our estimated coefficients—ranging from 0.24 to 0.33 for the fiscal balance, 0.23 to 0.32 for the aging rate, 0.05 to 0.06 for the lagged NFA position, and 0.30 to 0.36 for the oil balance—are thus quite close to those obtained by Lane and Milesi-Ferretti (2012). Using similar estimation techniques, Chinn and Prasad (2003) also show that the NFA to GDP ratio positively influences the medium-term current-account dynamics with an estimated coefficient of 0.07 (close to ours) but fail to establish other significant links. However, when they rely on cross-section estimation techniques, other variables such as fiscal balance, relative income, terms-of-trade volatility and average GDP growth significantly impact the current account—the fiscal balance coefficient is estimated at 0.34, close to ours. Using panel estimation techniques on annual data over the 1975-2007 period for 11 euro area countries, Decrassin and Stavrev (2009) find that the current account is essentially determined by population growth, oil balance, NFA, old dependency ratio, fiscal balance and relative per capita income—the respective estimated coefficients being -2.79, 0.54, 0.04, -0.17, 0.18 and 0.06. In a simplified current-account model, Gagnon (2011) also shows that the latter is mainly affected by the fiscal balance and net foreign asset position in industrial countries, with respective estimated coefficients of 0.30 and 0.07. On the whole, our findings are thus in line with previous empirical studies.[9]

4.2. Equilibrium exchange rates and misalignments

To derive currency misalignments, we estimate equilibrium exchange-rate values relying on the BEER approach (MacDonald, 1997; Clark and MacDonald, 1998). Following Alberola et al. (1999) and Bénassy-Quéré et al. (2009, 2011) among others, we consider a simple stock-flow model and express the real effective exchange rate (*reer,* in logarithms) as a function of the net foreign asset position (in percentage of GDP) and a proxy for relative productivity given by the variable *prod*:

$$reer_{i,t} = \lambda_i + \delta prod_{,it} + \vartheta nfa_{i,t} + u_{i,t} \tag{5}$$

$u_{i,t}$ being and i.i.d. error term, and λ_i accounting for country-fixed effects. The estimation of the long-term, cointegrating relationship (5) gives the equilibrium value of the real effective exchange rate. OLS estimates being biased and dependent on nuisance parameters, we rely on the Dynamic OLS (DOLS) method introduced by Kao and Chiang (2000) and Mark and Sul (2003) in the context of panel cointegration.[10] Roughly speaking, the DOLS procedure consists in augmenting the cointegrating relationship with lead and lagged differences of the regressors to control for the endogenous feedback effect. Using this procedure, we get the following results[11]:

$$reer_{i,t}^{est} = \hat{\lambda}_i + \underset{(0.150)}{0.400}\, prod_{i,t} + \underset{(0.03)}{0.069}\, nfa_{i,t} \tag{6}$$

where standard errors of the estimated coefficients are given in parentheses. As expected, a rise in

[9]Note that other empirical studies (for example Bussière et al., 2004; Gruber and Kamin, 2007; Cheung et al, 2010; Ca'Zorzi et al., 2012) have not been discussed here mainly because they are based on non-comparable country samples or estimation procedures.

[10] As a robustness check, we have also used the PMG approach introduced by Pesaran et al. (1999) which allows the short-run coefficients to differ freely across countries while the long-run coefficients are restricted to be the same for all individuals. Results (available upon request) are similar to those obtained with the DOLS procedure.

[11]Second generation panel unit root and cointegration tests—accounting for cross-section dependences—have been applied, showing that our three series can be considered as unit root processes and are cointegrated (see Tables A5 and A6 in Appendix). Note also that cross-section dependences have been accounted for in the DOLS estimation of the long-term, cointegrating relationship.

the relative productivity as well as in the NFA position leads to an exchange-rate appreciation. In addition, both those explanatory variables are significant at conventional levels.

The corresponding currency misalignments are then given by:

$$Mis_{i,t} = reer_{i,t} - reer_{i,t}^{est}$$

where a positive (resp. negative) sign refers to an overvaluation (resp. undervaluation).

5. PSTR estimation results

We start by testing the null hypothesis of linearity in Equation (1) against the PSTR alternative using the first-lagged misalignment series as the transition variable. In other words, we test whether the persistence of current-account imbalances differs according to the deviation of the exchange rate from its equilibrium value. Results are reported in Table 1 and show that the null of linearity is rejected in favor of the alternative of logistic PSTR specification. This finding indicates that currency misalignments impact the current-account gap differently, depending on the sign and size of the exchange-rate deviation to its equilibrium value. We thus now proceed to the estimation of the PSTR model to investigate this property more deeply.

Table 1. Results of linearity tests (p-values), whole sample

	r = 0	*r = 1*
LM	0.001	0.681
F	0.001	0.687

Note: *LM* and *F* denote Lagrange Multiplier and *F* tests for linearity. *r =0* refers to the null hypothesis of linearity against the alternative of a PSTR model with two regimes. *r =1* refers to the null hypothesis of PSTR model with two regimes against the alternative of a PSTR model with three regimes.

Table 2. Results of the PSTR estimation, whole sample

Variable	*Coefficient*	*t-statistic*
$CA_{i,t-1}^{gap}$	0.5806***	8.51
$CA_{i,t-1}^{gap} \times$ F	0.4968*	1.70
Threshold $\hat{c}$	0.1124	
Slope coefficient $\hat{\gamma}$	17.2894	

Note: *** (resp. **, *): significant at the 1% (resp. 5%, 10%) level.

As shown in Table 2, the effect of currency misalignments on persistence of current-account imbalances is clearly nonlinear. Indeed, for undervaluations and overvaluations up to 11%, the autoregressive coefficient is equal to 0.58, meaning that around half of disequilibrium is corrected. For overvaluations larger than 11%, persistence strongly increases, reaching the unit value in the extreme case (i.e., when $F = 1$).

These findings globally confirm the predictions of a number of simulation models according to which exchange-rate misalignments (overvaluation and undervaluation) lead to current-account imbalances (excessive surplus or deficit).[12] Some international institutions like the International Monetary Fund support this view and believe that a readjustment of the exchange rate constitutes one of the privileged tracks to correct global imbalances. Our results also partly explain the lack of consensus in the empirical literature regarding the current account - real exchange rate nexus and, hence, the relevance of our nonlinear, threshold specification. Indeed, small variations in the exchange rate that do not conduct to under- or overvaluation of the currency may not lead to current-account imbalances. However, beyond a certain threshold (11% in our case) of misalignment (an overvaluation here), current-account deficits are widening, thereby involving costly adjustment (or reversal). Furthermore, our results are also consistent with the stylized facts highlighted by several empirical studies according to which the reversal of current-account deficits is usually done through strong depreciation of the currency (see, among others, Freund, 2005 and Obstfeld and Rogoff, 2007).

Given that our panel of countries includes eurozone members and non-members, we now investigate whether belonging to a monetary union has an influence on our previous findings. To this end, we split our panel in two sub-samples: a panel including 11 euro area members, and a panel encompassing the other countries. While, as shown in Table 3, the null of linearity is also rejected for both sub-samples at the 5% significance level, interesting differences can be highlighted from the results displayed in Table 4.

Table 3. Results of linearity tests (p-values), sub-samples

	Euro members		Others	
Variable	*r = 0*	*r = 1*	*r = 0*	*r = 1*
LM	0.018	0.338	0.021	0.190
F	0.019	0.348	0.023	0.200

Note: *LM* and *F* denote Lagrange Multiplier and *F* tests for linearity. *r =0* refers to the null hypothesis of linearity against the alternative of a PSTR model with two regimes. *r =1* refers to the null hypothesis of PSTR model with two regimes against the alternative of a PSTR model with three regimes.

[12] See for example Mussa (2005), Goldstein and Lardy (2006), and Obstfeld and Rogoff (2005, 2007).

Table 4. Results of the PSTR estimation, sub-samples

	Euro members		Others	
Variable	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*
$CA_{i,t-1}^{gap}$	0.6055***	8.28	0.5162***	7.52
$CA_{i,t-1}^{gap} \times$ F	0.2892***	2.99	1.28***	4.49
Threshold $\hat{c}$	-0.0073		0.1406	
Slope coefficient $\hat{\gamma}$	880.7212		1279.3	

Note: *** (resp. **, *): significant at the 1% (resp. 5%, 10%) level.

The estimated threshold for the euro area is close to 0. This means that undervaluations and overvaluations impact differently the persistence of current-account imbalances. More specifically, while disequilibria tend to be corrected in cases of undervaluations, persistence increases in cases of overvaluations, but the estimated autoregressive coefficient remains lower than 1 even in the extreme case (the autoregressive coefficient is equal to 0.89 when $F = 1$). The situation is quite different for the other countries, with current-account imbalances that tend to accelerate in cases of overvaluations larger than 14%. In other words, while corrections of disequilibria are at play in the euro area even if they are persistent when the euro is overvalued, this is not the case in non-eurozone economies for which imbalances are enhanced when facing strong overvaluations.

These results are in line with the predictions of the optimum currency area theory (Mundell, 1961) and Friedman (1953), according to which countries with flexible exchange-rate regimes are more likely to adjust their current-account imbalances. Indeed, the main cost of monetary union membership is the loss of autonomy in the conduct of monetary policy and, therefore, an inability to adjust the exchange rate against the economic environment. Consequently, an exchange-rate misalignment (in particular an overvaluation) will result in a systematic deterioration of the current account, especially when internal adjustment measures (such as wage compression) are not set up to correct the loss of competitiveness. Euro area countries have very little leeway on their price competitiveness and, hence, weak overvaluations can lead to highly persistent current-account deficits. This is particularly true for countries such as Greece and Portugal which have experienced very deep current-account deficits in recent years. Figures A2 in Appendix illustrate these findings, with the clear link between the Greek and Portuguese overvaluations and persistent huge current-account deficits since the mid-1990s. Countries outside the euro area having more leeway in their price competitiveness, they can afford to have larger misalignments to suit their trade policy (or exchange-rate policy). However, our findings show that this autonomous management of exchange-rate policy is limited as beyond a certain level of overvaluation (14% in our case), the current-account deterioration can be much deeper. This is notably the case for Canada (Figures A2) for which the persistent current-account deficit is in line with the important overvaluation of the Canadian dollar at the end of the period under study.

6. Conclusion

Within the current context of global imbalances, the aim of this paper is to study persistence of current-account disequilibria, as well as the adjustment mechanism towards equilibrium by paying a particular attention to the impact of exchange-rate misalignments. We investigate whether the persistence of the gap between the observed current-account position and its equilibrium value depends on the deviation of the exchange rate to its equilibrium. To this end, we estimate a nonlinear panel smooth transition regression model on a sample of 22 industrialized countries over the period ranging from 1980 to 2011.

Our findings show that persistence of current-account imbalances is strongly dependent on currency misalignments. More specifically, there exists a misalignment threshold beyond which current-account imbalances are widening and tend to persist. Indeed, while there is no persistence in cases of currency undervaluation or weak overvaluation, persistence tends to augment for overvaluations higher than 11%. Decomposing our panel between members and non-members of the euro area, we show that belonging or not to a monetary union affects the current account – misalignments nexus. Indeed, while disequilibria tend to be persistent even for very low exchange-rate overvaluations in the euro area, this is not the case for non eurozone members. For the latter, persistence is observed for overvaluations higher than 14%. Our findings show that, due to the impossibility of exchange-rate adjustment in the euro area, a currency overvaluation will result in systematic current-account deterioration.

Our results have important policy implications, and suggest that exchange-rate misalignments should be followed with great attention. This is especially crucial for countries belonging to a monetary union, in order to avoid abrupt and significant economic costs linked to the adjustment of unsustainable current-account imbalances—such adjustment being impossible through the nominal exchange rate. Exchange-rate misalignments constituting a leading indicator of potential currency crises (Holtemöller and Mallick, 2012), they should, as the output gap, be a key instrument in the conduct of economic policy. By systematically monitoring exchange-rate misalignments and early alerting governments when the (effective) real exchange rate follows any adverse trend, monetary authorities should play a preventive role. This involves accurately estimating exchange-rate misalignments, using methods for which the member countries of the monetary union agreed. A restrictive fiscal policy would be more appropriate in cases of overvaluation to limit the loss of competitiveness and the deterioration of the current account. Conversely, in times of undervaluation, a more expansionary policy should be conducted. Such reactions are particularly desirable in a monetary union because important competitiveness divergences are harmful to the union. In a long-term perspective, countries with persistent current-account deficits should undertake structural changes (including more fiscal discipline, labor market reform, strengthening of private savings) to achieve a comparable level of productivity and competitiveness with their main trading partners.

Finally, if exchange-rate misalignments obviously impact current-account imbalances, other factors such as overheating of economic activity are likely to contribute to the deterioration of the current account (see Blanchard et al., 2005). Consequently, a promising extension of our paper would be to investigate the interactions between these macroeconomic discrepancies (output gap, misalignment, current-account gap), as well as their causal links to provide an in-depth analysis of the various necessary measures to reduce global imbalances.

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Appendix

Table A1. Data sources

Primary data	Sources	Expressed in relative terms	Notation
Current account balance to GDP ratio	WEO Database (IMF)	No	*CA*
Fiscal balance to GDP ratio	WEO Database, OECD Database	Yes	*rdef*
Net foreign asset to GDP ratio (Lagged)	Updated and extended version of dataset constructed by Lane and Milesi-Ferretti (2007)	No	*nfa*
Level of PPP-adjusted GDP per capita	WEO Database	Yes	*prod*
Old-age dependency ratio	WDI (The World Bank)	Yes	*rold*
Population growth rate	WDI	Yes	*popg*
M2 to GDP ratio	WDI, OECD Database	No	*m2*
Openness	WDI	No	*open*
GDP growth rate	WEO Database	Yes	*rgrw*
Oil balance	WEO	No	*oilb*
Terms of trade	WDI, DG ECFIN (European Commission)	No	*tot*

Note: The aging rate (denoted *raging*) does not appear in this list because it is directly calculated by the authors as described in the text. WEO: World Economic Outlook; WDI: World Development Indicators; OECD: Organization for Economic Co-operation and Development; DG ECFIN: Directorate General for Economic and Financial Affairs.

Table A2.Current-account estimation (Panel OLS with 4-year averaged data)

Variables	(1) *CA*	(2) *CA*	(3) *CA*	(4) *CA*	(5) *CA*	(6) *CA*
rdef	0.239***	0.247***	0.257***	0.257***	0.327***	0.327***
	(0.0844)	(0.0847)	(0.0887)	(0.0887)	(0.0813)	(0.0813)
nfa	0.0534***	0.0576***	0.0528***	0.0528***	0.0612***	0.0612***
	(0.00876)	(0.00839)	(0.00917)	(0.00917)	(0.00649)	(0.00649)
prod	0.0425	-0.0917	0.0360	0.0360		
	(0.109)	(0.0697)	(0.111)	(0.111)		
prods	-0.000492	0.0608	0.00365	0.00365		
	(0.0542)	(0.0386)	(0.0555)	(0.0555)		
rgrw	0.0973	0.0808	0.0463	0.0463		
	(0.190)	(0.190)	(0.201)	(0.201)		
raging	0.305***	0.321***	0.307***	0.307***	0.229***	0.229***
	(0.0857)	(0.0856)	(0.0893)	(0.0893)	(0.0659)	(0.0659)
rold	0.0203	0.00582	0.0200	0.0200		
	(0.0253)	(0.0238)	(0.0257)	(0.0257)		
popg	-2.714***	-2.829***	-2.720***	-2.720***	-2.718***	-2.718***
	(0.872)	(0.873)	(0.887)	(0.887)	(0.659)	(0.659)
m2	-0.0127**	-0.0135**	-0.0129	-0.0129		
	(0.00627)	(0.00628)	(0.00822)	(0.00822)		
open	0.0471***	0.0467***	0.0470***	0.0470***	0.0438***	0.0438***
	(0.00825)	(0.00830)	(0.00844)	(0.00844)	(0.00774)	(0.00774)
tot	0.0298	0.0161	0.0265	0.0265		
	(0.0214)	(0.0197)	(0.0225)	(0.0225)		
oilb	0.341***	0.296**	0.303**	0.303**	0.357***	0.357***
	(0.123)	(0.121)	(0.133)	(0.133)	(0.105)	(0.105)
Constant	-9.984		-9.675		-2.203***	
	(6.224)		(6.357)		(0.788)	
Observations	154	154	154	154	154	154
R-squared	0.683	0.677	0.688	0.688	0.669	0.669

Note: Robust standard errors are in parentheses; *** (resp. **, *): significant at the 1% (resp. 5%, 10%) level; (1): Model including all explanatory variables and constant; (2): Model including all explanatory variables without constant; (3): Model including all explanatory variables + constant + time dummy; (4): Model including all explanatory variables without constant + time dummy; (5): Model including only significant explanatory variables + constant + time dummy; (6): Model including only significant explanatory variables - constant + time dummy.

Table A3. Current-account estimation (Panel OLS with annual data)

Variables	(1) *CA*	(2) *CA*	(3) *CA*	(4) *CA*	(5) *CA*	(6) *CA*
rdef	0.197***	0.193***	0.206***	0.206***	0.210***	0.210***
	(0.0359)	(0.0362)	(0.0368)	(0.0368)	(0.0359)	(0.0359)
nfa	0.0550***	0.0584***	0.0556***	0.0556***	0.0610***	0.0610***
	(0.00367)	(0.00355)	(0.00375)	(0.00375)	(0.00298)	(0.00298)
prod	0.0725	-0.0564*	0.0676	0.0676		
	(0.0502)	(0.0309)	(0.0501)	(0.0501)		
prods	-0.0223	0.0363**	-0.0189	-0.0189		
	(0.0248)	(0.0171)	(0.0248)	(0.0248)		
rgrw	-0.0466	-0.0530	-0.0639	-0.0639		
	(0.0658)	(0.0662)	(0.0673)	(0.0673)		
raging	0.215***	0.215***	0.226***	0.226***	0.204***	0.204***
	(0.0399)	(0.0402)	(0.0414)	(0.0414)	(0.0365)	(0.0365)
rold	-0.00425	-0.0183*	-0.00400	-0.00400		
	(0.0115)	(0.0107)	(0.0115)	(0.0115)		
popg	-2.830***	-2.958***	-2.829***	-2.829***	-2.570***	-2.570***
	(0.357)	(0.357)	(0.357)	(0.357)	(0.285)	(0.285)
m2	-0.00793***	-0.00805***	-0.00987**	-0.00987**	-0.00910**	-0.00910**
	(0.00290)	(0.00292)	(0.00383)	(0.00383)	(0.00382)	(0.00382)
open	0.0399***	0.0392***	0.0398***	0.0398***	0.0400***	0.0400***
	(0.00398)	(0.00400)	(0.00402)	(0.00402)	(0.00380)	(0.00380)
tot	0.0359***	0.0300***	0.0321***	0.0321***	0.0335***	0.0335***
	(0.00838)	(0.00823)	(0.00892)	(0.00892)	(0.00891)	(0.00891)
oilb	0.398***	0.388***	0.356***	0.356***	0.414***	0.414***
	(0.0473)	(0.0476)	(0.0532)	(0.0532)	(0.0491)	(0.0491)
Constant	-8.876***		-9.638***		-5.254***	
	(2.738)		(2.777)		(1.047)	
Observations	682	682	682	682	682	682
R-squared	0.665	0.661	0.684	0.685	0.678	0.679

Note: Robust standard errors are in parentheses; *** (resp. **, *): significant at the 1% (resp. 5%, 10%) level; (1): Model including all explanatory variables and constant; (2): Model including all explanatory variables without constant; (3): Model including all explanatory variables + constant + time dummy; (4): Model including all explanatory variables without constant + time dummy; (5): Model including only significant explanatory variables + constant + time dummy; (6): Model including only significant explanatory variables - constant + time dummy.

Table A4. Correlation between the estimated current-account gaps

	CA^{gap1}	CA^{gap2}	CA^{gap3}	CA^{gap4}	CA^{gap5}	CA^{gap6}
CA^{gap1}	***1***	0.9910	0.9921	0.9921	0.9628	0.9628
CA^{gap2}	**0.9923**	***1***	0.9832	0.9832	0.9684	0.9684
CA^{gap3}	**0.9703**	**0.9628**	***1***	1.0000	0.9703	0.9703
CA^{gap4}	**0.9703**	**0.9628**	**1.0000**	***1***	0.9703	0.9703
CA^{gap5}	**0.9614**	**0.9617**	**0.9892**	**0.9892**	***1***	1.0000
CA^{gap6}	**0.9614**	**0.9617**	**0.9892**	**0.9892**	**1.0000**	***1***

Note: The correlation matrix above the diagonal relates to the different estimates of the current-account gap with 4-year averaged data, while the correlation matrix below the diagonal (in bold) refers to the different estimations of the current-account gap from annual data.

Table A5. CADF panel unit root test of Pesaran (2007)

Variables	Constant		Constant and trend	
	Stat. Test	P-Value	Stat. Test	P-Value
reer	-1.745	0.550	-2.327	0.528
$\Delta reer$	-4.078	0.000	-4.093	0.000
prod	-1.818	0.406	-2.505	0.190
$\Delta prod$	-3.378	0.000	-3.626	0.000
nfa	-0.289	1.000	-1.234	1.000
Δnfa	-3.499	0.000	-4.034	0.000

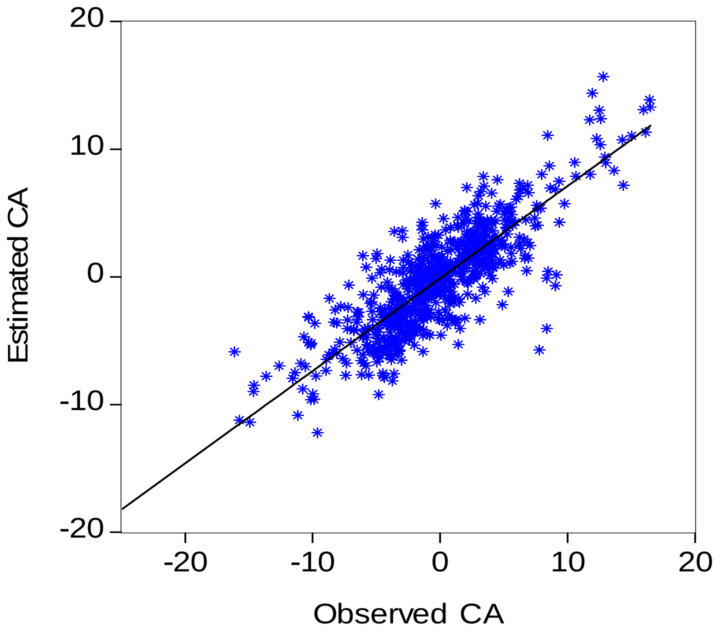
Note: The test is based on the unit root null hypothesis. 2 lags are used for variables in level, and 1 lag for variables in first difference.

Table A6. Westerlund (2007) panel cointegration tests

Statistics	With constant			With constant and trend		
	Value	Z-Value	P-Value	Value	Z-Value	P-Value
G_t	-2.338	-1.546	0.189	-3.077	-3.063	0.197
G_a	-4.930	3.137	0.249	-5.382	5.279	0.071
P_t	-9.271	-1.196	0.005	-12.542	-2.008	0.003
P_a	-6.912	-0.878	0.006	-9.044	1.002	0.004

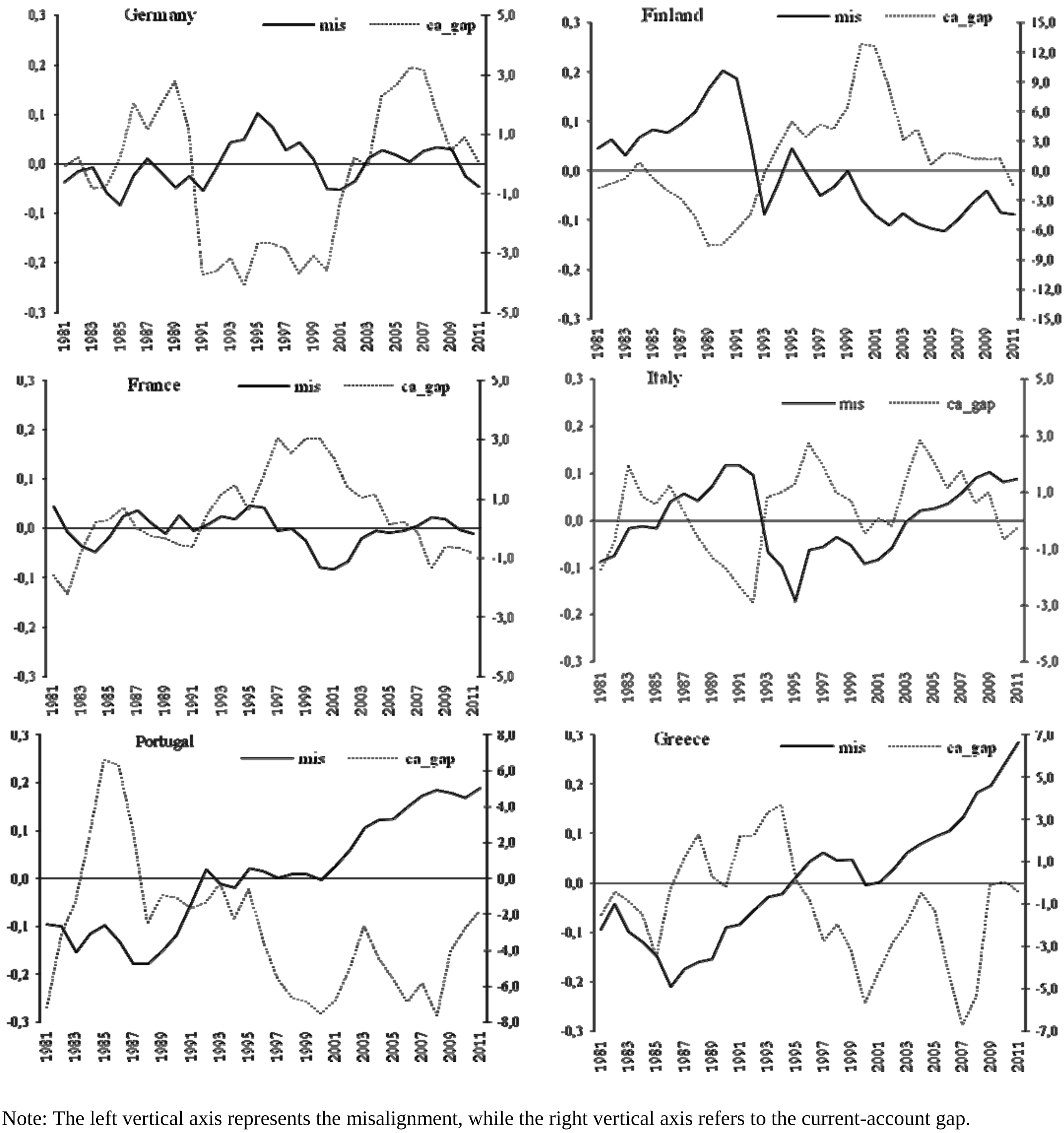
Note: P-values are robust critical values obtained through bootstrapping with 1000 replications. The Bartlett kernel window width is set according to $4(T/100)^{2/9} \approx 3$.

Figure A1. Estimation accuracy: observed current account and estimated current account (from the specification (6) of Table A3)



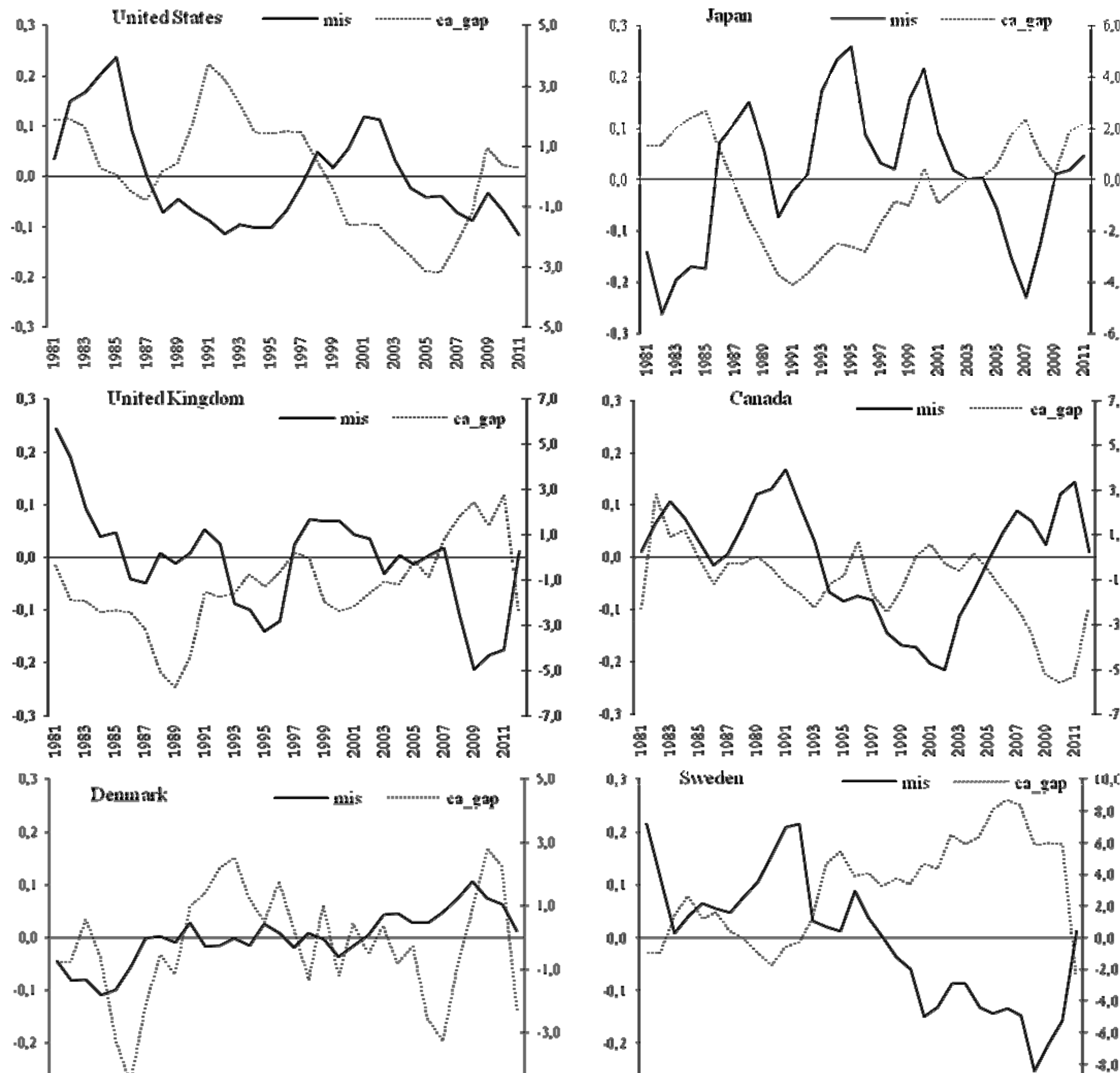
Figures A2. Misalignments and current-account gaps

Misalignments and current-account gaps, eurozone countries



Note: The left vertical axis represents the misalignment, while the right vertical axis refers to the current-account gap.

Misalignments and current-account gaps, non-eurozone countries



Note: The left vertical axis represents the misalignment, while the right vertical axis refers to the current-account gap.