OECD Economics Department Working Papers No. 813

Are Global Imbalances Sustainable? Shedding Further Light on the Causes of Current Account Reversals

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https://dx.doi.org/10.1787/5km4m2x07xhb-en

OECD

Unclassified **ECO/WKP(2010)69**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **10-Nov-2010**

English - Or. English

ECONOMICS DEPARTMENT

ECO/WKP(2010)69
Unclassified

ARE GLOBAL IMBALANCES SUSTAINABLE? SHEDDING FURTHER LIGHT ON THE CAUSES OF CURRENT ACCOUNT REVERSALS

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JT03292167

English - Or. English

ABSTRACT/RESUMÉ

**Are global imbalances sustainable?
Shedding further light on the causes of current account reversals**

Large shifts in countries' external current account positions can be disruptive, often reflecting sudden stops in the flows of external finance and leading to exchange rate and banking crises. As a result, an empirical literature has emerged on the sustainability of, and the determinants of large swings in, current account positions. We shed further light on this issue by testing for the presence of unit roots in the current account balance-to-GDP ratios of a large set of mature and emerging-market economies using a methodology that allows for structural breaks in intercepts and trends. We then construct a chronology of current account reversals that is consistent with sustainability of external positions and use it to estimate the factors explaining the likelihood and magnitude of such reversals using a selection model with ordered probit in the first stage. We find that most of the factors that explain the probability of reversals, such as trends in capital flows, in the budget balance and in external positions, also influence their magnitude. But there are a few exceptions. For instance, the stance of monetary policy and the magnitude of external imbalances prior to a reversal seem to be more powerful predictors of the probability of reversals than of their magnitude.

JEL classification codes: C32; C35; F32
Keywords: current account reversals; current account sustainability; capital flows

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**Les déséquilibres mondiaux sont-ils viables ?
Mieux comprendre les causes des retournements de balance courante**

Les amples variations des soldes des paiements courants des pays peuvent avoir des effets perturbateurs, puisqu'elles tiennent souvent à de brusques interruptions des entrées de capitaux extérieurs et débouchent fréquemment sur des crises de change et bancaires. En conséquence, de nombreux travaux empiriques ont été réalisés sur la viabilité des soldes des paiements courants et les déterminants de leurs amples fluctuations. Nous apportons un nouvel éclairage sur cette question en procédant à un test de racine unitaire sur les ratios solde des paiements courants/PIB d'un vaste ensemble d'économies parvenues à maturité et émergentes, à partir d'une méthodologie tenant compte des ruptures structurelles dans les niveaux et les tendances des séries statistiques considérées. Nous établissons ensuite une chronologie des retournements de balance courante concordant avec la viabilité des positions extérieures, et nous l'utilisons pour estimer les facteurs qui expliquent la probabilité et l'ampleur de ces retournements à l'aide d'un modèle de sélection probit ordonné au premier stade. Nous parvenons à la conclusion que la plupart des facteurs qui expliquent la probabilité des retournements, telles que les tendances dans les flux de capitaux, dans le solde budgétaire et dans les positions extérieures, influent également sur leur ampleur. On relève toutefois quelques exceptions. Ainsi, l'orientation de la politique monétaire et l'ampleur des déséquilibres externes avant un retournement semblent être de meilleures variables explicatives de la probabilité des retournements que de leur ampleur.

Classification JEL : C32 ; C35 ; F32
Mots clés : retournements de balance courante ; viabilité de la balance courante ; flux de capitaux

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ARE GLOBAL IMBALANCES SUSTAINABLE? SHEDDING FURTHER LIGHT ON THE CAUSES OF CURRENT ACCOUNT REVERSALS

Luiz de Mello, Pier Carlo Padoan and Linda Rousová[1]

1. Introduction

The emergence of large current account imbalances among the world's major economies in the ten-year period leading to the global crisis of 2008-09 has rekindled interest among researchers and policymakers in the sustainability of external positions and on the policy levers that can be used to reduce global imbalances on a durable basis. Current account imbalances are not necessarily undesirable, to the extent that they reflect increased financial integration and a more efficient allocation of global savings across countries.[2] However, empirical research shows that large current account deficits make sharp reversals in a country's external position more likely. Because such reversals can be disruptive, often reflecting sudden stops capital flows and leading to exchange rate tensions, banking crises and lower post-adjustment GDP growth, a growing empirical literature has emerged on current account sustainability (Milesi-Ferretti and Razin, 1998, 2000; Edwards, 2005; Eichengreen and Adalet, 2005; Assman and Boysen-Hogrefe, 2010).

In this paper, we shed further light on current account sustainability by first testing for the presence of unit roots in the current account balance-to-GDP ratios of a large set of countries using the methodology proposed by Lee and Strazicich (1999, 2003), which allows for structural breaks in the levels (means) and slopes (trends) of the relevant series. We find that the external positions of most countries are stationary around structural breaks. In other words, external imbalances build up while remaining sustainable for a period of time until a structural break occurs.[3] On the basis of the endogenously determined breaks, we

1. The authors thank, without implicating, the participants of the conference on "Advances in International Economics and Economic Dynamics: A Conference in Honour of Giancarlo Gandolfo", organised by Research Centre of International Economics (CIDEI) and the Department of Public Economics of La Sapienza University of Rome on 20-21 September 2010, as well as colleagues from the OECD Economics Department for helpful comments and discussions. Special thanks go to Penny Elghadab for editorial support.

2. It has been argued that increased capital mobility across countries and deeper financial markets in individual countries may be consistent with widening current account imbalances (Gourinchas and Rey, 2005; Mendoza, Quadrini and Rios-Rull, 2007).

3. de Mello and Padoan (2010) use the same methodology for testing for the presence of unit roots in the current account-to-GDP series of the world's major countries/regions (United States, China, Japan, Germany and the oil-exporting countries) to set a chronology of current-account reversals. On the basis of an event analysis, the authors show that structural breaks are associated with shifts in the fiscal stance, exchange rate parities and potential output growth, a finding that underscores the scope for macroeconomic and structural policies to ensure the sustainability of external positions while avoiding potentially disruptive reversals.

construct a chronology of current account reversals and use it to estimate the factors explaining the likelihood and magnitude of such reversals using a selection model that includes an ordered probit in the selection stage.

Our approach improves upon the existing empirical literature in different ways. In particular:

- Our chronology of current account reversals is based on the endogenous identification of structural breaks that are consistent with stationary external positions, rather than on ad hoc definitions of current account reversals based on the actual size of adjustments (Milesi-Ferretti and Razin, 1998, 2000; Eichengreen and Adalet, 2005; Edwards, 2005; Liesenfeld *et al.*, 2007). As a result, our chronology is not sensitive to cross-country differences in the volatility of external positions.[4]

- Structural breaks are allowed in both the levels and slopes of the ratios of current account balance to GDP, whereas the literature focuses on just the level of external positions to set the chronology of reversals. It is important to consider reversals in trends, because external sustainability can be maintained without a large shift in the level of the current account balance in relation to GDP.

- By using a selection model, the determinants of the likelihood and magnitude of reversals are estimated simultaneously, whereas most of the literature uses probit modelling to estimate the probability of reversals. The selection model takes into account the correlation that exists between the errors of the ordered probit equation and those of the regression explaining the main determinants of the magnitude of reversals, given that the magnitude of reversals depends on the probability of a reversal taking place.

- Finally, structural breaks are allowed for both improvements and deteriorations of external positions, where the literature is usually limited to episodes of large reductions in current account deficits. In addition, both emerging-market and mature economies are included in the sample, whereas most of the literature focuses on low and middle-income countries.

The paper's main findings are as follows:

- The probability of a current account reversal depends on both the level and the slope of external positions before the reversal takes place, GDP growth, trends in capital flows (portfolio investment and FDI) and the macroeconomic policy stance, proxied by the discount rate or a dummy variable describing the country's exchange rate regime, and the budget balance. We also find significant evidence of simultaneous reconfigurations in external positions across different countries, since a reversal in a given country is more likely to occur the higher the number of simultaneous reversals in the reference country's geographical area.

- As for the determinants of the magnitude of reversals, the results show that most of the factors that play an important role in explaining the probability of reversals also influence their magnitude. But there are a few exceptions. For instance, the stance of monetary policy (proxied by either the exchange rate regime dummy or the discount rate) is a powerful determinant of the probability of reversals but, once a reversal occurs, its magnitude is unaffected by monetary policy. It also seems that the magnitude of external imbalances prior to a reversal is a more powerful predictor of the probability of reversals than of their magnitude.

4. To our knowledge the only study that also defines structural breaks on the basis of the data generating process is Bagnai and Manzocchi (1999), although they use Zivot and Andrews (1992) test, which may suffer from spurious rejection problems.

- Trends in capital flows are important predictors of both the probability and the magnitude of reversals. Whereas rising portfolio investment raises the probability of improvements in external positions and is associated with larger reversals when they do occur, the converse is true for FDI, whose increase reduces the probability and magnitude of improvements. This finding could be associated with the increase in factor payments abroad once FDI operations start, which affects the current account balance.

These findings are not without policy implications. In particular, the macroeconomic policy stance affects both the probability and the magnitude of reversals. A monetary tightening (proxied by an increase in the discount rate), if sustained over a period of three years prior to a reversal, reduces the probability and magnitude of improvements in a country's external position. As for fiscal policy, by contrast, a tightening of the fiscal stance prior to a reversal raises the probability and magnitude of an impending improvement in external positions. This is most probably because the corresponding increase in government saving is not fully offset by a decrease in private saving.

The paper is organised as follows. Section 2 reviews trends in external positions in the world's main deficit and surplus countries. Section 3 describes the methodology used for testing for the presence of unit roots in external positions and for setting a chronology of current account reversals. Section 4 describes the methodology for estimating the determinants of the probability of occurrence and the magnitude of reversals and reports the paper's main empirical findings. Section 5 discusses the main findings and concludes.

2. Trends in current account positions

Global imbalances and the major surplus and deficit countries/regions[5]

Global imbalances, measured as the sum in absolute terms of the current account positions of the world's major countries/regions, have exhibited sharp swings over the last 40 years but rarely reached the pre-crisis level of over 5% of world GDP in 2008 (**Figure 1**).[6] Imbalances rose sharply in the first half of the 1980s, following the second oil shock, and peaked at the middle of the decade, between the Plaza and Louvre agreements on exchange rate management. Imbalances began to rise again gradually in the second half of the 1990s, an upward trend that came to an end with the eruption of the global financial crisis in 2008. The United States has accounted for the lion's share of the world's current account deficits since the early 1980s. But the mix of surplus countries has changed, with the emergence of Germany, China and the oil-exporting countries as the main surplus countries/regions.

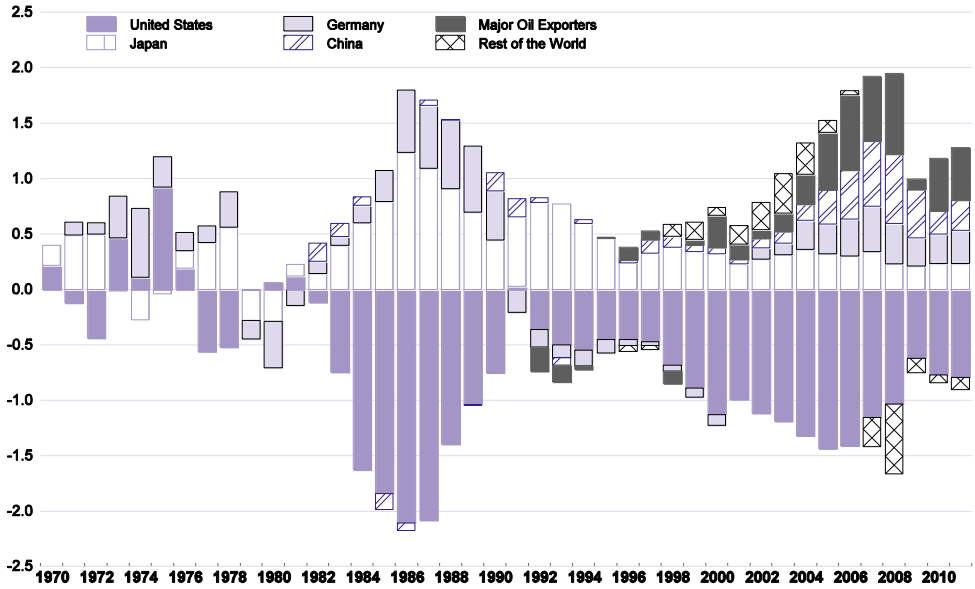
Consistent with these trends in global imbalances, there has been a sustained increase in the net foreign asset positions of the surplus countries. Japan has accumulated a net investment position of close to 50% of GDP, and China has sustained a positive net investment position since 2000. Germany depleted its accumulated assets in the 1990s following unification as a result of persistent current account deficits, a situation that has since then been reversed. By contrast, the United States was a net creditor until 1990 but has since then accumulated a net investment deficit of close to 20% of GDP (**Figure 2**).

5. This section draws on de Mello and Padoan (2010).

6. External imbalances are also sizeable within the euro area, where large current account surpluses (in relation to GDP) in Germany and Netherlands are matched by large deficits in Greece, Ireland, Portugal and Spain. See OECD (2009 and 2010a) for more information.

Figure 1. Global imbalances, 1970-2011

Current account balances,[1] in % of world GDP

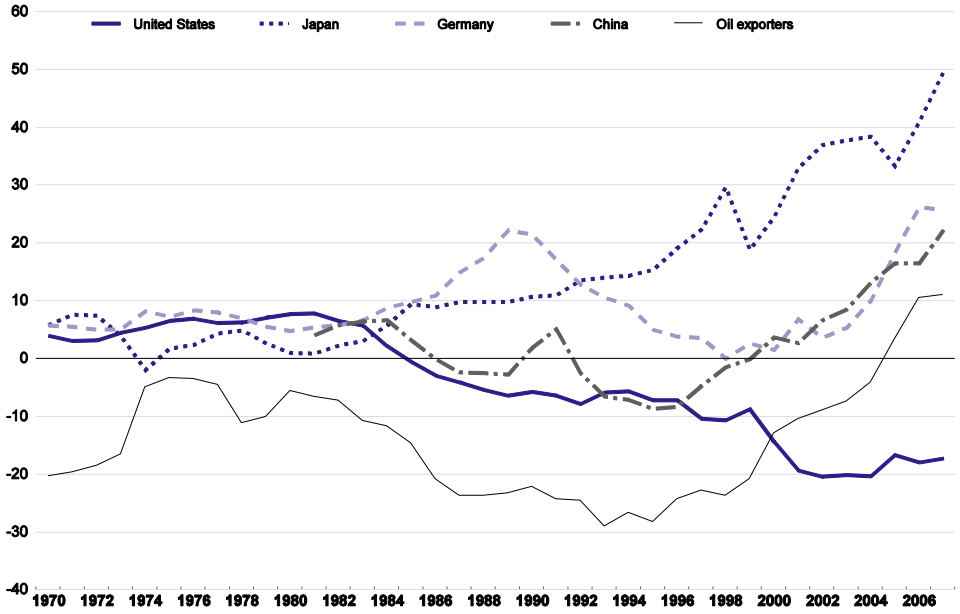


1. Data for 2010-11 are projections from the OECD Economic Outlook 87 database.

Source: OECD (*Economic Outlook* 87) and national sources.

Figure 2. Net investment positions, 1970-2007

In % of individual country GDP



Source: Updated and extended version of the External Wealth of Nations Mark II database developed by Lane and Milesi-Ferretti (2007).

3. Identifying current account reversals

The methodology

There are different methods for assessing the sustainability of current account positions. In the absence of capital transfers or measurement errors and omissions, a country's current account balance can be defined as:

$$NFA_t - NFA_{t-1} \equiv CA_t = r\, NFA_{t-1} + TB_t\,, \tag{1}$$

where *NFA*, *CA* and *TB* denote, respectively, net foreign assets, the current account balance and the trade (goods and services) balance in per cent of GDP; *r* is the rate of return on net foreign assets; and *t* is a time index.

Equation (1) can be solved forward subject to a no-Ponzi-game transversality condition ($\lim_{T\to\infty}(1+r)^{-T} NFA_{t+T+1} = 0$), such that $NFA_{t-1} = -\sum_{j=0}^{\infty}(1+r)^{-(j+1)} TB_{t+j}$. It then follows that the sustainability of current account positions can be assessed by testing for stationarity of CA (in levels) and NFA (in first differences) (Trehan and Walsh, 1991). The implication of non-stationarity is that the CA and NFA series are not mean-reverting, and fluctuations in these series would only converge back to equilibrium in response to exogenous shocks.

Testing for stationarity

The Lee and Strazicich (1999, 2003) procedure is used to test for the presence of unit roots in external positions. This minimum Lagrange Multiplier test has the advantage of allowing for structural breaks in levels (intercepts) and slopes (trends) in both the null (unit roots with breaks) and alternative (stationarity around breaks) hypotheses. The methodology therefore improves upon previous tests that also determine structural breaks endogenously but define the breaks only under the alternative hypothesis, such as that of Zivot and Andrews (1992), which may suffer from spurious rejection problems. Rejection of the Lee-Strazicich null unambiguously implies a trend stationary process.

In line with Equation (1), we apply the Lee-Strazicich unit root test on the first differences of net foreign assets (in per cent of GDP) to assess the sustainability of external positions. Using annual data on net foreign assets available from Lane and Milesi-Ferretti (2007), rather than data on current account positions, allows us to maximise the number of observations and cover 101 countries for the full period between 1971 and 2007, instead of 19 countries in the case of current account data. We start by allowing for the presence of two breaks in levels and slopes. If one of the breaks identified on the basis of the two-break tests is not found to be significant (in both intercepts and trends), we use instead an alternative version of the test that allows for the presence of a single break in external positions.[7]

The results of the unit root tests, reported for each country in **Appendix 1**, show that the hypothesis of a unit root with breaks can be rejected against the alternative of stationarity around breaks for the vast majority of countries.[8] Rejection of the null hypothesis suggests that external positions are sustainable

7. Although setting a fixed number of breaks is a limitation of the methodology used, we are confident that we are not missing any important break, because for the majority of countries identification of at most two structural breaks ensures that their external positions are stationary.

8. To be sure we also ran the unit root tests for the current account-to-GDP ratio. The results (not reported but available upon request) suggest that for about one-third of the 19 countries for which information is

between breaks but not indefinitely.[9] Failure to account for structural breaks would lead to an erroneous acceptance of the hypothesis of unit roots, which would imply that current account balances are not sustainable. In fact, when using the augmented Dickey-Fuller test (with two lags and a trend), which does not allow for structural breaks, the hypothesis of a unit root in the current account balance cannot be rejected at 10% significance level for 51 countries in our sample of 101 countries compared to 4 countries (Norway, Colombia, India and Malaysia), when using the Lee-Strazicich procedure.

A chronology of current account reversals

Based on the test results reported in Appendix 1, we end up with a chronology of 159 reversals that are consistent with stationarity in external positions. Our chronology excludes 9 countries for which shifts in both the levels and slopes of their external positions were not found to be significant when using the Lee-Strazicich test with one break, as well as the four countries whose external positions were not found to be stationary. To illustrate, the structural breaks identified for the world's major deficit and surplus countries are depicted in **Figure 3**.

Our chronology differs from those reported in the literature in three main ways. *First*, in our chronology reversals depend on the dynamics of external positions, which differ across countries, as in the literature pioneered by Bagnai and Manzocchi (1999). Therefore, our chronology is not driven by countries whose external positions tend to exhibit greater variation. Instead, most of the literature uses arbitrary thresholds to define reversals, usually in terms of a reduction in the current account deficit by a given amount (typically, at least 3-5% of GDP) in a single year or over a number of years based on a moving average of current account outcomes and subject to a window of "tranquil" periods between reversals (Milesi-Ferretti and Razin, 1998, 2000; Eichengreen and Adalet, 2005; Edwards, 2005; Liesenfeld *et al.*, 2007). The ad hoc threshold-based methodology leads to an inconsistent timing of reversals in the presence of volatile cycles, as noted by Assmann and Boysen-Hogrefe (2010), who use a Markov switching technique that allows for country-specific means and volatility to identify reversals and assess their determinants.

Second, our methodology has the advantage of ensuring that the chronology of reversals is consistent with stationarity in external positions. Instead, by setting an arbitrary threshold for the magnitude of breaks that can be characterised as reversals, the empirical literature potentially mixes stationary and integrated series.

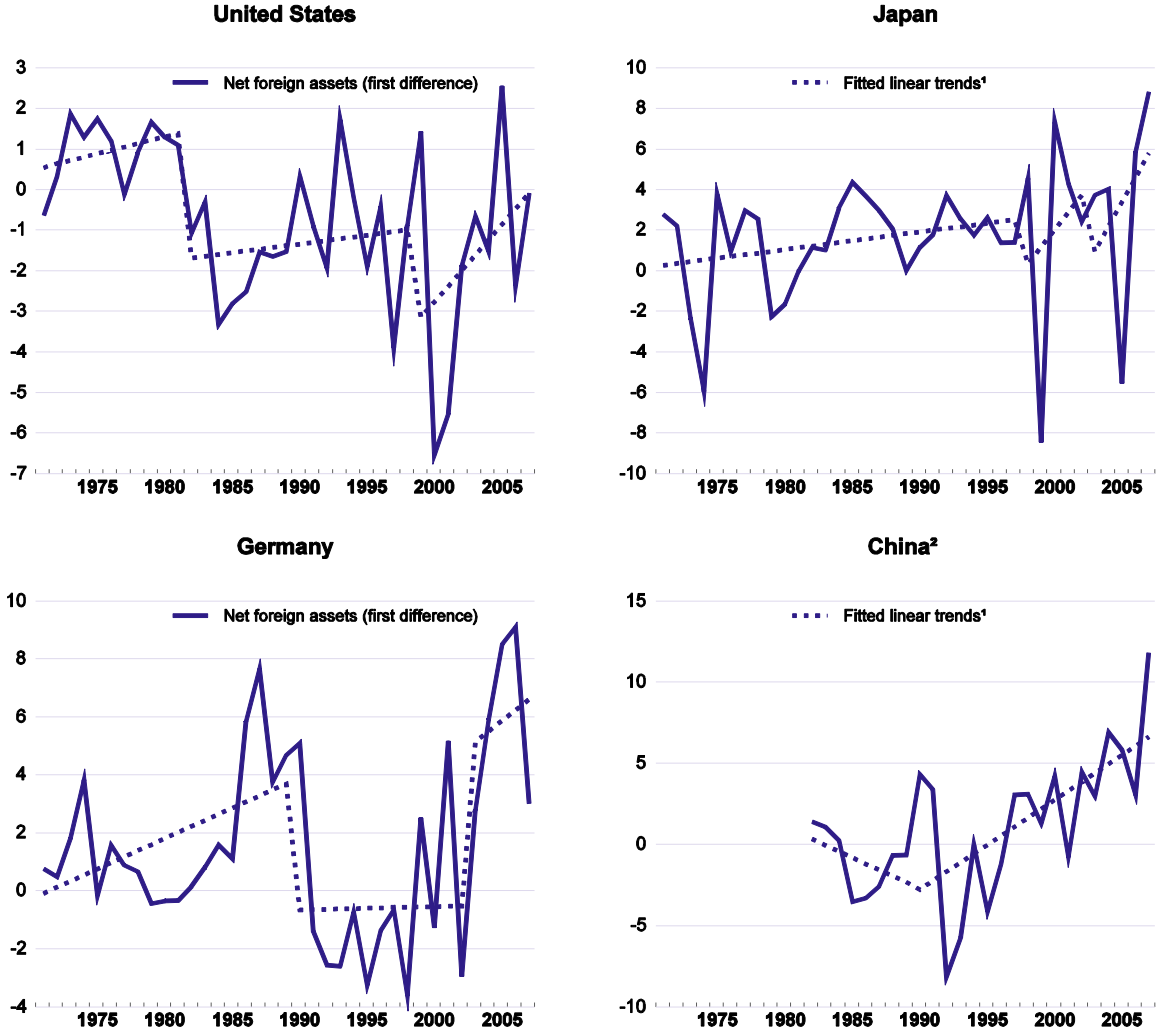
Finally, we allow for reversals in the level and/or slope of a country's external position, whereas the empirical literature typically focuses on breaks in levels, but not in slopes. Our chronology therefore includes regime changes that are important from the point of view of ensuring the sustainability of external positions but are not necessarily accompanied by large swings in the level of the current account balance in relation to GDP. Reversals in slopes, such as the Chinese reversal in 1990 (depicted in Figure 3), would not be picked up by methodologies that focus on swings in levels only.

available for both NFA and CA for the whole period of analysis, the null hypothesis of unit roots is not rejected for CA while being rejected for NFA (in first differences).

9. Only in Bahrain, Chile, El Salvador, Guatemala, Honduras, Liberia, Syria and Turkey were the dNFA series found to be stationary without breaks.

Figure 3. Current account balances and structural breaks, 1971-2007

Based on the structural breaks identified in Appendix 1, in % of individual country GDP



1. Linear trends are estimated using ordinary least squares to take account of the structural breaks.
2. The Lee-Strazicich test detects one structural break for China in 1990 and rejects the null hypothesis of a unit root at the 1% significance level.

Source: Authors' estimations based on Appendix .

A number of characteristics of our chronology are noteworthy. In particular:

- The number of improvements and deteriorations of external positions is fairly balanced. We identify 91 reversals associated with improvements in external positions and 68 reversals associated with deteriorations (**Table 1**), where an improvement (deterioration) is defined as a positive (negative) shift in the slope of the current account balance following a reversal. Ignoring the deteriorations, as is the case of most of the literature (Milesi-Ferretti and Razin, 1998, 2000; Eichengreen and Adalet, 2005; Liesenfeld *et al.*, 2007), would omit important outcomes and bias the results of the empirical analysis.

Table 1. Current account shifts due to reversals[1]

Slope shifts \ Level shifts	Negative	Positive	Total
Negative	21	47	68
Positive	75	16	91
Total	96	63	159

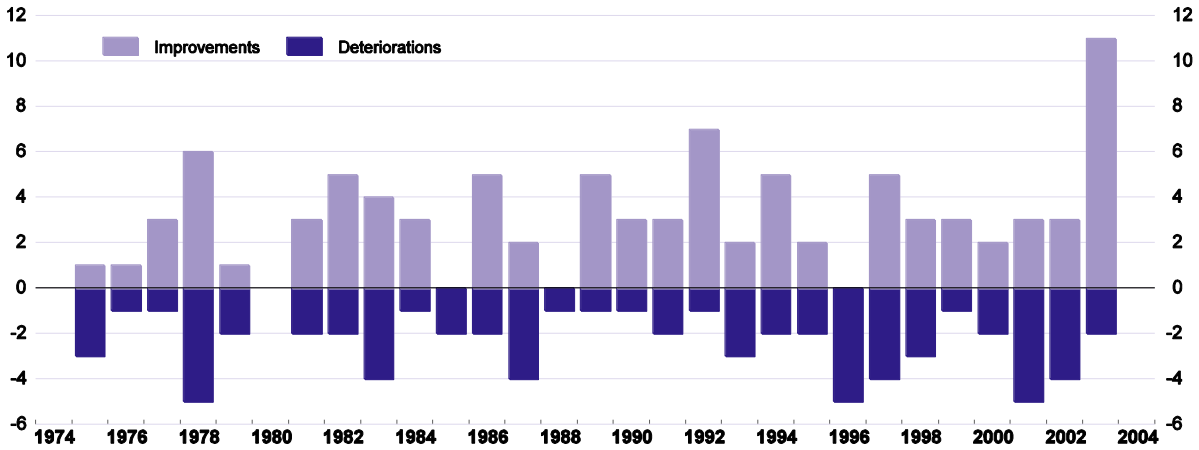
1. Only reversals associated with stationary external positions are considered.

Source: Authors' computations based on the chronology reported in Appendix 1.

- Most improvements took place in 1978, 1992 and 2003, whereas deteriorations are most frequent in 1978, 1996 and 2001 (**Figure 4**). The correlation between the number of positive and negative reversals in a given year is 0.36, indicating that large adjustments in external positions are a global phenomenon: large external adjustments tend to take place simultaneously across countries and are therefore triggered by common developments.

Figure 4. Time distribution of current account reversals: Improvements and deteriorations, 1974-2004

Number of reversals per year[1]



1. An improvement (deterioration) is defined as a positive (negative) shift in the slope of the external position following a reversal. The number of improvements (deteriorations) is shown on a positive (negative) scale. Only reversals associated with a stationary current account balance are considered.

Source: Based on the chronology of reversals reported in Appendix 1.

- Most reversals involve a shift in levels followed by a shift (of the opposite sign) in slopes. A drop in levels is followed by an upward shift in slopes in 78% of reversals, and an increase in levels is followed by a downward shift in slopes in about 75% of reversals.[10] By contrast, simultaneous positive and negative shifts in both levels and slopes are less frequent.

10. Based on the Person's χ^2 test, the null hypothesis that the rows and columns of Table 1 are independent is rejected at conventional significance levels ($\chi^2(1) = 43.2$, p-value = 0.00).

- Reversals are fairly equally distributed among countries, regardless of their income level (**Table 2**). Restricting the analysis to low- and middle-income countries, as is customary in the literature, would therefore bias the results. Whereas Edwards (2005) and Eichengreen and Adalet (2005) also include mature economies in their samples, most of the empirical literature focuses predominantly on low- and middle-income countries (Bagnai and Manzocchi, 1999; Milesi-Ferretti and Razin, 1998, 2000; Liesenfeld *et al.*, 2007; Assmann and Boysen-Hogrefe, 2010).

Table 2. Geographical distribution of current account reversals

	Number of countries	Reversals per country	Deteriorations (in % of all reversals)	Improvements (in % of all reversals)
Total[1]	97	1.6	43	57
OECD and Malta	23	1.8	46	54
Latin America	20	1.3	42	58
Middle East	9	1.5	54	46
Asia and Pacific	9	2.0	33	67
Africa	36	1.7	41	59

1. Only reversals associated with a stationary current account balance are considered.

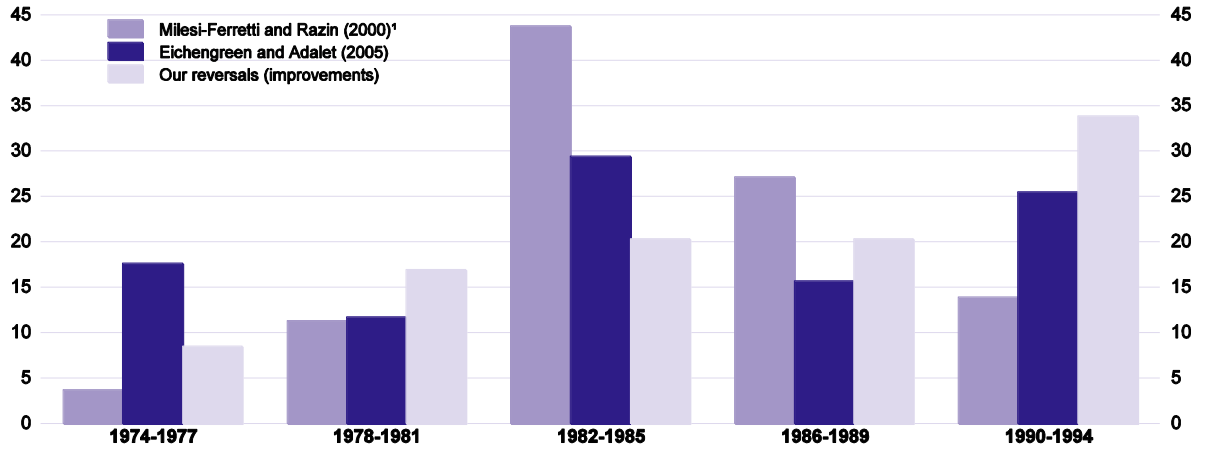
Source: Authors' computations based on the chronology reported in Appendix 1.

Finally, it is possible to compare our chronology with that of Eichengreen and Adalet (2005), who report the year of reversals between 1972 and 1997 for 49 countries (**Figure 5**). They detect 106 reversals, defined as a 2 percentage-point reduction in the current account balance-to-GDP ratio relative to the average of three preceding years. Despite their different methodology, there is a positive and significant correlation of 0.43 between their chronology and ours (based on a comparison of the relative frequencies of breaks per year and omitting the negative current account reversals from our chronology to ensure comparability). A partial comparison with the reversals identified by Milesi-Ferretti and Razin (2000) is also possible, since the authors report a distribution of breaks over 4- or 5-year periods between 1973 and 1994 using a sample of 105 low- and middle-income countries. The number of reversals detected by the authors varies between 100 and 167 depending on the magnitude of reversals. Nevertheless, further comparison with the literature on current account reversals (Bagnai and Manzocchi, 1999; Edwards, 2005; Assmann and Boysen-Hogrefe, 2010) is often not possible, because the dating of alternative reversals is usually not reported.[11]

11. Edwards (2005) focuses on the period 1970-2001 and includes 163 countries. He identifies 412 reversals, defined as a reduction in the current account deficit of at least 4% of GDP in one year. Assmann and Boysen-Hogrefe (2010) focus on 96 countries between 1970 and 2004 and provide an overview of the number of reversals depending on the commonly used definitions of reversals. They use a Markov-switching model to identify reversals in the current account balance-to-GDP ratio. Depending on model specification, they identify between 68 and 112 reversals. Finally, Bagnai and Manzocchi (1999) focus on 49 countries and identify 35 reversals on the basis of unit root tests that allow for the presence of one endogenous break.

Figure 5. Chronology of current account reversals

Reversals per period, in per cent of reversals identified over the period 1974-94



1. Based on a definition of reversals as reductions in the current account deficit-to-GDP ratio by at least 3 percentage points over three years with respect to the average of the preceding three years.

Source: Authors' computations.

4. The determinants of current account reversals

We use a selection model that allows us to estimate jointly the probability of a reversal taking place and the determinants of the magnitude of a reversal, if it occurs. Instead, most of the literature focuses on the determinants of the probability of reversals using probit modelling (Milesi-Ferretti and Razin, 1998, 2000; Eichengreen and Adalet, 2005; Edwards, 2005; Liesenfeld *et al.*, 2007) and is therefore silent on the effects of these determinants on the actual magnitude of reversals. This is important from the point of view of identifying the policy levers that could ensure a durable narrowing of imbalances in the aftermath of structural breaks.

The methodology

To deal with the non-occurrence of reversals in a number of countries in the sample and the different types of reversals (*i.e.*, improvements and deteriorations), we use a selection model with an ordered probit specification of the selection equation as follows:

$$P_i^* = Z_i'\gamma + u_i, \text{ with } u_i \mid Z_i \sim \mathrm{N}(0,1), \qquad (1)$$

where P_i^* is a latent variable for the occurrence of reversal i, Z_i is a vector of exogenous variables and u_i is the error term.

Instead of observing P_i^*, we detect only the occurrence of a positive or a negative reversal or we do not observe a reversal at all. Therefore, we define a variable, P_i, that takes on values: -1, if $P_i^* \le \alpha_1$ and a negative reversal (deterioration) occurs; 0, if $\alpha_1 < P_i^* \le \alpha_2$ and no reversal occurs; and 1, if

$\alpha_2 < P_i^*$ and a positive reversal (improvement) occurs. The probabilities of these three states can be modelled using an ordered probit model.

To model the determinants of the magnitude of reversals, we set up the outcome equation as follows:

$$R_i = X_i'\beta + \varepsilon_i, \text{ with } \varepsilon_i \mid X_i \sim \mathrm{N}(0, \sigma^2), \tag{2}$$

where R_i denotes a change in trend due to a reversal as estimated by the Lee-Strazicich procedure in Appendix 1, and X_i and ε_i are the vector of exogenous variables and the error term, respectively.

However, R_i can be observed only if a reversal occurs (*i.e.*, if $P_i \neq 0$). Since the error terms u_i and ε_i are likely to incorporate common unobserved factors, such as exogenous shocks that affect both the probability of a reversal taking place and its magnitude, we expect a non-zero correlation between the two error terms, which would introduce a selection bias in equation (2) if it were estimated by OLS. Similarly as in standard selection models:

$$\begin{aligned} &E(R_i \mid P_i \neq 0, X_i) = X_i'\beta + E(\varepsilon_i \mid P_i \neq 0, X_i) = X_i'\beta + E(\varepsilon_i \mid P^* \leq \alpha_1 \vee P^* > \alpha_2) \\ &= X_i'\beta + E(\varepsilon_i \mid u_i < \alpha_1 - Z\gamma \vee u_i > \alpha_2 - Z\gamma) \\ &= X_i'\beta + \rho\sigma\left[-\varphi(\alpha_1 - Z\gamma) + \varphi(\alpha_2 - Z\gamma)\right] / \left[\Phi(\alpha_1 - Z\gamma) + 1 - \Phi(\alpha_2 - Z\gamma)\right] \end{aligned},$$

where ρ is the correlation between the error terms in equation (1) and (2), σ is the standard deviation of ε_i, Φ is the standard normal cumulative distribution function, and φ is the standard normal density function.

The choice of explanatory variables to be included in both the selection and the outcome equations is motivated by the empirical literature. Milesi-Ferretti and Razin (1998, 2000) include the current account balance-to-GDP ratio, the rate of growth of GDP and the investment-to-GDP ratio, all in levels and averaged over a number of years prior to the reversal, as well as indicators of trade openness, external indebtedness, terms of trade and real effective exchange rate, among others. In addition to these variables, we include the ratio of (net) portfolio investment and FDI inflows (in levels and rates of change), given the strong correlation that has been shown to exist in the empirical literature between sudden stops in capital flows and current account reversals (Edwards, 2005). Moreover, we include proxies for the monetary policy stance, including in different specifications a dummy variable describing the reference country's exchange rate regime[12] or the money market discount rate. The fiscal stance is proxied by the budget balance-to-GDP ratio. Finally, we include the number of improvements and deteriorations of external positions in the reference country's geographical area to deal with the possibility of regional contagion, which are important determinants of capital flow reversals. All variables (except for the number of reversals in the reference country's economic area and the exchange-rate peg dummy) are averaged over three years prior to reversals and lagged one period to deal with simultaneity. Data sources and the definition of the variables of interest are reported in **Appendix 2**. A comparison of the different methodologies used in the empirical literature is available in **Appendix 3**.

12. The IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* provides information on fixed exchange-rate regimes based on the declared status of the reporting countries. However, this classification may turn out to be inaccurate for many countries (Shambaugh, 2004). The advantage of the indicator used here is that it captures the *de facto* behaviour of exchange rates as it takes a value of "1" if the exchange rate remained within ±2% bands against the base currency in a given year and "0" otherwise.

To take into account the correlation between the error terms, we estimate equations (1) and (2) simultaneously using a limited-information maximum likelihood (LIML) method. To avoid multicollinearity, we exclude the two indicators of regional reversals from the outcome equation.[13] Motivation for selecting these indicators for exclusion is that we expect regional contagion to affect the probability of a reversal.[14] But there is less compelling evidence that contagion would also affect the magnitude of reversals, which would likely be driven predominantly by policy responses in the reference country.

The baseline results

The results reported in **Table 3** are based on a general-to-specific methodology. Therefore, only the variables that have been found to be statistically significant in the ordered probit regressions have been retained;[15] namely, the level and first difference of the reference country's lagged external position, GDP growth, the first-difference of portfolio and FDI flows, a monetary policy indicator (the foreign-exchange rate peg dummy in the baseline regressions) and the number of positive and negative reversals in the reference country's economic area.

The estimated ordered probit selection equation (model 1) suggests that the magnitude of external positions affects the probability of an impending reversal: the higher the level or the faster the improvement in external positions prior to a reversal, the lower the probability of further improvements. By contrast, the faster the growth in GDP prior to a reversal, the higher the probability of further improvements in external positions. As for capital inflows, the effects of portfolio investment and FDI are different: whereas rising portfolio capital inflows prior to a reversal increase the probability of an improvement in external positions, the converse is true for FDI inflows. Since rising portfolio inflows reflect a deterioration of external positions prior to a reversal, it is plausible that they also raise the probability of an improvement after a reversal. Following the same argument, rising FDI inflows should also raise the probability of an impending reversal, but the negative effect of FDI could be related to an increase in factor income payments abroad that is expected to take place once operations begin following FDI inflows as well as to a possible increase in imports by the newly established firms.[16] The number of (positive or negative) reversals in the reference country's geographical area also leads to an improvement in the reference country's external position: the larger the number of countries facing external reversals the more like the reference country is to also face a swing in its external position, which is consistent with the presence of regional effects in current account determination.

13. The selection of appropriate exclusion restrictions is important for identification in the probit equation, but not in the outcome equation, whose identification is not affected by the exclusion restrictions.

14. There is a large literature on financial contagion (see Kaminsky, Reinhart and Vegh, 2003, for an overview). However, Edwards (2005) is to our knowledge the only study that models international spillovers in the context of current account reversals. He shows that the probability of a current account reversal increases if a country is situated in a region where many countries experience a sudden stop of capital inflows.

15. The following variables were included in the model and found to be statistically insignificant (in levels and first differences, lagged and averaged over three years): real effective exchange rate, U.S. interest rate, GDP (per capita and level), GDP growth in OECD countries, inflation, external debt indicators, net current transfers from abroad, trade indicators, terms of trade, government debt and foreign reserves.

16. For instance, Swenson (2004) finds that investment inflows into the United States increase import growth at the aggregate manufacturing level. Using the OECD input-output tables, Kleinert (2003) provides evidence that inward FDI stocks have a significant positive impact on imported intermediate goods.

Table 3. Reversals in external positions: Baseline regressions[1]

	Reversals in levels and/or slopes			Reversals in slopes
	(1)	(2)	(3)	(4)
Selection equation				
Dependent variable (reversals coded as:)	(-1,0,1)	(-2,-1,0,1,2)	(-1,0,1)	(-1,0,1)
dNFA (level)[2]	-0.0210***	-0.0234***	-0.0210***	-0.0220***
	(0.000)	(0.000)	(0.000)	(0.000)
dNFA (change)[2]	-0.0279***	-0.0265***	-0.0279***	-0.0282***
	(0.000)	(0.000)	(0.000)	(0.001)
GDP growth (level)[2]	0.0228*	0.0205*	0.0228**	0.0185
	(0.076)	(0.097)	(0.015)	(0.165)
Portfolio inflows (change)[2]	0.0286**	0.0241***	0.0286***	0.0271**
	(0.017)	(0.005)	(0.000)	(0.043)
FDI (change)[2]	-0.0768**	-0.0688**	-0.0768**	-0.0841**
	(0.028)	(0.040)	(0.022)	(0.012)
Exchange-rate peg	-0.125	-0.116	-0.125**	-0.212**
	(0.167)	(0.194)	(0.031)	(0.028)
Improvements in the region	0.0545	0.0515	0.0545	0.0775**
	(0.147)	(0.169)	(0.425)	(0.044)
Deteriorations in the region	0.260***	0.246***	0.260*	0.230***
	(0.000)	(0.000)	(0.068)	(0.000)
Outcome equation				
Dependent variable	Magnitude of reversals	Magnitude of reversals	Magnitude of reversals	Magnitude of reversals
dNFA (level)[2]	-0.122	-0.103	-0.122	-0.174
	(0.422)	(0.525)	(0.407)	(0.245)
dNFA (change)[2]	-0.850**	-0.893**	-0.850**	-1.069**
	(0.043)	(0.045)	(0.017)	(0.013)
GDP growth (level)[2]	-0.583	-0.500	-0.583	-0.394
	(0.308)	(0.399)	(0.452)	(0.523)
Portfolio inflows (change)[2]	1.485***	1.482***	1.485***	1.433***
	(0.000)	(0.000)	(0.000)	(0.000)
FDI (change)[2]	-4.793***	-4.892***	-4.793***	-5.051***
	(0.000)	(0.000)	(0.000)	(0.000)
Exchange-rate peg	-3.139	-3.794	-3.139**	-0.807
	(0.264)	(0.207)	(0.040)	(0.787)
Constant	4.743*	4.937*	4.743**	3.098
	(0.051)	(0.052)	(0.042)	(0.225)
ρ	0.418***	0.365***	0.418***	0.455***
Wald test of indep. eqns. ($\rho = 0$)[3]	(0.000)	(0.000)	(0.000)	(0.000)
Observations (selected)	2009 (108)	2009 (108)	2009 (108)	2009 (93)

1. ***, **, * denote significance at the 1, 5, and 10% significance levels, respectively. P-values (in parentheses) are based on robust standard errors except for model (3), where standard errors are clustered by geographical area.
2. Averaged over three years preceding the reference year.
3. P-values reported.

Source: Authors' estimations.

The results of the ordered probit regressions are comparable to those of the outcome equation, but GDP growth and the level of external positions prior to a reversal do not seem to be important determinants of the magnitude of an impending reversal. In other words, whereas a large external position reduces the probability of improvements, it does not affect the magnitude of improvements, once a reversal has taken place. This is also the case of GDP growth, which is found to be a good determinant of the probability of reversals, but it is not associated with the magnitude of reversals. The null hypothesis that $\rho = 0$ is rejected by the data, which confirms the validity of our identification strategy.

The baseline findings are robust to recoding the reversals to distinguish between structural breaks in levels and slopes. This is done by coding a deterioration (improvement) in both the level and slope of external positions as "-2" ("2") and a deterioration (improvement) only in the slope of external positions as "-1" ("1"). The absence of a reversal is coded as "0", as before. The results of the selection model based on this alternative definition of reversals are comparable to those reported above (model 2). This is also the case when using standard errors clustered by geographical area (model 3) and when reversals are redefined to include significant structural breaks in slopes only, rather than in levels and/or slopes (model 4). Monetary policy, proxied by the exchange rate regime dummy, is nevertheless found to be statistically significant (models 3 and 4), with improvements in the slope of external positions being less likely in countries that have a pegged exchange rate, a result that is in line with Milesi-Ferretti and Razin (2000). This is most probably due to the fact that countries that maintain exchange rate pegs are unable to adjust their monetary stance to their own economic conditions: they may be unable to tighten monetary policy to reduce absorption when the economy is overheating, which would lead to a (further) deterioration in their external positions.[17]

The role of monetary and fiscal policy

To better capture the effect of monetary policy on reversals, the exchange rate regime dummy was replaced by the discount rate. The results show that a monetary tightening (*i.e.*, increasing discount rates) over the period leading to a reversal increases the probability of an improvement in the reference country's external position but reduces the magnitude of the reversal, when it takes place (**Table 4**). The number of observations is nevertheless lower than in the baseline regressions due to missing data on discount rate for some countries, but the results remain by and large qualitatively unchanged.

Because data on budget balances are available only for a small sub-set of countries, the effect of fiscal policy on the probability and magnitude of reversals can only be gauged as a robustness check, rather than as part of the baseline specification. The results show that a tightening of the fiscal stance over a three-year period prior to a reversal raises the probability and magnitude of an impending reversal, when it does take place (models 3 and 4). To some extent, this finding reflects the fact that the corresponding increase in government saving brought about by the fiscal tightening is not fully offset by a decrease in private saving. Empirical analysis for OECD countries suggests that, contrary to the predictions based on Ricardian Equivalence, only about one-half of increases in government saving are offset by a reduction in private saving in the short term, against about two-thirds in the long term (de Mello, Kongsrud and Price, 2004).

17. In addition, the results are robust to using alternative measure of the magnitude of reversals calculated as changes (between reversals) in linear trends estimated by ordinary least squares instead of using the magnitude of reversals in trends as estimated by the Lee-Strazicich methodology. The only exception is the coefficient of FDI that ceases to be significant in the selection equation. The results are available on request. The results are also broadly robust to exclusion of short reversals (defined as those preceded by another reversal in less than five years), although the coefficient on portfolio investment loses significance in the selection equation.

Table 4. Reversals in external positions: Regressions with discount rate and budget balance[1]

	Reversals in levels and/or slopes	Reversals in slopes	Reversals in levels and/or slopes	Reversals in slopes
	(1)	(2)	(3)	(4)
Selection equation				
Dependent variable (reversals coded as:)	(-1,0,1)	(-1,0,1)	(-1,0,1)	(-1,0,1)
dNFA (level)[2]	-0.0211***	-0.0208***	-0.0227	-0.0216
	(0.000)	(0.000)	(0.101)	(0.137)
dNFA (change)[2]	-0.0334***	-0.0330***	-0.0480**	-0.0425**
	(0.000)	(0.001)	(0.011)	(0.030)
Growth (level)[2]	0.0140	0.0135	-0.0822	-0.116**
	(0.370)	(0.404)	(0.128)	(0.037)
Portfolio (change)[2]	0.0247*	0.0218	0.0179	0.0234
	(0.053)	(0.126)	(0.243)	(0.142)
FDI (change)[2]	-0.0791**	-0.0852**	0.0381	-0.0157
	(0.034)	(0.017)	(0.579)	(0.788)
Discount rate (change)[2]	0.000391***	0.000392***	-0.0452	-0.0355
	(0.000)	(0.000)	(0.213)	(0.373)
Budget balance (change)[2]			0.157**	0.171**
			(0.034)	(0.039)
Improvements in the region	0.0653*	0.0616	-0.0757	-0.0136
	(0.098)	(0.144)	(0.432)	(0.896)
Deteriorations in the region	0.189***	0.180**	0.596***	0.503***
	(0.005)	(0.010)	(0.000)	(0.003)
Outcome equation				
Dependent variable	Magnitude of reversals	Magnitude of reversals	Magnitude of reversals	Magnitude of reversals
dNFA (level)[2]	-0.177	-0.413	0.0832	-0.316
	(0.565)	(0.148)	(0.820)	(0.411)
dNFA (change)[2]	-0.838*	-1.003**	-0.324	-0.550
	(0.079)	(0.038)	(0.558)	(0.200)
Growth (level)[2]	-0.741	-0.677	-5.173***	-4.550***
	(0.298)	(0.367)	(0.000)	(0.000)
Portf (change)[2]	1.523***	1.527***	2.193***	2.023***
	(0.000)	(0.000)	(0.000)	(0.002)
FDI (change)[2]	-4.879***	-5.244***	-3.353	-3.719
	(0.000)	(0.000)	(0.140)	(0.356)
Discount rate (change)[2]	-0.349	-0.539**	3.242	1.543
	(0.187)	(0.037)	(0.172)	(0.536)
Budget balance (change)[2]			3.270**	3.041**
			(0.025)	(0.027)
Constant	3.486	2.873	13.01***	10.75***
	(0.164)	(0.298)	(0.000)	(0.000)
ρ	0.432***	0.467***	0.585***	0.635***
Wald test of indep. eqns. ($\rho = 0$)[3]	(0.000)	(0.000)	(0.000)	(0.000)
Observations (selected)	1474 (85)	1474 (75)	441(30)	441(24)

1. Refers to selection models with ordered probit regressions. ***, **, * denote significance at the 1, 5, and 10% significance levels, respectively. P-values (in parentheses) are based on robust standard errors.
2. Averaged over three years preceding the reference year.
3. P-values reported.

Source: Authors' estimations.

Asymmetries in reversals

To shed light on whether or not the probability of a reversal is affected by the type of reversal, we redefined the reversals as improvements and deteriorations in external positions separately. This was done by coding the dependent variable of the probit model as "1" in the event of an improvement (deterioration) and "0", otherwise. Consistently, the dependent variable used in the regression on the determinants of the magnitude of reversals is the absolute value of the magnitude of reversals.

The results, reported in **Table 5**, show that the significance of some variables in the ordered probit model was driven only by one type of reversal: improvement or a deterioration in external positions. For instance, the probability of an improvement does not seem to depend on the slopes of portfolio investment and FDI inflows prior to a reversal (model 1), whereas movements in capital flows are important determinants of the probability of a deterioration in external positions (model 2). Trends in capital flows prior to a reversal continue to be powerful predictors of the magnitude of reversals.

As for regional effects, it appears that an improvement in the external positions of neighbouring countries leads to an improvement in the reference country's external position, a finding that may be driven by positive terms-of-trade shocks that affect countries in the same geographical area symmetrically. By contrast, a deterioration of the external position of neighbouring countries is associated with an improvement in the reference country's external position. This may be due to a fear of regional contagion, which elicits a policy response in the reference country to prevent a deterioration of its external position that would trigger adverse market reactions.

More recent data

Because there has been a rapid increase in capital flows since the early 1990s (**Figure 6**), we experimented with splitting the sample into two sub-samples using 1991 as a cut-off year.[18] In doing so, we find that capital flows play a more important role in more recent sub-sample (model 4) than in the 1970s and 1980s (model 3). In particular, the probability of reversals is not affected significantly by capital flows in the period between 1974 and 1990, whereas the trends in both portfolio investment and FDI inflows turn out to be highly significant in the period 1991-2004.[19]

5. Discussion and conclusions

This paper investigated the dynamics of the external positions of 101 countries in the period 1971-2007. Using a unit root test that allows for endogenous structural breaks in both the levels and slopes of external positions, we showed that the vast majority of countries run sustainable current account balances only for a limited period of time until a reversal occurs. To estimate simultaneously the determinants of the probability of occurrence and the magnitude of reversals, we used a selection model that takes into account the correlations that exist between the disturbance terms of both regressions. Our results highlight the effect of both capital flows and macroeconomic policy on the likelihood and magnitude of reversals.

18. This year is chosen in order to obtain two balanced subsamples regarding the number of observations.

19. This is consistent with the evidence reported by Debelle and Galati (2007) who do not detect any discernible change in the nature of capital flows prior to current account reversals using data on 21 industrial countries during 1974-2003. This finding is most probably because the authors identify very few reversals in the post-1990 period: only 6 out of their 28 reversals took place after 1990 and only one of those occurred after 1993.

Table 5. Reversals in external positions: Asymmetric effects[1]

	Subsample of improvements (1)	Subsample of deteriorations (2)	Subsample of 1974-1990 (3)	Subsample of 1991-2004 (4)
Selection equation				
Dependent variable (reversals coded as:)	(0,1)	(0,1)	(-1,0,1)	(-1,0,1)
dNFA (level)[2]	-0.0184***	0.0262***	-0.0264***	-0.0173***
	(0.001)	(0.000)	(0.000)	(0.009)
dNFA (change)[2]	-0.0327***	0.0256**	0.00739	-0.0393***
	(0.008)	(0.017)	(0.620)	(0.000)
GDP growth (level)[2]	0.0199	-0.0282	0.0165	0.0373*
	(0.266)	(0.132)	(0.358)	(0.070)
Portfolio inflows (change)[2]	0.0181	-0.0570**	-0.0489	0.0285**
	(0.184)	(0.036)	(0.183)	(0.015)
FDI (change)[2]	-0.0421*	0.111***	-0.0260	-0.0815**
	(0.100)	(0.001)	(0.756)	(0.023)
Exchange-rate peg	-0.118	0.108	0.0682	-0.273**
	(0.327)	(0.414)	(0.617)	(0.029)
Improvements in the region	0.125***	0.109**	0.00488	0.0596
	(0.001)	(0.025)	(0.946)	(0.143)
Deteriorations in the region	0.111	-0.581***	0.435***	0.218***
	(0.175)	(0.000)	(0.000)	(0.005)
Outcome equation				
Dependent variable	Magnitude of improvement	Magnitude of deterioration	Magnitude of reversals	Magnitude of reversals
dNFA (level)[2]	-0.0823	-0.470	-0.551**	0.195
	(0.696)	(0.239)	(0.033)	(0.417)
dNFA (change)[2]	-0.0472	1.221**	-0.933	-0.928**
	(0.914)	(0.037)	(0.266)	(0.017)
GDP growth (level)[2]	-0.412	1.440**	-0.589	-0.527
	(0.610)	(0.042)	(0.433)	(0.483)
Portfolio inflows (change)[2]	1.085***	0.641	4.458	1.482***
	(0.000)	(0.761)	(0.164)	(0.000)
FDI (change)[2]	-2.563**	3.779***	-5.595**	-4.390***
	(0.018)	(0.000)	(0.011)	(0.000)
Exchange-rate peg	2.014	5.357	0.817	-5.367
	(0.591)	(0.201)	(0.846)	(0.104)
Constant	42.45***	21.27	3.270	4.277*
	(0.006)	(0.161)	(0.404)	(0.099)
ρ	-0.693**	-0.523	0.326***	0.528***
Wald test of indep. eqns. ($\rho = 0$)[3]	(0.000)	(0.128)	(0.000)	(0.000)
Observations (selected)	2009 (64)	2009 (44)	997 (45)	1012 (63)

1. ***, **, * denote significance at the 1, 5, and 10% significance levels, respectively. P-values (in parentheses) are based on robust standard errors.

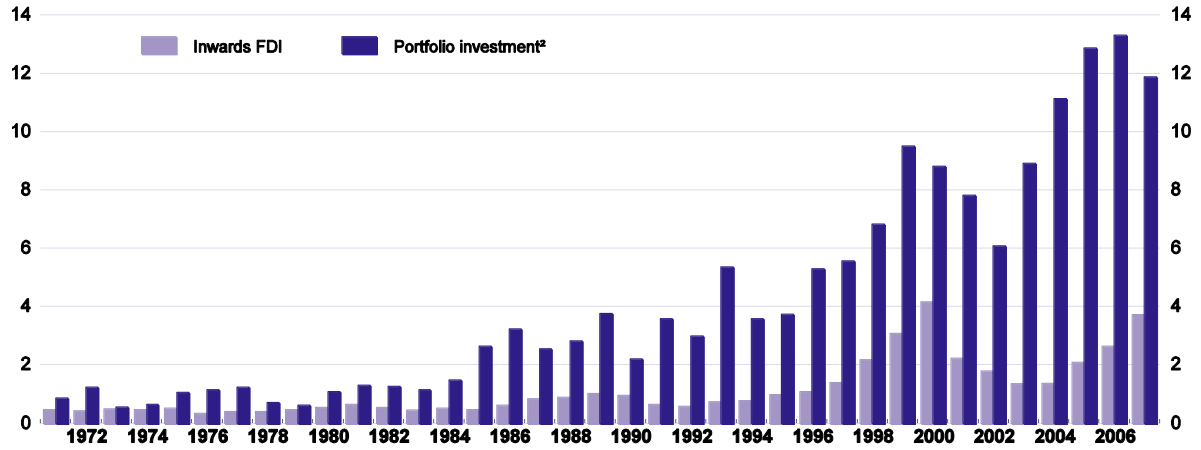
2. Averaged over three years preceding the reference year.

3. P-values reported.

Source: Authors' estimations.

Figure 6. Capital flows

In per cent of world GDP[1]



1. Based on the GDP of those countries for which data on inward FDI and portfolio investment flows are available.

2. Calculated as liabilities plus assets (in absolute value).

Source: Data available from International Monetary Fund (*International Financial Statistics*); and authors' calculations.

Capital flows

We find that capital flows are important determinants of current account reversals. This is in line with Edwards (2005) who shows that when countries are faced with a sudden stop of capital inflows they also have a high probability of undergoing a current account reversal. However, we show that the effect of capital flows on current account reversals differs for portfolio investment and FDI inflows; rising portfolio capital inflows increases the probability and magnitude of a subsequent improvement in external positions, whereas the converse is true for FDI inflows. In addition, our results indicate that the role of capital flows became more important in the last two decades and suggest that the ensuing reconfiguration of capital flows could lead to structural shifts in external positions around the globe.

These findings also contribute to the recent debate on whether or not, due to a savings glut in East Asia, demand for foreign financial assets by those countries has been the main driver of the current-account deficit in the United States (Bernanke, 2005; Caballero, Farhi and Gourinchas, 2008; Obstfeld and Rogoff, 2009). To the extent that an increase in capital inflows from East Asia, at least as far as portfolio investment is concerned, corresponds to a deterioration of the United States' external position, there is likely to be an improvement in the United States external positions once a reversal occurs.

Macroeconomic policies

Our results confirm the well known effect of macroeconomic policy on current account determination. By reducing absorption over the period leading up to a reversal, a tightening of monetary policy is likely to increase the likelihood of an improvement in external positions. We also find that when an improvement does occur, a monetary tightening is associated with smaller subsequent swings in external positions, most probably by addressing the underlying causes of the impending current account reversal. In addition, we provide some evidence that fixed exchange rates regimes decrease the probability of an improvement in external positions, a finding in line with Milesi-Ferretti and Razin (2000), which might be related to the fact that countries with fixed exchange rates are unable to adjust their monetary stance to their own

economic conditions. As for fiscal policy, a tightening of the fiscal stance over a number of years prior to a reversal would likely increase the probability and magnitude of an improvement in external positions, when it does take place. To some extent, this finding can be attributed to the fact that the corresponding increase in government saving is not fully offset by a decrease in private saving.

One shortcoming of our analysis is that due to the lack of cross-country data on structural reforms, we do not capture their effects that could result in shifts in external positions through their impact on savings. In countries with incipient formal safety nets, household savings have been found to be very responsive to increases in government-financed social spending.[20] A strengthening of social protection programmes in some surplus emerging-market economies would therefore reduce both public and household savings and could therefore result in a structural break in those countries' external positions.[21] Likewise, reform of tax systems could raise both government and household savings in deficit countries, leading to a structural improvement in their external positions. This is the case, for example, of scrapping income tax deductibility for mortgage payments or shifting the personal income tax further to a consumption base, which would weaken incentives for over-consumption in deficit countries, such as the United States.[22]

Apart from the effects of capital flows and macroeconomic policies, our results point to the presence of regional spillover effects, since the probability of a current account reversal taking place depends on the number of reversals in other countries in the region. Finally, the dynamics of the external positions *per se* appear to play a significant role. In particular, we show that not only the level, but also the current account trend, determines whether external positions cease to be sustainable or not.

20. Baldacci *et al*. (2010) and Furceri and Mourougane (2010) find that a 1% increase in social spending could reduce the saving-to-GDP ratio by about ½ percentage point in the average OECD country, but by as much as 1 percentage point in China. Barnett and Brooks (2010) show that an increase in health spending by CNY 1 leads to up to a CNY 2 increase in urban household consumption. As a result the projected increase by 1¾ percentage points of GDP in social spending in China could reduce saving by about 1½-2% of GDP in the medium and long terms.

21. Empirical evidence for China suggests that pension and health care reforms have a significant impact on household saving. Feng *et al*. (2009) show that the pension reform for enterprise employees in China implemented in the late 1990s lowered pension wealth and raised household savings. See also OECD (2010b) for more information.

22. It should nevertheless be recognised that empirical evidence on the effect of tax reform on the current account balanced is fairly mixed. Reducing the average tax wedge would improve the current account balance through an increase in exports and a decrease in imports (Nicoletti *et al*., 2003), an increase in investment (OECD, 2003; Alesina *et al*., 2002) and a decrease in net FDI outflows (Nicoletti *et al*., 2003). On the other hand, a reduction in the overall tax burden would weaken the current account balance (Kennedy and Sløk, 2005).

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APPENDIX 1. UNIT ROOT TESTS

	Two breaks				One break		
	Lag[1]	Test[2]	Break date (level, trend)[3]		Lag[1]	Test[2]	Break date (level, trend)[3]
Algeria	0	-6.924***	1978 (n,s)	1995 (s,s)			
Argentina	0	-6.692***	1998 (n,n)	2002 (s,s)	0	-5.779***	2001 (s,s)
Australia	1	-7.17***	1995 (s,s)	2002 (s,n)			
Austria	0	-7.004***	1981 (s,n)	1987 (s,n)			
Bahrain	0	-7.861***	1981 (s,s)	2000 (n,n)	0	-7.323***	2003 (n,n)
Belgium	0	-6.965***	1979 (s,s)	1999 (s,s)			
Benin	1	-7.143***	1989 (s,n)	2003 (s,s)			
Bolivia	0	-6.945***	1987 (s,n)	1997 (s,s)			
Brazil	0	-6.184**	1982 (s,n)	1999 (n,s)			
Burundi	0	-7.744***	1978 (n,s)	1994 (n,s)			
Cameroon	2	-6.729***	1978 (s,s)	1991 (s,s)			
Canada	0	-6.908***	1990 (n,s)	2001 (s,n)			
Central African Rep.	0	-8.521***	2000 (s,s)	2003 (n,s)			
Chad	2	-7.377***	1978 (s,n)	2000 (n,s)			
Chile	0	-7.893***	1978 (n,n)	1990 (s,n)	0	-6.729***	1999 (n,n)
Colombia	2	-4.329	1996 (s,s)	2003 (n,s)			
Congo, Dem. Rep. of	0	-9.241***	1984 (n,n)	2000 (s,s)	0	-8.849***	1997 (s,s)
Congo, Republic of	1	-7.452***	1986 (s,s)	2002 (n,s)			
Costa Rica	0	-7.636***	1982 (s,s)	1991 (n,s)			
Côte d'Ivoire	0	-7.292***	1992 (s,s)	1995 (n,s)			
Denmark	2	-6.218**	1983 (s,s)	1989 (s,s)			
Dominican Republic	1	-8.962***	1997 (n,s)	2003 (s,s)			
Ecuador	1	-7.414***	1977 (n,n)	1985 (n,s)	1	-5.68***	1978 (s,s)
Egypt	2	-5.944**	1976 (s,s)	1993 (n,s)			
El Salvador	0	-7.302***	1982 (n,n)	1994 (n,s)	0	-6.238***	1994 (n,n)
Equatorial Guinea	1	-6.11**	1981 (s,s)	1996 (s,s)			
Ethiopia	0	-8.436***	1989 (s,s)	1998 (n,s)			
Finland	0	-12.076***	1997 (n,s)	2000 (s,n)			
France	1	-8.833***	1993 (s,s)	1996 (s,s)			
Gabon	2	-6.532***	1978 (s,s)	1986 (s,s)			
Gambia	0	-7.656***	1981 (n,s)	1997 (n,s)			
Germany	0	-6.178**	1990 (s,n)	2003 (n,s)			
Ghana	2	-9.62***	1997 (s,s)	2002 (s,s)			
Greece	2	-6.932***	1987 (s,n)	1992 (s,s)			
Guatemala	0	-6.36**	1977 (n,s)	1989 (n,n)	0	-6.02***	1982 (n,n)
Guinea	0	-7.444***	1985 (n,s)	1999 (n,n)	0	-6.535***	2002 (n,s)
Guyana	1	-8.699***	1984 (n,n)	1993 (s,n)	1	-7.057***	1992 (n,s)
Haiti	2	-6.875***	1983 (s,s)	1996 (s,n)			

APPENDIX 1. UNIT ROOT TESTS (continued)

	Two breaks				One break		
	Lag[1]	Test[2]	Break date (level, trend)[3]		Lag[1]	Test[2]	Break date (level, trend)[3]
Honduras	0	-6.06**	1995 (n,s)	2003 (n,n)	0	-5.618***	1995 (n,n)
Iceland	0	-7.602***	1992 (n,s)	2002 (s,s)			
India	2	-4.994	1989 (n,n)	2000 (n,n)	2	-3.328	1996 (n,n)
Indonesia	0	-6.541***	1993 (s,n)	2001 (s,s)			
Iran, Islamic Rep. of	2	-8***	1978 (s,s)	1994 (n,s)			
Ireland	0	-8.191***	1998 (s,s)	2001 (s,s)			
Israel	2	-7.068***	1985 (n,n)	1998 (s,s)	2	-5.746***	1998 (s,s)
Italy	2	-8.38***	1978 (s,s)	1992 (n,s)			
Jamaica	0	-7.827***	1979 (n,s)	1991 (s,s)			
Japan	2	-7.66***	1998 (s,s)	2003 (s,s)			
Jordan	1	-8.27***	1990 (s,s)	1994 (n,s)			
Kenya	2	-6.9***	1989 (s,s)	1997 (s,s)			
Lebanon	0	-8.192***	1984 (s,s)	1993 (n,s)			
Liberia	1	-8.105***	1992 (s,n)	2001 (n,n)	1	-7.744***	2001 (n,n)
Madagascar	0	-10.967***	1978 (s,s)	2002 (s,s)			
Malawi	0	-9.041***	1980 (n,n)	2003 (s,s)	0	-9.103***	2003 (s,s)
Malaysia	0	-4.988	1980 (s,n)	1990 (s,s)			
Mali	1	-7.23***	1983 (s,n)	1991 (s,s)			
Malta	0	-6.889***	1979 (s,n)	2000 (n,n)	0	-5.568***	2000 (n,s)
Mauritania	1	-8.083***	1983 (s,s)	2003 (s,n)			
Mauritius	0	-6.511***	1975 (s,n)	1987 (n,s)			
Mexico	0	-7.585***	1981 (s,n)	1989 (s,n)			
Morocco	0	-4.973	1975 (n,n)	1987 (n,s)	0	-4.24*	1987 (n,s)
Myanmar	2	-12.691***	1983 (s,s)	1997 (s,s)			
Nepal	1	-6.937***	1981 (n,s)	2003 (s,s)			
Netherlands	0	-9.633***	1992 (s,s)	2003 (n,s)			
New Zealand	0	-6.684***	1995 (s,s)	2001 (s,s)			
Nicaragua	0	-6.022**	1994 (n,s)	1997 (n,n)	1	-5.099***	1991 (n,s)
Niger	0	-8.024***	1982 (n,s)	1985 (s,n)			
Nigeria	2	-7.355***	1987 (s,s)	2003 (n,n)	2	-5.803***	1986 (s,s)
Norway	1	-5.194	1977 (n,s)	1986 (n,s)			
Pakistan	1	-6.367**	1983 (s,s)	1998 (n,s)			
Panama	0	-8.974***	1978 (s,s)	1993 (n,s)			
Paraguay	1	-6.09**	1987 (n,n)	1995 (n,s)	1	-5.398***	1994 (s,s)
Peru	1	-6.495***	1977 (n,s)	1986 (s,s)			
Philippines	1	-5.843**	1975 (s,s)	1986 (s,s)			
Qatar	1	-7.197***	1977 (s,s)	1996 (s,s)			
Rwanda	0	-8.211***	1999 (n,n)	2003 (s,s)	0	-6.894***	2003 (s,s)
Samoa	0	-5.538*	1984 (s,s)	1994 (n,s)			
Saudi Arabia	2	-7.937***	1977 (s,s)	1983 (n,s)			
Senegal	0	-7.411***	1988 (s,s)	2003 (s,s)			
Sierra Leone	1	-6.185**	1992 (s,s)	2001 (s,s)			
Singapore	0	-5.672*	1994 (n,s)	2001 (n,s)			
South Africa	0	-7.922***	1984 (n,s)	1994 (n,s)			
Spain	1	-7.477***	1975 (s,s)	1998 (n,n)	1	-6.621***	1997 (s,s)

APPENDIX 1. UNIT ROOT TESTS (continued)

	Two breaks				One break		
	Lag[1]	Test[2]	Break date (level, trend)[3]		Lag[1]	Test[2]	Break date (level, trend)[3]
Sri Lanka	2	-6.652***	1978 (s,s)	1990 (s,s)			
Sudan	2	-12.568***	1977 (s,s)	1995 (n,n)	2	-10.334***	1977 (s,s)
Swaziland	0	-6.093**	1976 (n,s)	1984 (n,s)			
Sweden	0	-7.805***	1989 (s,s)	2002 (n,s)			
Switzerland	1	-6.741***	1982 (s,s)	1986 (s,s)			
Syrian Arab Rep.	0	-6.972***	1983 (n,n)	1986 (n,n)	0	-6.904***	1983 (n,n)
Tanzania	0	-7.879***	1974 (n,s)	1981 (n,n)	0	-7.929***	1987 (n,s)
Thailand	0	-7.817***	1992 (s,s)	2001 (n,s)			
Togo	0	-8.858***	1976 (n,n)	1979 (n,s)	0	-7.989***	1979 (n,s)
Trinidad and Tobago	0	-5.849**	1975 (s,n)	1982 (s,s)			
Tunisia	0	-5.871**	1996 (s,n)	2003 (n,s)			
Turkey	0	-6.935***	1977 (n,n)	1999 (n,n)	0	-5.872***	1999 (n,n)
Uganda	0	-8.466***	1999 (s,s)	2003 (s,s)			
United Kingdom	0	-8.207***	1974 (n,n)	1985 (s,s)	0	-7.758***	1985 (s,s)
United States	0	-5.809**	1982 (s,s)	1999 (s,s)			
Uruguay	2	-5.761**	1982 (n,s)	1998 (s,s)			
Venezuela, Rep. Bol.	2	-5.406*	1977 (n,n)	1996 (n,s)	0	-4.371*	1975 (n,s)
Zambia	0	-7.65***	1983 (s,s)	1986 (s,s)			

1. The optimal number of lagged first-differenced terms included in the unit root test to correct for serial correlation is selected according to the general-to-specific procedure of Lee and Strazicich (1999 and 2003) with a maximum number of lags set to 2.

2. Critical values for the two- and one-break tests are available from Lee and Strazicich (1999 and 2003). The search process excludes the first and last 3 observations over the period 1971-2007. Statistical significance of the LM unit root test statistics with linear trend at the 1, 5 and 10% levels is indicated by ***, ** and *, respectively.

3. The statistical significance/insignificance of the estimated breaks in levels and trends are denoted at the 10% level by “s” and “n”, respectively.

Source: Authors’ estimations.

APPENDIX 2. DATA SOURCES AND DEFINITIONS

Variable	Description
Current account balance (CA)	External current account balance defined in per cent of GDP, available from the World Bank's *World Development Indicators* and the OECD's *Economic Outlook* 87 databases.
Net foreign assets (NFA)	Defined in per cent of GDP, available from the updated and extended version of the *External Wealth of Nations Mark II* database developed by Lane and Milesi-Ferretti (2007). First-differenced data are computed as $dNFA = (NFA_t - NFA_{t-1}) / GDP_{t-1} * 100$.
Portfolio inflows	Net portfolio investment inflows (calculated as liabilities minus assets) in per cent of GDP, available from the International Monetary Fund's *International Financial Statistics* database (lines 78bgdzf and 78bfdzf).
FDI	Foreign direct investment inflows in per cent of GDP, available from the International Monetary Fund's *International Financial Statistics* database (line 78bddzf).
GDP growth rate	Defined as $dGDP = (GDP_t - GDP_{t-1}) / GDP_{t-1} * 100$, available from the World Bank's *World Development Indicators* database.
Exchange rate peg	Dummy variable that takes a value of "1" if a country has a fixed exchange rate regime and "0" otherwise, using the Shambaugh Exchange Rate Regime Classification (Shambaugh, 2004).
Discount rate	Discount/bank rate (in per cent per annum), available from the International Monetary Fund's *International Financial Statistics* database (line 60).
Budget balance	Defined in per cent of GDP, available from the OECD *Economic Outlook 87* database.
Improvements in the region	Total number of significant reversals in levels and/or slopes associated with an increase in trends in a given year in the same economic area excluding reversals in the reference country as identified by the Lee-Strazicich test reported in Appendix 1. The economic areas used are: OECD countries (as of 2009, plus Malta), Latin America, Middle East, Asia and Pacific, and Africa.
Deteriorations in the region	Total number of significant reversals in levels and/or slopes associated with a decrease in trends in a given year in the same economic area excluding reversals in the reference country as identified by the Lee-Strazicich test reported in Appendix 1. The economic areas used are: OECD countries (as of 2009, plus Malta), Latin America, Middle East, Asia and Pacific, and Africa.
Magnitude of reversal	Magnitude of reversals in trend as estimated by the Lee-Strazicich test in Appendix 2
Magnitude of improvement	Magnitude of a positive reversal in trend as estimated by the Lee-Strazicich test in Appendix 1.
Magnitude of deterioration	Magnitude of a negative reversal in trend in absolute value as estimated by the Lee-Strazicich test in Appendix 1.

APPENDIX 3. LITERATURE OVERVIEW

Study	Sample	Definition of reversals	Estimation technique	Dependent variable	Findings[1]
Milesi-Ferretti and Razin (2000)	1970-1996, 105 low- and middle-income countries	Ad hoc (based on sharp reductions in current account deficit defined in % of GDP)	Probit	Chronology of reversals (0-1 dummy)	Current account balance (-) Foreign exchange reserves (-) GDP per capita (+) Terms of trade (-) Exchange rate peg (-)
Eichengreen and Adalet (2005)	1880-2000, middle and high-income countries	Ad hoc (based on sharp reductions in current account deficit defined in % of GDP)	Probit	Chronology of reversals (0-1 dummy)	Current account balance[2] (-) Openness (+) Lagged UK or US growth (-) Trade balance (-) Gold Standard dummy (-) Breton Woods dummy (-)
Edwards (2005)	1970-2001, 163 countries	Ad hoc (based on sharp reductions in current account deficit defined in % of GDP)	Probit IV probit	Chronology of reversals (0-1 dummy)	Current account balance[2] (-) Sudden stop (+) Sudden stop in region (+)
Assman and Boysen-Hogrefe (2010)	1970-2004, 96 developing countries	Via estimated state probabilities using a two-state Markov switching model between less and more sustainable states (*i.e.*, with lower and higher level of current account balance, respectively)	Markov switching VAR model	Transition probability from a less to a more sustainable state	Current account balance (-) Official transfers (+) Change in terms of trade (+) Openness (+) US real interest rates (+)
Bagnai and Manzocchi (1999)	1965-1994, 49 developing countries	Unit root tests with one endogeneous break	Panel data	Current account balance (in % of GDP) around endogenous reversals	GDP growth (-)[3] Government balance (+) Change in terms of trade (+) External debt (-)[3] Debt service (-)

1. The sign of the estimated relationship between the explanatory variable and the dependent variable (or the probability of a reversal in the case of probit models) is denoted by "+" or "-". Only robust results that are also significant at the 10 per cent level are reported. The description of the explanatory variables is indicative, as many of them are expressed in per cent of GDP and lagged and/or averaged over several years preceding the reversal.
2. Current account balance (not deficit) is used for better comparison.
3. Onsignificant using the subsample of positive reversals only.

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