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Patterns of current account adjustment: insights from past experience

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EUROSYSTEM

WORKING PAPER SERIES

NO 762 / JUNE 2007

PATTERNS OF CURRENT ACCOUNT ADJUSTMENT

INSIGHTS FROM PAST EXPERIENCE

by Bernardina Algieri
and Thierry Bracke

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PATTERNS OF CURRENT ACCOUNT ADJUSTMENT

INSIGHTS FROM PAST EXPERIENCE [1]

by Bernardina Algieri [2]

and Thierry Bracke [3]

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Abstract

The paper examines over seventy episodes of current account adjustment in industrial and major emerging market economies. It argues that these episodes were characterised by strongly divergent economic developments. To reduce this divergence, the paper classifies episodes with similar characteristics in three groups, using cluster analysis. A majority of cases was characterised by internal adjustment through a slowdown of domestic demand and did not involve significant exchange rate movements. In some cases, the adjustment was mainly external, facilitated by a relatively modest exchange rate depreciation and without economic slowdown. Finally, some cases involved a crisis-like combination of a severe slowdown and a significant currency depreciation. Using a multinomial logit, we find that this classification of episodes helps improve the predictability of current account adjustment.

Key words: external imbalances, current account adjustment, cluster analysis, multinomial logit.

JEL classification number: F32, C14, C25

Non-technical summary

The paper reviews the experience with current account adjustment in industrial and systemically important emerging market economies. It looks at episodes where individual countries recorded an improvement in their current account position that was relatively rapid (within 4 years), substantial (exceeding a predefined, country-specific threshold) and sustained (no subsequent deterioration). We identify 71 episodes that meet these criteria since the mid-1970s.

A review of such episodes can help address important questions about current account corrections, for instance on the occurrence of economic slowdowns or large currency movements as drivers of such corrections. This allows to verify empirically some of the main results from the theoretical literature, such as Obstfeld and Rogoff's (2005) findings on the need of a real effective exchange rate depreciation. General interest in these questions is intricately linked with the widening global imbalances, in particular the current account deficit of the United States, which rose to 6.5% of GDP in 2006. Although today's global imbalances are unique in many respects (e.g. unprecedented scale, unique financial dimensions, importance of structural factors in surplus countries), empirical regularities from the past may still be informative to understand the likely adjustment mechanism of the US current account deficit.

Looking across the 71 episodes, we find that adjustment was on average accompanied by some slowdown in real GDP growth and some real effective depreciation in the deficit country. This finding is not new. It is in line with a large body of empirical literature on current account reversals. However, these average trends mask an unusually large degree of heterogeneity. In roughly one-third of the cases, economic growth accelerated, rather than decelerating, and also in one-third of the cases, the real effective exchange rate appreciated, rather than depreciating. The paper argues that this diversity makes any meaningful inference difficult.

To enhance inference, we classify episodes into groups, based on the main adjustment characteristics. This is done with cluster analysis, a technique based on numerical optimisation that requires minimal judgement on the part of the user. The analysis leads to a classification in three groups, which we find to be robust and to exhibit significantly different macroeconomic and financial trends. In a first group of "internal adjustment" cases, there is a slowdown of real GDP growth but not much change in the real exchange rate (even on average a slight appreciation). In a second group of "external adjustment" cases, the real exchange rate depreciated but there is not much movement in real GDP growth (even on average a slight increase). In a third group of "mixed adjustment", the adjustment is characterised by a combination of slower economic growth and a depreciating exchange rate. Developments in this group are more pronounced than in the two other groups, pointing to the crisis-like character of this third group. Besides these different real GDP and exchange rate characteristics, the three groups also exhibit different developments in terms of imports and exports, domestic demand components, financial variables, and global variables.

Taking the results one step further, we analyse what explains the type of adjustment. An important finding is that the three adjustment types are rather evenly spread across countries, suggesting that the type of adjustment is not a function of the size of the country, its degree of openness, its degree of industrialisation, or the region to which it belongs. Instead, results from a multinomial logit model, estimating the likelihood of the three types of adjustment, suggest that adjustment patterns are mainly a function of the underlying economic problems in the deficit country. Internal adjustment seems to be common among countries that are at an advanced stage of the cycle and that are experiencing buoyant domestic demand growth, external adjustment is more likely when the exchange rate is overvalued, and mixed adjustments are typically signalled by a combination of on overvalued exchange rate and indications of an overheating economy.

I – Introduction

Widening global external imbalances have triggered a discussion as to whether, when and how these imbalances will adjust. The divergence of opinions increases with each of these questions. There is considerable agreement that an adjustment will take place as trade imbalances at their present level would at some point generate unsustainable external debt dynamics. There is less certainty when this adjustment will take place, with some considering that imbalances can be sustained over a prolonged period and others arguing that an adjustment is more imminent. The degree of uncertainty is highest about the pattern of adjustment. It could involve different combinations of demand rebalancing between surplus and deficit countries, changes in real effective exchange rates between surplus and deficit countries, and underlying structural changes in the main surplus and deficit countries.

This paper aims to shed some light on this last question, namely how an adjustment of external imbalances could take place and what macroeconomic implications this could have. The key issue is whether an adjustment, if it were to occur, would be accompanied by changes in global growth patterns and by increased volatility in global financial markets. To address this question, the paper reviews past experience with current account adjustment in individual countries. Such adjustment is defined as a rapid, sizeable and sustainable correction of a current account deficit.

How relevant is the past, given that today's current account imbalances are largely unprecedented? The sum of all current account deficits reached 3 percent of global GDP in 2006, above levels seen in the past three decades. Yet, there have been important peaks also in the past, for instance during the oil crisis of the late-1970s and early-1980s (1½ percent of global GDP) and the US twin deficit episode of the mid-1980s (2 percent) (Chart 1). These past peaks suggest that large current account imbalances per se are not unprecedented, and hence, that the stylised facts from the past could contain relevant lessons for today.

Several additional features set today's global imbalances apart from the past. They include the growing concentration of current account deficits in a single country, the United States, the increasing weight of non-industrial surplus countries (Chart 1), the unprecedented extent of global financial integration, and the importance of official reserve accumulation as a source of financing of the US current account deficit.

Chart 1: Global current account positions : surplus versus deficit countries
Sum of surplus (deficit) positions in percent of global GDP, 1973-2006

Note: Statistical error is a residual computed to match surpluses and deficits. Estimated data for 2006.
Source: IMF World Economic Outlook (April 2007), IMF International Financial Statistics, OECD Economic Outlook

Although these factors call for caution in using past patterns as a guide for a possible future rebalancing of the US current account, empirical regularities from the past are a natural benchmark to test whether theoretical relations hold empirically. Theoretical results about current account adjustment have flourished in the recent past, in particular regarding the size of exchange rate realignment that is likely to accompany a current account rebalancing. Some models predict a relatively large depreciation in the deficit country to ensure a shift in the relative price of tradables and non-tradables (see for instance Obstfeld and Rogoff, 2005 and Rogoff, 2006) or to enable a switch in international portfolio allocations (Blanchard, Giavazzi and Sa, 2005). Simulations based on dynamic stochastic general equilibrium models (IMF, 2006a) also conclude that any scenario of global current account rebalancing will entail some exchange rate movements.

Given that past episodes have been so diverse, can one still draw any meaningful inference? This is the central question this paper aims to address. In our view, inference can be enhanced by classifying episodes that share similar characteristics into groups. Some authors have taken a first step in that direction, by distinguishing for instance low-growth from high-growth adjustment cases (Croke, Kamin and Leduc, 2005; IMF, 2007) or export-led from import-led adjustment cases (Guidotti et al., 2003). We take the classification efforts one step further by introducing a cluster analysis, which allows to form groups on the basis of numerical optimisation techniques. Each of the groups correspond to different adjustment patterns. Once the groups are established, we validate them by checking that economic developments differ significantly among them. We adapt and extend techniques that are commonly used in the current account reversal literature. First, we conduct an event-study analysis, checking whether changes in each variable from pre-to post-adjustment levels are different between groups. Second, we examine whether economic developments prior to the adjustment are different across groups. To this purpose, and differently from the existing literature, we fit a multinomial logit model that estimates the likelihood of the three types of adjustment.

To foreshadow the main conclusions, we classify the 71 episodes in three groups:

- The first group, constituting around half of the episodes (36), experienced a slowdown of real GDP growth but not much change in the real exchange rate (even on average a slight appreciation) during the adjustment. We label this "internal adjustment", given that the current account improvement essentially comes through a slowdown in domestic demand growth and import growth. This type of adjustment seems to be typical when the deficit prior to the adjustment widened mainly due to buoyant domestic demand growth. The multinomial logit model suggests that the likelihood of such an adjustment increases as economies reach an advanced stage of the business cycle, as indicated by a positive and widening output gap. This type of adjustment therefore appears to be of a largely cyclical nature. Asset price movements seem to play some role in this group, as the internal adjustment is typically accompanied by a pronounced slowdown of asset price inflation (e.g. house prices) following a period of rapid increase.

- The second group, constituting half of the remaining cases (17), is characterised by a depreciating real exchange rate without much movement in real GDP growth (even on average a slight increase in growth). We label this "external adjustment", as the current account improvement is made possible by an exchange rate-induced improvement in the country's competitiveness, favouring an increase in net exports. The pick-up in net exports provides a positive impetus to economic growth and explains the absence of an economic slowdown in this group. According to the logit model, this adjustment pattern is more likely when the widening current account deficit reflected sluggish export growth and when the exchange rate is overvalued. Differently from the internal adjustment,

which is common among high-growth countries, external adjustment seems to be preceded by sluggish economic growth, possibly because these economies face competitiveness problems.

- The third and final group (remaining 18 cases) is characterised by a combination of slower economic growth and a depreciating exchange rate. We therefore label it "mixed adjustment". Developments in this group are more pronounced than in the two other groups. The slowdown is, on average, more pronounced than in the internal adjustment cases and the depreciation is, on average, larger than in the external adjustment cases. This points to the crisis-like character of the mixed adjustment episodes. The current account improvement reflects both a sharp contraction of domestic demand (hence less domestic demand for foreign goods) and a sharp improvement in the country's competitiveness (and hence increased foreign demand for domestic goods). In terms of leading indicators, the logit model suggests that mixed adjustments are typically signalled by a combination of on overvalued exchange rate – pointing to the need for correction on the external side – and indications of potential overheating – pointing to the need for correction on the internal side.

An important finding is also that the three adjustment types are rather evenly spread across all types of countries. Whether a current account deficits corrects through internal, external or mixed adjustment therefore does not seem to be a function of the size of the country, its degree of openness, its degree of industrialisation, or the region to which it belongs. Instead, the logit results for each of the three groups suggest that the adjustment patterns are mainly a function of the underlying problems of the deficit country.

There are certain limitations to the approach used in this paper. While the event-study approach and the logit model allow to uncover correlations or comovements among variables, they do not allow to draw any inference on underlying structural relations. Another potential limitation is the focus on developments in deficit countries,[1] which implies a need for caution in the context of current global imbalances, as these are partly related to structural factors in surplus countries (see for instance the savings glut hypothesis, Bernanke, 2005).

The paper provides several contributions to the current account adjustment literature. It explicitly examines diversity across adjustment episodes and proposes a classification that is statistically robust and economically meaningful. While we are admittedly not the first to flag the diversity between episodes, a systematic analysis has so far not been undertaken. A further novelty of the paper relates to the use of a discrete choice model with multiple outcomes instead of a standard binomial outcome analysis. As another contribution, we devote considerable attention to the selection of adjustment episodes and examine the sensitivity of the selection to changes in the underlying criteria. By introducing some country-specific criteria that take into account the degree of openness, we select a larger number of adjustment episodes in G7 countries than in other papers, which should enhance the relevance of our findings for large and less open economies. A final important element of this paper relates to the use of quarterly data, allowing for a finer analysis of adjustment dynamics. Most papers, except for Croke, Kamin and Leduc (2005), are based on annual data.

The rest of the paper is organised as follows. After a brief review of related literature in section II and a presentation of the data and the definition of adjustment episodes in section III, we present the cluster

[1] We partly remedy this by inspecting also global variables (global growth, global monetary conditions, and international oil prices).

analysis in section IV. As a next step, section V reviews the adjustment dynamics in each group on the basis of an event-study and a statistical analysis while section VI presents economic developments before the adjustment on the basis of a multinomial logit. Section VII summarises the results and outlines implications for the adjustment of global imbalances.

II – Related literature

1. Main results of the literature

Several empirical studies have reviewed the determinants and consequences of current account adjustment. Milesi-Ferretti and Razin (2000) were the first to do so in a systematic way, adapting Eichengreen, Rose and Wyplosz' (1995) methodology from currency crises to current account adjustment. Milesi-Ferretti and Razin focused on low- and middle-income countries as their work was motivated by the Asian crisis of 1997-98. The authors detect several adjustment episodes ("reversals") on the basis of a set of empirical criteria and find that slightly more than half of them are associated with an economic slowdown. Using a probit analysis, they find that adjustments are more likely in countries with large current account deficits, lower reserves, higher GDP per capita, worsening terms of trade, an increasing investment rate and floating exchange rate. Two external variables, namely OECD growth and the US interest rate, also turn out to be robust predictors of adjustment.

This approach was extended to industrial countries by Freund (2005). Using a dataset of 25 adjustment episodes during 1980-1997, she finds that average adjustments start when the current account deficit reaches 5 percent of GDP. Slowing income growth and a real depreciation of about 10 to 20 percent are the major drivers of adjustment. Strengthening real export growth, decreasing investment growth and a levelling off in the budget deficit are also part of the adjustment process. These findings suggest that current account adjustments in industrial countries are largely manifestations of the business cycle. Freund's probit analysis fails to identify good predictors of current account reversals, leading the author to conclude that the exact timing of an adjustment is very difficult to forecast.

Subsequent work, summarised in Appendix A, has largely confirmed these findings. A number of authors have extended or qualified these findings in a number of directions.

Alternative definitions of adjustment episodes. Most authors adopt Milesi-Ferretti and Razin (2000) and Freund's (2005) criteria to identify adjustment episodes. These empirical criteria specify, inter alia, the minimum deficit prior to the adjustment, the minimum size of the current account improvement, and the maximum timeframe within which the adjustment has to occur. Some authors depart from this common definition, using statistical tests to detect structural breaks (Bagnai and Manzocchi, 1999a and 1999b) or considering also rapid current account deteriorations from a surplus position (Edwards, 2006b and IMF, 2007). We apply neither of these extensions in this paper, as the first one (statistical approach) involves some weaknesses (inability to determine the true significance value of the testing procedure, the restrictive assumption that the current account experiences at most one structural change) while the second one (also current account improvements) seems of limited relevance for the policy questions at hand. Nevertheless, these extensions point out that the selection of episodes needs to be carried out judiciously. We will therefore, when selecting adjustment episodes, examine the sensitivity of our selection to changes in the definition.

Historical studies. Adalet and Eichengreen's (2006) samples goes back to the gold standard of the late-19th century. They find that adjustments were more frequent in recent history (post-Bretton Woods era) than in earlier historical episodes. Also de Haan et al. (2006) and IMF (2007) use somewhat longer samples than the rest of the literature, starting in 1960. In this paper, we will restrict the sample to the post-Bretton Woods era, starting in 1973.

Role of financial variables and sudden stops. Several authors have sought to bridge the literature on current account adjustments with that on sudden stops. Sudden stops refer to abrupt and large reductions in capital inflows and have been studied inter alia by Calvo et al. (2004) and Calvo and Talvi (2006). Edwards (2005c) finds that sudden stops, in the presence of large current account deficits, increase the likelihood of a current account adjustment. De Haan et al. (2006) show that a higher degree of financial openness lowers the probability of current account adjustment in OECD countries. Freund and Warnock (2006) study the composition of financial flows but do not find a systematic relation with current account adjustments. Also Debelle and Galati (2005) examine the role of financial flows, highlighting that financial account variables help explain why countries run a large current account deficit, but not why they go through a current account adjustment.

Adjustment in developing and emerging market economies. A number of papers focus mainly on developing and emerging market economies, including the seminal work of Milesi-Ferretti and Razin (2000), the comparison of Asia's and Latin America's experience by Guidotti et al. (2003), and the studies of transition economies by Aristovnik (2005), Benhima and Havrylchyk (2006), and Komárek et al. (2005). In this paper, we focus on industrial economies and the most advanced emerging market economies.

2. Focus on diversity in the literature

The diversity across adjustment episodes is generally acknowledged in the literature. Only few authors, however, have explicitly addressed it by distinguishing subgroups of adjustment.

Distinction between low-growth and high-growth adjustment. Croke, Kamin and Leduc (2005) and IMF (2007) select among their industrial country episodes the top and the bottom performers in terms of real GDP growth. Croke, Kamin and Leduc find that the low-growth cases are not characterised by significantly higher volatility in exchange rates, interest rates or share prices. The IMF finds that low-growth cases tend to exhibit a relatively modest degree of real effective depreciation, whereas high-growth cases were associated with above-average real depreciation.

Distinction between export-led and import-driven adjustment. Guidotti et al. (2003) investigate differences in export and import performance during adjustments in emerging market and developing economies. They conclude that stronger export growth was the main driver of adjustment in emerging Asia while slowing import growth was the main driver in Latin America. The authors attribute this difference to structural factors, highlighting that more closed economies and economies with a higher degree of liability dollarisation are more likely to adjust through import contraction.

Distinction between large and small countries. Edwards (2005c) finds that the harmful effects of current account adjustment on economic growth tend to be more significant for larger countries.

Distinction in terms of adjustment threshold. Clarida, Goretti and Taylor (2006) identify country-specific thresholds for current account adjustment, i.e. levels of the current account to output ratio above which the current account tends to revert to equilibrium. Applying their methodology to G7 countries, they find that

thresholds differ significantly across countries, ranging on the deficit side from 0.18 percent in Japan to 4.05 percent in Canada.

These papers highlight that adjustments have different implications for macroeconomic and financial stability. The central contribution of this paper is to assess the diversity across episodes in a systematic way, in terms of both the adjustment dynamics and the developments before the start of the adjustment. Before presenting the results, the following section reviews the data and the episode selection.

III – Data and selection of adjustment episodes

1. Data

The paper uses quarterly macroeconomic and financial data over the period 1973 Q1 to 2006 Q4 for a sample of 45 industrial and emerging market economies.[2] It includes 23 industrial countries (with individual euro area countries until 1998 and the euro area as a whole since 1999) and 22 emerging market economies. The country coverage is in line with the intended focus of the paper on high- and middle-income countries instead of low-income ones (see Appendix B for a complete list of countries).

The time series include the current account balance, export and import volumes and prices, real GDP growth and its main components (fixed investment, private consumption, government consumption), consumer prices, interest rates (short and long-term), other asset prices (house prices, share prices), government balances (including cyclically adjusted), and external variables (real GDP growth in the OECD as a proxy for global growth conditions, the real short-term interest rate in the United States as a proxy for global monetary conditions, and oil prices) (see Appendix B for a complete list overview of the series).

The data are checked for compatibility, statistical breaks, and seasonality. The series are mainly from the OECD's Economic Outlook and Main Economic Indicators, complemented with figures from the Bank for International Settlements, the International Monetary Fund and the European Central Bank. Compatibility of the time series has been checked with other databases, in particular with the annual series published in the IMF World Economic Outlook. Statistical breaks have been verified and corrected. The series exhibiting seasonal patterns have been seasonally adjusted using the census X-12 additive method.

2. Definition of adjustment episodes

The starting point of the analysis is the selection of relevant episodes. Most available papers use the following definition (see Appendix C for a detailed overview):

i. *initial balance*: the current account balance records a deficit of at least 2 percent or 3 percent of GDP before the adjustment;

ii. *size of the adjustment*: the current account balance increases by a certain percentage of GDP (2, 3, or 5 percent) *and* improves by at least 1/3 of the initial deficit level;

iii. *timeframe of adjustment*: the adjustment takes place within 3 years; and,

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[2] This is in line with the intention to focus on developments in post-Bretton-Woods era. For some countries, data start after 1973, depending on availability.

iv. *sustainability of adjustment*: the improvement is sustained during at least 5 years.[3]

Authors have not reported the sensitivity of the selection to changes in this definition, which seems surprising as the selection can have important implications for the results. For instance, if the criteria were to select only very rapid and large current account improvements, the results are by construction likely to suggest that adjustment tends to be disorderly. Such a bias is not unlikely given that the design of the criteria goes back to Milesi-Ferretti and Razin (1998 and 2000) whose explicit focus was on crisis or near-crisis situations. This could lead to premature conclusions, ignoring the possibility of a more gradual and smooth adjustment.

To analyse these issues, we test the sensitivity of the selection to changes in the defining criteria. The results, reported in Appendix C, suggest that even small modifications to the criteria can considerably change the episode selection. We use this property to increase the number of selected episodes through a careful relaxation of some criteria. In doing so, we want to maximise the number of episodes in order to improve statistical inference while at the same time avoiding the selection of irrelevant episodes from the point of view of the policy questions we want to address. Balancing these requirements, we consider the following criteria:

i. *initial balance*: we require the current account to record a deficit before the adjustment. The sample therefore includes cases where the current account improved from just below balance. An advantage of this approach, which is also adopted by IMF (2007), is that it allows to significantly increase the sample size compared to most of the existing literature. A potential drawback could be that adjustment dynamics of small and large deficits may be different. However, as illustrated below, average dynamics turn out to be very similar when the sample is restricted to large deficit cases.

ii. *size of the adjustment*: we consider a fixed threshold across countries not to be very meaningful. In a small open economy subject to large terms of trade shocks (e.g. an oil exporter such as Norway), a current account fluctuation of, say 2 percent of GDP, may occur relatively frequently. For a closed economy, by contrast, such a fluctuation may be a rather rare event. It seems preferable to select a threshold that accounts for the country-specific degree of variation in the current account. In particular, we select as threshold one standard deviation of the country's current account to GDP ratio. This threshold is lowest in the euro area (0.7 percent of GDP) and highest in Norway (7.2 percent).

iii. *timeframe of adjustment*: the adjustment should take place within 4 years. We therefore allow for a somewhat slower adjustment than most of the literature, which is justified as we want to avoid an excessive bias of our selection towards crisis-like episodes.

iv. *sustainability of adjustment*: for this criterion, there is no specific reason to deviate from the literature. Hence, we require, as in most papers, that the current account improvement is sustained over a period of 5 years.

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[3] The precise requirement is that that the minimum current account balance in the 5 years after the adjustment should remain above the maximum current account balance in the 3 years before the adjustment.

3. Resulting sample of adjustment episodes

Applying these criteria to our sample, 71 episodes qualify as current account adjustment. This selection is larger than in most of the available literature focusing on a comparable time period and a similar set of countries, as shown by a detailed comparison with the samples of Freund (2005) and Edwards (2005c) in Appendix D.[4,5] A potential concern could be that this wider selection increases dispersion in the sample. We will therefore, where relevant, also report results on the basis of a more limited sample comparable to that of Freund (2005).

Most adjustments took place in the 1980s and 1990s (26 and 28 episodes, respectively). The relatively low number of episodes in the 1970s (10) could suggest a lower frequency of adjustments in an era of comparatively still more limited economic and trade integration.[6] The number of episodes since 2000 is rather low (7) as adjustments are identified until 2003 only, given that the identification of adjustments requires data over a sufficiently long span of years.

Most adjustments took place in industrial countries. This mainly reflects the country selection and should therefore not be taken as evidence about the relative likelihood of adjustment in industrial and emerging market economies. Authors with a broader country coverage, such as Adalet and Eichengreen (2006), Edwards (2002), and Guidotti et al. (2003), actually find that adjustment has been more frequent in low- or middle-income than in advanced economies.

Table 1: Number of adjustment episodes by country type and time

Country group	1970s[(a)]	1980s	1990s	2000s[(b)]	Total
G7	3	7	3	1	14
Other industrial countries	6	13	9	0	28
Emerging market economies	1	6	16	6	29
Total	10	26	28	7	71

Notes: (a) Starting in 1973. (b) Episodes until 2003 on the basis of data until 2006.

An important feature of our dataset is the inclusion of 14 episodes in G7 economies, far above the number of G7 cases covered in the literature. This results from the design of the selection criteria, in particular the consideration of a country-specific threshold for the size of the adjustment, which tends to be lower for the relatively more closed G7 countries. This important novelty helps improve the relevance of our findings for large economies and hence also for the case of the United States.

4 The starting dates of some episodes differ in our sample due to the quarterly frequency of data, which should allow for higher precision in identifying turning points.

5 A few episodes that are considered in the literature are not picked up by our criteria, in particular some repeated reversals in Edwards (2005c). A typical example is Portugal, for which Edwards found adjustments in 1983, 1984, 1985 and 1986. We deem it inappropriate to consider these episodes separately and instead consider this as a single adjustment episode.

6 Some caution is needed in drawing such a conclusion because the increase in the number of episodes over time is also related to the increase in the number of countries in our sample, with new emerging market economies, for instance transition economies, being added as quarterly data become available.

4. Diversity across episodes

Macroeconomic and financial developments differ strongly between adjustment episodes. To see this, we inspect more closely the individual episodes, looking in particular at growth and exchange rates, the two main drivers of adjustment according to the existing literature. Appendix D compares average post-adjustment to average pre-adjustment levels of these two variables.[7] In a majority of cases, real GDP growth recorded a decline and the real effective exchange rate a depreciation, in line with the findings of the literature. However, in about one-third of the episodes, developments went against this average trend, as growth accelerated in 25 cases and the exchange rate appreciated in another 25 cases. This casual evidence suggests that averages may mask important differences across episodes.

A more rigorous indication of dispersion is shown in Chart 2, which plots the median as well as the 10th and 90th percentile of the distribution of the two variables across the 71 episodes.[8] The percentiles suggest a large degree of dispersion. Real GDP growth moves within a band of almost -5 to +10 percent, while the exchange rate change moves within a band of -10 to +10 percent (Chart 2a). As these large bands could be due to variations in country-specific levels, we apply a technical correction, demeaning the series by their country-specific averages over time. This indeed reduces the bands, but they remain large (Chart 2b). Beyond these technical corrections, we test whether the wide confidence intervals are specific to our sample. We recompute the medians and percentiles for the subset of 25 episodes identified by Freund (2005). Yet, also with this corrections, the bands remain relatively large (Chart 2c).

Chart 2: Growth and exchange rate developments before and during adjustment episodes

Real GDP growth and change in the real effective exchange rate. Movements from 16 quarters before to 16 quarters after the start of adjustment. Median, 10-percentile and 90-percentile of 71 episodes.

Notes: (a) Variable minus its average value over the episode. (b) Sample limited to that of Freund (2005).

7 The pre- and post-adjustment levels are computed as the average over the second and third year before and the second and third year after the start of the adjustment. Similar results hold for other reference periods.

8 We use medians and percentiles in view of potential non-normalities of the data. Using bands of two standard deviations produces even slightly larger measures of dispersion.

Taken together, these elements imply a considerable degree of variation across episodes. As a result, inference from past experience becomes particularly difficult. This diversity provides the justification for our cluster analysis, which is explored in the next section.

IV – Cluster analysis: methodology and resulting grouping

1. Methodology

To reduce dispersion across episodes, it is useful to group them on the basis of common economic characteristics. This is done with cluster analysis, a numerical optimisation tool that maximises similarity within groups while minimising similarity across different groups (Romesburg, 2004; Everitt et al. 2001; Jain et al., 1999). Cluster analysis has some clear advantages over an ad-hoc approach. It does not require any random decisions on cut-off values between groups, for instance between "high" and "low"-growth cases as in Croke, Kamin and Leduc (2005) and IMF (2007) or between "small" and "large" economies as in Edwards (2005c). Instead, the dividing line between groups is identified through an optimisation process. Moreover, cluster analysis allows to take into account various characteristics when forming the groups, which could for instance be economic growth, exchange rate developments, asset price developments, external developments, etc. To capture these dimensions in a single metric, cluster analysis uses a distance measure. For two episodes, say α and β, with underlying characteristics α_1 and β_1, α_2 and β_2, etc.,[9] the distance is measured on the basis of the following Euclidean metric:[10]

$$d(\alpha,\beta)=\sqrt{\sum_i(\alpha_i-\beta_i)^2}$$

One challenge with such analysis is the selection of relevant underlying characteristics. This selection essentially depends on the policy question at hand. In our analysis, we select two characteristics, real GDP growth and the real effective exchange rate, given that growth and exchange rate developments are of particular interest for the policy questions outlined at the start of the paper as they capture the degree of, respectively, real and financial disruption associated to an adjustment. Moreover, slowing economic growth and real depreciations have been identified in the existing literature as leading indicators of adjustment events (de Haan et al., 2006; Edwards, 2005c; Freund, 2005). We explore alternative cluster scenarios based on additional characteristics and use these as a robustness check of our baseline cluster analysis (see below under robustness).

Another important choice relates to the type of cluster analysis. We adopt the *k*-means method, a commonly used technique that partitions the observations in a predefined number of groups.[11] Under this

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9 In our analysis, we standardise all variables before measuring the distance in order to avoid that the outcome of the analysis depends on the scale of data. Such standardisation prevents that variables with large values skew the distance measure and thereby ensures that each of the economic variables has the same weight in the analysis.

10 Cluster analysis can also be based on non-Euclidean distance measures, such as the square Euclidean distance, the Manhattan distance, the Chebychev distance and the power distance. These alternative distance measures are useful for specific types of data (e.g. ordinal data) but not relevant for our analysis.

11 As an alternative, one could also consider a hierarchical cluster analysis, which decomposes the observations in sequences of nested groups, from fine to coarse aggregation. However, a set-up with "main groups" and "subgroups" would introduce too much complexity for our purposes and could lead to the creation of subgroups with very few observations, for which inference would become impossible.

iterative technique, which starts from a random grouping, individual observations are reclassified on the basis of the distance of each individual observation to the means of the various groups, until a stable solution is found whereby observations do not change groups. While solidly anchored in the literature (Romesburg, 2004; Everitt et al. 2001), this technique has an important drawback, notably that it requires an ex-ante decision by the user about the number of groups k. There exist no standard statistical tests to identify the optimal number. We therefore develop our own approach to identify the optimal number by comparing group averages for each of the underlying economic characteristics. Concretely, we start with two groups, $k = 2$, test whether the mean differences between the groups are significantly different, and then increase the number of groups k until the group means are no longer significantly different. The optimal number of groups k^* is defined as the highest number for which we find a significant difference between all groups.

2. Outcome of the cluster analysis

Using real GDP growth and real effective exchange rate changes as underlying characteristics,[12] we explore classifications with two, three and four groups (k = 2, 3 and 4). We then check the significance of pairwise differences between groups, using the non-parametric Wilcoxon-Mann-Whitney test with null hypothesis of equal medians. This non-parametric test does not rest on the normality assumption and is valid also for small samples.[13] For a discussion of the advantages of this test, we refer to Detken and Smets (2004) and Adalid and Detken (2007), who apply it to episodes of asset price boom and bust cycles.

For two groups (k = 2), the test suggests that changes in real GDP growth and in the real effective exchange rate are significantly different between the groups. Also for three groups (k = 3), pairwise differences are significant. For four groups (k = 4), however, exchange rate changes are no longer significantly different, in particular for groups 2 and 4 (table 2).

Table 2: Significance of group differences

Difference between group medians, z-statistic in brackets of the Wilcoxon-Mann-Whitney test for H_0: equality of group medians

	Two groups $k = 2$	Three groups $k = 3$			Four groups $k = 4$					
	group 1 vs group 2	group 1 vs group 2	group 1 vs group 3	group 2 vs group 3	group 1 vs group 2	group 1 vs group 3	group 1 vs group 4	group 2 vs group 3	group 2 vs group 4	group 3 vs group 4
Change in real GDP growth	-0.76 **	-4.71 **	0.85 **	5.56 **	3.57 **	6.66 **	12.53 **	3.09 **	8.97 **	5.88 **
	(3.33)	*(4.89)*	*(2.53)*	*(4.41)*	*(4.22)*	*(5.02)*	*(3.49)*	*(4.12)*	*(3.66)*	*(3.87)*
Change in real eff. exch. rate	-5.94 **	19.77 **	25.20 **	5.44 *	5.89 *	-15.68 **	6.03 *	-21.57 **	0.14	21.71 **
	(4.74)	*(4.60)*	*(5.10)*	*(1.75)*	*(1.70)*	*(2.42)*	*(1.95)*	*(4.74)*	*(1.19)*	*(4.17)*

Note: ** denotes significance at 5% level, * at 10% level

12 For these two variables, we compare the average post-adjustment level (second and third year after adjustment) with the average pre-adjustment level (second and third year before the adjustment). We compute the simple difference for real GDP growth and the difference in logs for the real effective exchange rate, an approximation of the percentage change. Other reference periods are explored under the discussion of robustness.

13 We also apply a parametric t-test, which rests on the normality assumption, yielding broadly similar results (not reported).

We conclude that the optimal number of groups is three, $k^* = 3$. Some additional considerations support this choice. Most importantly, the three groups have a meaningful economic interpretation. As discussed in section V, the groups correspond to fundamentally different types of adjustment, which we will label internal adjustment, external adjustment and mixed adjustment. With four groups, the economic interpretation becomes more difficult and the classification turns out to be mainly based on the degree of adjustment rather than on fundamental differences in the adjustment mechanisms. A further consideration relates to the size of the groups. With more than three groups, the number of observations would potentially become too small, with on average only 71 / 4 or around 18 observations per group.

The broad geographical distribution of groups is presented in table 3, while the classification of each individual episode is presented in Appendix D. A majority of cases are of the internal adjustment type (36), while the remaining episodes are evenly spread over external (17) and mixed adjustment (18). There is no clear differentiation across country groups. The episodes in G7 countries are evenly spread across the three types, perhaps somewhat counter to the possible intuition that larger economies would tend to be characterised by similar dynamics. Also the emerging market country episodes are spread out over the three types, even though they are somewhat more strongly represented in the mixed adjustment type than the industrial countries. This is in line with the nature of emerging market economies crises, which involved combinations of sharply falling output and a strongly depreciating currency.

Table 3: Number of adjustment episodes by type

Country group	Internal	External	Mixed
G7	6	3	5
Other industrial countries	17	6	5
Emerging market economies	13	8	8
All countries	36	17	18

3. Robustness

The cluster analysis requires partly arbitrary choices regarding the underlying variables (real GDP growth and the real effective exchange rate) and the reference period over which changes in these variables are computed (two to three years pre- and post-adjustment). To assess the robustness of these choices, we check how the classification changes when additional macroeconomic or financial variables are introduced or when other reference periods are used.

The results are presented in Appendix E. Most of the 71 episodes remain within the same group under various alternative analyses, so that we can conclude that the baseline cluster analysis is fairly robust. There are also around 10-15 borderline cases that switch groups for some of the alternative criteria. A potential strategy to enhance robustness could be to remove all these borderline cases from the sample. This would however artificially change the results as we would no longer consider the full spectrum of past cases. We therefore prefer to use the results of the baseline cluster. The choice is supported by the consensus in the literature that growth and exchange rates, the variables used in our baseline, are key drivers of past adjustments. Moreover, the reference window allows to capture genuine adjustment dynamics (through the consideration of a window that is close to the adjustment) while avoiding noise from developments immediately around the adjustment (through the exclusion of the first year before and after the adjustment).

V – Economic developments during current account adjustment

In this section, we explore whether the classification resulting from the cluster analysis is robust by comparing adjustment dynamics in the different groups. To do so, we apply an event-study approach as well as a series of statistical tests on group medians.

1. Event-study analysis

The event-study approach, which follows Eichengreen, Rose and Wyplosz (1995), reviews median developments in economic variables before and after the adjustment over a window of 32 quarters (8 years). Chart 3 presents the results for the current account balance, the real effective exchange rate and real GDP growth. While the current account behaviour is broadly similar in the three groups, there are notable differences for the exchange rate and for real GDP growth. The median real effective exchange rate records a steep depreciation in the cases of external and mixed adjustment, while it appreciates slightly in the case of internal adjustment. Real GDP growth falls sharply in the cases of internal and mixed adjustment, and on average even turns negative in the case of mixed adjustment. In the external adjustment group, by contrast, GDP growth is weak before the adjustment but accelerates throughout the adjustment (with the exception of a short blip in the first year after adjustment). These patterns confirm that internal adjustment is typically accompanied by lower economic growth, external adjustment by an exchange rate-led trade balance correction, and mixed adjustment by a combination of a slowdown and significant depreciation. Similar event-study charts for around 20 additional variables, presented in Appendix F, confirm that the three adjustment types present different adjustment dynamics.

Chart 3: Adjustment dynamics in the three groups
Median values in each group from 16 quarters before to 16 quarters after the start of adjustment

Note: (a) Increase = appreciation

2. Statistical analysis

While the event-study approach provides an attractive visualisation of the adjustment dynamics, it does not permit any statistical inference. As a more thorough approach, we test whether the changes in the variables from their pre- to their post-adjustment levels are significantly different from zero and significantly different between groups.[14] We use non-parametric tests on the median of the distributions given the higher power of

[14] We use the same timeframe as in the cluster analysis, comparing the average over the second and third year after adjustment with the average over the second and third year prior to adjustment. The results are broadly similar when we use other horizons.

such tests for small samples and for variables that are not normally distributed, as is likely to be the case with several of the variables considered here. The left-hand columns of table 4 report the results of the Wilcoxon rank sign test for the null hypothesis that the median of each group is zero, while the right-hand columns present the results of the Wilcoxon-Man-Whitney test of the null hypothesis that two groups have the same median.[15]

3. Main results

The results for real GDP growth and the real effective exchange rate are identical to what was reported above. As for the other variables, we also find significant differences between groups (table 4):

- *Current account and its components.* Although the size of the current account improvement is similar for the three adjustment types, its composition is significantly different. Internal adjustment clearly takes place through a compression of imports while external and mixed adjustments are primarily associated to increasing exports.
- *Domestic demand and its components*. There are very significant differences between the three groups in terms of domestic demand growth. In the case of internal and mixed adjustment, domestic demand growth contracts significantly, by respectively 2.9 and 4.8 percentage points. This reflects a slowdown in private consumption growth and an even more pronounced correction in fixed private investment growth. The collapse in domestic demand is significantly larger in the mixed adjustment cases, suggesting that these cases have a more crisis-like nature. In the case of external adjustment, by contrast, domestic demand growth records a strengthening of around 0.7 percentage points. This is in line with the idea that the correction of the trade balance takes place mainly on the export side and hence even enables a pick-up of domestic consumption and investment growth.
- *Consumer and asset prices*. There are also differences between the three adjustment types in terms of price developments. Internal adjustments are accompanied by a statistically significant decline in inflation, in line with the intuition that such adjustment is more likely in overheating economies with high inflation at the start of the adjustment. Inflation picks up in the mixed adjustment case, perhaps as a result from the large degree of currency depreciation, even though the magnitude of the inflation increase is statistically insignificant. As for asset prices, an interesting finding is that house prices record a significant decline in the internal adjustment cases, suggesting a possible role of wealth effects from a collapse of those prices as one driver of internal adjustment. Changes in stock prices, by contrast, turn out to be insignificant in all three adjustment groups.
- *Government position*. Government balances decline on average in all three adjustment groups, even though this decline is not statistically significant (with the exception of the mixed adjustment case). Prima facie, this would suggest that fiscal consolidation did not contribute, on average, to current account adjustments. One possible reason is the operation of automatic stabilisers, as the decline in GDP growth during internal and mixed adjustments would be expected to trigger worsening public finances. Changes in cyclically-adjusted government balances, which correct for the operation of automatic stabilisers, are indeed somewhat smaller, but they are still negative in two of the three adjustment groups (though again insignificant).

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15 Parametric t-tests yield similar results (not reported).

Table 4: Economic developments by adjustment type

Change from pre- to post-adjustment level, median by group and median differences between groups

Between brackets: p-value for significance test of group medians [(a)] and differences between group medians [(b)]

	Medians by adjustment type			Differences between adjustment types		
Variable	group 1: internal adjustment	group 2: external adjustment	group 3: mixed adjustment	group 1 vs group 2	group 1 vs group 3	group 2 vs group 3
Clustering criteria						
Real GDP growth	-1.83 **	2.19 **	-3.07 **	-4.02 **	1.23 **	5.25 **
	(0.001)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.025)*	*(0.000)*
Real effective exchange rate	5.65 **	-14.12 **	-19.56 **	19.77 **	25.20 **	5.44 *
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.085)*
Current account and components						
Current account in % of GDP	4.38 **	3.81 **	4.40 **	0.58	-0.02	-0.59
	(0.000)	*(0.000)*	*(0.000)*	*(0.277)*	*(0.912)*	*(0.575)*
Exports in % of GDP	1.76 **	5.13 **	3.56 **	-3.37 **	-1.80 **	1.57
	(0.000)	*(0.001)*	*(0.000)*	*(0.019)*	*(0.038)*	*(0.668)*
Imports in % of GDP	-2.12 **	2.12 *	0.59	-4.23 **	-2.71	1.53 *
	(0.000)	*(0.076)*	*(0.500)*	*(0.001)*	*(0.106)*	*(0.070)*
Domestic demand and unemployment						
Real domestic demand growth	-2.93 **	0.71 *	-4.85 **	-3.64 **	1.92 **	5.56 **
	(0.000)	*(0.076)*	*(0.000)*	*(0.000)*	*(0.001)*	*(0.000)*
Real private consumption growth	-2.21 **	0.53	-5.63 **	-2.74 **	3.42 **	6.16 **
	(0.000)	*(0.210)*	*(0.000)*	*(0.002)*	*(0.000)*	*(0.034)*
Real private investment growth	-7.33 **	7.37 **	-8.29 **	-14.71 **	0.96	15.66 **
	(0.000)	*(0.003)*	*(0.000)*	*(0.000)*	*(0.110)*	*(0.000)*
Unemployment rate, in %	0.83 **	2.12 **	2.14 **	-1.29	-1.32	-0.03
	(0.019)	*(0.019)*	*(0.022)*	*(0.148)*	*(0.185)*	*(0.895)*
Consumer and asset prices						
Consumer prices, annual % change	-2.64 **	-2.05 **	0.70	-0.58	-3.33 **	-2.75 **
	(0.011)	*(0.025)*	*(0.113)*	*(0.530)*	*(0.006)*	*(0.002)*
Real short-term interest rate	1.12 **	1.07	2.91 **	0.05	-1.79	-1.84
	(0.007)	*(0.535)*	*(0.048)*	*(0.514)*	*(0.978)*	*(0.561)*
Real long-term interest rate	0.42	4.44 *	0.38	-4.02	0.04 *	4.05 *
	(0.140)	*(0.050)*	*(0.975)*	*(0.281)*	*(0.230)*	*(0.041)*
House prices, annual % change	-15.99 **	-8.42	-1.31	-7.57	-14.68	-7.11
	(0.008)	*(0.176)*	*(0.237)*	*(0.602)*	*(0.881)*	*(0.949)*
Share prices, annual % change	0.50	16.99	14.88	-16.49	-14.38	2.11
	(0.710)	*(0.133)*	*(0.134)*	*(0.156)*	*(0.101)*	*(0.793)*
Government balance						
Government balance in % of GDP	-0.73	-1.12	-2.00 **	0.40	1.27 **	0.87
	(0.755)	*(0.438)*	*(0.004)*	*(0.609)*	*(0.031)*	*(0.170)*
Cycl. adj. gov. bal. in % of GDP	-0.16	0.74	-0.94	-0.90	0.78	1.67
	(0.836)	*(0.889)*	*(0.208)*	*(0.854)*	*(0.391)*	*(0.401)*
External variables						
Global GDP growth	-0.45	0.90 **	-0.27	-1.35 **	-0.18	1.16 **
	(0.322)	*(0.007)*	*(0.446)*	*(0.010)*	*(0.971)*	*(0.012)*
Real US short-term interest rate	-0.45	-0.19	1.41	-0.25	-1.85	-1.60
	(0.900)	*(0.463)*	*(0.145)*	*(0.620)*	*(0.321)*	*(0.117)*
Oil price in US dollar	8.57 **	-2.76	5.20 **	11.33 **	3.37	-7.96 *
	(0.001)	*(0.758)*	*(0.031)*	*(0.033)*	*(0.883)*	*(0.089)*

*Notes: * and ** denote significance at the 10% and 5% level*

(a) Wilcoxon signed rank test on group median, H_0: group median = 0

(b) Wilcoxon-Mann-Whitney test on difference between group medians, H_0: median of group i = median of group j

- *External variables.* We find that internal and mixed adjustments are not linked in a significant way with the global economic cycle, but that external adjustments tend coincide with periods of an acceleration of global economic activity. The result is intuitive and suggest that, whereas internal and mixed adjustments are mainly internal phenomena, external adjustments based on higher export growth are facilitated by stronger global growth. We do not find any significant link between the

three types of adjustment and US monetary policy. Finally, for oil prices, the tests suggest that internal and mixed adjustment occurred during phases of increasing oil prices.

All in all, the results confirm that the group classification has a meaningful economic interpretation. Internal adjustment mainly takes place through a compression of domestic demand, triggering a slowdown in import growth. External adjustment mainly occurs through higher export growth, benefiting from exchange rate depreciation and higher global growth. Mixed adjustment combines elements of these two adjustment patterns, as it is driven by a slowing domestic demand in conjunction with a depreciating exchange rate.

VI – Economic developments prior to current account adjustment

The previous section has established that the three groups exhibit different economic and financial dynamics throughout the adjustment process. This section explores whether a similar result holds for pre-adjustment dynamics. Are the three types of adjustment preceded by different economic developments? To examine this, the discrete choice model that has been used in the current account reversal literature is extended to a multinomial setting.

1. Discrete choice models in the current account literature

A number of authors have estimated the likelihood of a current account adjustment using discrete choice models (Adalet and Eichengreen, 2006; Benhima and Havrylchyk, 2006; de Haan et al, 2006; Debelle and Galati, 2005; Edwards, 2005c; Freund, 2005; Milesi-Ferretti and Razin, 2000). In these models, the dependent variable takes two values, 1 during the first year of adjustment and 0 otherwise. The independent variables are macroeconomic and financial indicators, usually lagged by one or more periods. All authors find the current account itself to be statistically significant in signalling an adjustment, while the significance of other variables (e.g. real GDP growth, exchange rate, foreign exchange reserves, terms of trade, global growth) differs across papers.[16]

These results are insightful but have in our view a serious shortcoming as they do not differentiate across adjustment types. The models used in the literature rely on the assumption that a single equation can signal all current account adjustments. This assumption seems restrictive as one would expect the significance and possibly even the sign of some variables to differ between adjustment types. An internal adjustment, for instance, is more likely to be signalled by indicators of overheating, while an external adjustment is more likely to be signalled by an overvalued exchange rate.

2. Model specification

We apply the approach of the literature in a first specification, using a binomial logit with a dependent variable that takes value $S_1 = 0$ during tranquil times and $S_1 = 1$ before a current account adjustment. We then extend this discrete choice model to a multinomial setting so as to allow for differentiation between the three adjustment groups. The second specification uses a multinomial dependent variable with four states, $S_2 = 0$ during tranquil times, $S_2 = 1$ during a two year-period prior to an internal adjustment, $S_2 = 2$ prior to

16 See Appendix table A1 for a complete overview of the significant variables in each paper.

an external adjustment, and $S_2 = 3$ prior to a mixed adjustment. This second specification allows us to estimate the specific likelihood of each of type of adjustment.

The timing of the independent variable is important. In our specification, we assign a non-zero value to our independent variable not only in the exact quarter where the adjustment starts, but also in the eight quarters before.[17] The approach is appealing from a policy viewpoint, as it allows to signal adjustments not just in the current quarter but over a horizon of two years, and from an econometric viewpoint, as it allows to avoid the use of lagged independent variables (see Bussière and Fratzscher (2006) for an application of a similar technique in a context of early warning systems for currency crises). The observations immediately after the start of adjustment (2 years) are excluded from our estimations so as to avoid any potential bias that may arise when the model does not distinguish post-adjustment times from tranquil times.[18]

Differently from the current account reversal literature, which mostly relies on probit models, we use a logit model. This allows to capture potential non-linear effects that are commonly found to be important in early-warning contexts. As a robustness check, we also fit an ordered probit model, which yields very similar estimated coefficients and predicted probabilities (not reported).

The choice of explanatory variables is motivated by existing studies, as well as by the significance and goodness of fit of various specifications. A full set of estimation results based on specifications comparable to the literature, in particular Adalet and Eichengreen (2006), Debelle and Galati (2005), de Haan et al. (2006) and Freund (2005), is reported in Appendix G. In what follows, we present the results of one specification for which we find several significant coefficients and an appropriate goodness of fit. This specification includes six explanatory variables: (i) the current account balance in percent of GDP; (ii) an import expansion variable, measured as the difference between the current level of imports to GDP and its average over the past ten years; (iii) exchange rate overvaluation, measured as the difference between the current level of the real effective exchange rate and its average over the past ten years;[19] (iv) the output gap in percent of potential GDP; (v) a credit expansion variable, measured as the difference between the current level of the credit to GDP ratio and its average over the past ten years; and (vi) the oil price in real terms, for countries that are net oil importers (this variable is muted, taking value 0, for net oil exporters), so as to capture one of the potential exogenous shocks that may trigger a current account adjustment.[20]

3. Main results

The two specifications are fitted on observations between 1973 Q1 (the start of our sample) and 2003 Q4 (the latest point at which we identify the start of an adjustment, see section III). Estimation results are reported in table 5. The column "without adjustment types" reports the coefficients of the first

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17 Alternative horizons yield broadly similar estimated coefficients and estimated probabilities.

18 As an alternative, we also estimate specifications that assign a separate value for the dependent variable in the two years after adjustment, as in Bussière and Fratzscher (2006). The results (not reported here) are broadly similar.

19 We lag the measure of overvaluation by two years, to account for the fact that, on average, the exchange rate starts to correct already two years prior to the adjustment.

20 The real oil price is proxied by dividing the nominal oil price by the US consumer price index. This real oil price is then multiplied by a dummy with value 1 if the country is a net oil-importer. For net oil-exporters, the dummy takes value 0 and the variable hence does not enter the specification. The dummy is based on the sign of the oil trade balance of the IMF World Economic Outlook. The dummy is allowed to change over time (for instance, Canada changed from a net oil-importer to a net oil exporter in 1983).

specification, the traditional binomial model as adopted in the literature. This specification apparently delivers good results, as most variables are significant and enter the model with the expected signs. A larger current account deficit, an import expansion, overvaluation, a higher output gap, and an increase in oil prices for oil importers all increase the likelihood of adjustment.

Allowing for a distinction between the three adjustment types, however, most coefficients change size, significance, and sometimes even sign. The multinomial logit results are reported in the right-hand side of table 3. The statistical tests confirm that most coefficients are statistically significantly different. This result also holds for all coefficients jointly, as reported in the joint test for equality of coefficients in the last row.[21] All in all, these results clearly confirm that each type of adjustment is signalled by different economic developments. This provides a further validation of the classification and confirms that one single equation cannot predict different types of current account adjustment.

Table 5: Estimation results of the binomial and multinomial logit models
Estimated coefficients and estimated difference between coefficients, with significance tests

	(1) Binomial (without distinction by adjustment type): estimated coefficients [(a)]	(2) Multinomial (with distinction by adjustment type)					
		Estimated coefficients [(a)]			Difference between coefficients [(a,b)]		
		Internal	External	Mixed	Internal vs external	Internal vs mixed	External vs mixed
Current account	-0.242 **	-0.291 **	-0.191 **	-0.190 **	-0.100 **	-0.102 **	-0.002
	(0.019)	*(0.024)*	*(0.035)*	*(0.031)*	*(0.013)*	*(0.003)*	*(0.973)*
Import expansion	0.734 **	0.467 **	-1.502 **	2.269 **	1.969 **	-1.802 **	-3.771 **
	(0.168)	*(0.222)*	*(0.416)*	*(0.274)*	*(0.000)*	*(0.000)*	*(0.000)*
Overvaluation	0.019 **	-0.007	0.047 **	0.047 **	-0.054 **	-0.054 **	0.000
	(0.006)	*(0.007)*	*(0.011)*	*(0.010)*	*(0.000)*	*(0.000)*	*(0.993)*
Output gap	0.044 **	0.128 **	-0.259 **	0.160 **	0.387 **	-0.032	-0.419 **
	(0.218)	*(0.029)*	*(0.043)*	*(0.039)*	*(0.000)*	*(0.478)*	*(0.000)*
Credit expansion	0.411	-0.716 *	2.150 **	0.572	-2.865 **	-1.287 **	1.578 **
	(0.286)	*(0.388)*	*(0.499)*	*(0.494)*	*(0.000)*	*(0.025)*	*(0.017)*
Oil price (oil importers)	0.016 **	0.013 **	0.032 **	0.015 **	-0.019 **	-0.002	0.017 **
	(0.003)	*(0.004)*	*(0.007)*	*(0.006)*	*(0.010)*	*(0.781)*	*(0.038)*
Number of observations	2347			2347			
Pseudo R^2	0.16			0.19			
Joint test for equality of all coefficients [(c)]					127.61 **	62.63 **	133.12 **
					(0.000)	*(0.000)*	*(0.000)*

Notes: * denotes significance at 10% level, ** at 5% level. (a) Standard error in brackets. (b) p-value in brackets. (c) χ^2 statistic, p-value in brackets.

The results for the individual variables have a meaningful economic interpretation:

- the import expansion variable is significant and positive in the internal and mixed adjustment cases. This can be explained by the fact that current account deficits resulting from very rapid import growth require a correction on the import side through lower domestic demand growth, and hence involve some form of internal adjustment. By contrast, rapid import expansion makes an external

[21] We use a likelihood ratio test. It is also a test whether two or more states can be combined, known as test for combining dependent categories (Long and Freese, 2006). The fact that coefficients are significantly different suggests that the four states are significantly different.

adjustment less likely, suggesting that instead sluggish export performance is a leading indicator of external adjustment;

- overvaluation makes an external or mixed adjustment more likely, but has no significance as a leading indicator of internal adjustment. This is in line with the intuition that external and mixed adjustments tend to occur in countries with an overvalued exchange rate;
- a positive output gap is a relevant signal for internal or mixed adjustment, suggesting that these types of adjustment mainly occur at an advanced stage of the cycle. The output gap has the opposite sign in case of external adjustment, in line with the idea that external adjustment primarily occurs in countries with low economic growth, possibly due to competitiveness problems.
- credit expansion is significant and positive variable in the external adjustment case. Bearing in mind that this case involves significant currency depreciation, this result is consistent with the early warning literature on currency crises. Specifically, strong credit growth is typically found to be a leading indicator of currency crashes (see e.g. Bussière and Fratzscher, 2006).
- for net-oil importing countries, increasing oil prices are significant as a trigger for all three types of adjustment.

Alternative specifications reported yield similar results. Under four very different specifications reported in Appendix G – those of Adalet and Eichengreen (2006), Debelle and Galati (2005), de Haan et al. (2006) and Freund (2005)) – most coefficients display different signs and different significance levels across the three adjustment types. This corroborates the idea that each type of adjustment is preceded by a different set of leading indicators.

4. Specification tests

We apply a number of tests to assess the robustness and quality of our model.

Goodness of fit. We asses the two types of errors of the early-warning model, namely adjustments that are not signalled by the model (type 1-error) and signal of adjustment that turn out to be false (type 2-error). The model is said to produce a signal if the estimated probability of adjustment exceeds a user-defined threshold, which we set at 0.25 so as to broadly balance the two types of errors.[22] Such errors are not commonly reported in the current account adjustment literature, with the exception of Milesi-Ferretti and Razin (2000) and Benhima and Havrylchyk (2006). Yet, they are important to gauge the model's quality for policy purposes. In the second specification, we find a type 1-error of 40.6 percent and a type 2-error of 58.3 percent (table 6).

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22 The estimated probability of adjustment is given by the estimated probability of being in state $S_1 = 1$ for the first specification and by the estimated probability of being in either state $S_2 = 1$, $S_2 = 2$ or $S_2 = 3$ for the second specification.

The choice of the threshold implies a trade-off between the two types of errors. A lower threshold will increase the number of alarms, thereby reducing the number of type 1-errors, but will at the same time increase the number of type 2-errors. Using other thresholds changes the numerical but not the qualitative aspects of our results.

Table 6: Goodness of fit of the multinomial logit model

Number of adjustments *(1)*	466
of which : not preceded by alarm *(2)*	189
Type 1 error = *(2)/(1)*	40.6
Alarms *(3)*	665
of which : not followed by adjustment *(4)*	388
Type 2 error = *(4)/(4)*	58.3

Note: Goodness of fit computed for threshold $\bar{p} = 0.25$. See text for explanation of the concepts.

Prediction of adjustment type. Another important aspect is whether the model signals the correct type of adjustment. The model is said to predict an adjustment of a certain type if the estimated likelihood of that type is above the estimated likelihood of the two other adjustment types. The type 1-error is lowest, at 17 percent, for internal adjustments, and reaches 39 percent for mixed adjustments and 44 percent for external adjustments (table 7). This suggests a comparatively better performance of the model in signalling internal adjustment. For a review of the performance of the model for all countries in our sample, we refer to the charts in Appendix G, which plot the estimated probability of adjustment as well as the relative probabilities of the three types of adjustment.

Table 7: Performance of the multinomial model in predicting the type of adjustment

	By adjustment type		
	Internal	External	Mixed
Number of adjustments *(1)*	240	106	120
of which : predicted as another type*(2)*	41	42	53
Type 1 error = *(2)/(1)*	17.1	39.6	44.2
Number of predictions of this type *(3)*	305	85	76
of which : followed by another type *(4)*	106	21	32
Type 2 error = *(4)/(4)*	34.8	24.7	42.1

Independence of irrelevant alternatives (IIA). The multinomial model is valid only if the relative probabilities between two states are independent from all other states. We test this IIA assumption using the Hausman and McFadden (1984) test and Small and Hsiao's (1985) likelihood-ratio test.[23] Both tests confirm the IIA assumption for our specification (table 8).[24]

Table 8: Tests of the IIA assumption for the multinomial model

	Hausman test			Likelihood-ratio test		
	χ^2 value	p> χ^2	sign. [(a)]	χ^2 value	p> χ^2	sign. [(a)]
State S_2 = 1 (internal adjustment)	-9.9	1.000	**	11.5	0.649	**
State S_2 = 2 (external adjustment)	-11.3	1.000	**	17.4	0.234	**
State S_2 = 3 (mixed adjustment)	7.6	0.911	**	15.8	0.327	**

Notes: (a) sign. = significance level. * denotes significance at 10% level, ** at 5% level.

23 The tests are computed with stata modules produced by Long and Freese (2006), as available under http://www.indiana.edu/~jslsoc/.

24 The Hausman test produces some negative χ^2 values. Hausman and Fadden (1984) suggest that such a negative test statistic is evidence that the IIA assumption is not violated. Long and Freese (2006) find a negative value to be common for this statistic.

Outliers. We detect potential outliers by computing Cook's distance, which summarises the effect of removing individual observations from the sample (Long and Freese, 2006, p. 151). We detect considerable outliers in our original sample for several observations of Singapore and Venezuela. These two countries have therefore been excluded completely from the estimation results reported above.

5. Out of sample properties

Poor out-of-sample performance is a common weakness in early-warning systems. To review such performance, we estimate the multinomial model on post-2004 data. This is a genuine out of sample exercise as the selection of variables and estimation of coefficients is based on data until 2003 only. Table 9 lists the countries for which the predicted likelihood of adjustment exceeds the 0.25 threshold at some point since 2004. It also lists the relative probabilities of the three adjustment types.

Table 9: Out-of-sample predictions of the multinomial model
Countries with predicted probability of adjustment above 0.25 after 2004 Q1

			Relative probabilities of adjustment types [(b)]		
Country	Probability of adjustment (peak)	Time	Internal adjustment	External adjustment	Mixed adjustment
Industrial countries					
Australia	0.54	2006 Q2	0.29	**0.49**	0.22
Iceland	0.95	2005 Q4	0.29	0.26	**0.45**
New Zealand	0.73	2006 Q2	**0.57**	0.24	0.20
United States	0.51	2006 Q3	**0.65**	0.20	0.15
Emerging market economies					
Bulgaria	0.98	2006 Q3 [(a)]	0.11	0.03	**0.86**
Czech Republic	0.54	2004 Q3	**0.50**	0.10	0.40
Hungary	0.80	2005 Q1	0.21	0.08	**0.71**
Poland	0.41	2004 Q3	0.27	0.26	**0.47**
Romania	0.88	2006 Q2 [(a)]	0.17	0.11	**0.72**
Slovak Republic	0.90	2006 Q3	**0.32**	0.05	0.63
Thailand	0.38	2005 Q4	**0.87**	0.03	0.10
Turkey	0.72	2006 Q2 [(a)]	0.26	0.26	**0.49**

Notes: (a) Maximum reached in latest quarter with availalble data. (b) Maximum values in bold.

The model predicts a total of 12 current account adjustments after 2004. To assess whether these predictions are reasonable, we compare them with the IMF staff assessment in the World Economic Outlook of April 2007 (IMF, 2007):

- *Australia* and *New Zealand*. The model predicts an external adjustment in Australia and an internal one for New Zealand. This prediction seems to have limited plausibility as the two countries have for long been running current account deficits without correction. Nevertheless, the increasing probability of an internal adjustment in New Zealand does seem compatible with the existing concerns about economic overheating as of early-2007.
- *Iceland*. The model signals a very high likelihood of mixed adjustment, which has indeed materialised through a depreciating currency and a slowdown in late-2005 and 2006. The IMF expects an improvement in the current account deficit from 26 percent of GDP in 2006 to 12 percent in 2007.

- *United States*. The model points to an increasing likelihood of adjustment of the internal type. The expected slowdown of US real GDP growth in 2007 would be in line with this outcome, although it remains to be seen whether this slowdown will significantly change the future path of the US current account deficit.
- *Czech Republic* and *Poland*. The model signals a high likelihood of adjustment in these two countries as of 2004. This signal proved to be correct in as far as the current account deficit fell from 6 percent of GDP in 2004 to 2 percent in 2005 in the Czech Republic and from 4 percent to 1 percent in Poland over the same period.
- *Bulgaria*, *Hungary*, *Romania*, and *Turkey*. The model signals a high likelihood of adjustment in these countries, of either an internal or mixed nature. This seems in line with the IMF's policy assessment that large current account deficits are a key policy challenge for some of these countries.
- *Thailand*. The model started flagging an increased likelihood of internal adjustment in 2006, which turned out to be reasonably accurate as the country experienced considerable financial market turbulence around the end of that year.

Although good out-of-sample performance was not the primary objective of the multinomial model, we conclude that its performance is very reasonable. The model correctly detects those countries where a current account adjustment has recently taken place or started (Czech Republic, Iceland, Poland) or where an adjustment is widely expected over the next years (Hungary, United States). Having said that, as with any early-warning model, its results should be supplemented with careful analysis and cautious judgement to draw any policy implications.

VII – Conclusions

The paper has examined past experience with the adjustment of current account deficits. In line with the literature, we have found that adjusting economies experienced, on average, an economic slowdown and a real effective exchange rate depreciation. However, we have also highlighted that these average patterns mask a large degree of variation. Using a cluster analysis, past current account corrections can be classified in three groups. These three groups are corroborated through an event-study analysis and a statistical analysis of adjustment dynamics as well as through a multinomial model that predicts the likelihood of adjustment.

A first group, constituting the majority of episodes, experienced a growth slowdown but not much change in the real exchange rate (even on average a slight appreciation). This group is labelled "internal adjustment", given that the current account correction essentially comes through a slowdown in domestic demand growth, translating into reduced demand for foreign goods and therefore lower import growth. This type of adjustment seems to be typical when the deficit widening resulted from buoyant domestic demand growth. The multinomial logit model suggests that the likelihood of such an adjustment increases as economies reach an advanced stage of the business cycle, as indicated by a positive and widening output gap. On balance, this type of adjustment therefore appears to be of a largely cyclical nature. Asset price movements seem to play some role in this group, as the internal adjustment is on average accompanied by a statistically significant deceleration of asset price inflation (e.g. house prices) following a period of rapid increase.

A second group, constituting half of the remaining cases, is characterised by a depreciating real exchange rate without much movement in real GDP growth (even on average a slight increase in growth). It is

labelled "external adjustment", as a real exchange rate depreciation induces an improvement in the country's competitiveness, favouring an increase in net exports. The pick-up in net exports provides a positive impetus to economic growth and explains the absence of an economic slowdown in this group. According to the logit model, this adjustment pattern is more likely when the widening current account deficit reflects sluggish export growth performance and when the exchange rate is overvalued. Differently from internal adjustment, which is common among high-growth countries, external adjustment seems to be preceded by sluggish economic growth, possibly reflecting competitiveness problems of the economies concerned.

A third and final group is characterised by a combination of slower economic growth and a depreciating exchange rate. Accordingly, the group is labelled "mixed adjustment". Developments in this group are more pronounced than in the two other groups. The slowdown is, on average, deeper than in the internal adjustment cases and the depreciation is, on average, larger than in the external adjustment cases. This points to the crisis-like character of mixed adjustment episodes. The current account improvement reflects both a sharp contraction of domestic demand (hence less domestic demand for foreign goods) and a sharp improvement in the country's competitiveness (and hence increased foreign demand for domestic goods). In terms of leading indicators, the logit model suggests that mixed adjustments are typically signalled by a combination of an overvalued exchange rate – pointing to the need for correction on the external side – and indications of potential overheating – pointing to the need for correction on the internal side.

An important finding is also that the three adjustment types are rather evenly spread across all types of countries. Whether a current account deficit corrects through internal, external or mixed adjustment does not seem to be a function of the size of the country, its degree of openness, its degree of industrialisation, or its exchange rate regime choice. Instead, the logit results confirm that adjustment patterns are primarily explained by underlying economic problems in the deficit country.

By way of final conclusion, let us revert to one of the initial motivations of the paper, namely how a correction of today's current account deficit of the United States could materialise. In drawing lessons for the future, some important caveats apply. The empirical evidence presented in the paper is mainly backward-looking. Today's global imbalances are unique in terms of scale, geographical composition, and financial dimension. And finally, the analysis in this paper centres on the experience in deficit countries, which is only partly relevant for global imbalances as the underlying causes are partly rooted in the surplus economies.

At a general level, the paper allows to conclude, for the United States today, there is no single route of current account adjustment. While such a conclusion may seem self-evident, it still serves as a reminder that available studies focusing on average developments across adjustment episodes should be interpreted with caution. There is no clear one-to-one relation between current account adjustment, currency movements, and economic cycles. Various combinations of relative growth rotation and exchange rate adjustment appear possible in the context of current account adjustment.

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Appendix A: Summary of the literature on past current account adjustment

Table A: Key findings of the literature

Authors	Sample period [a]	Number of countries	Number of episodes	Macroeconomic developments during the adjustment	Significant leading indicators of adjustment [b]	Specific findings of the paper
Adalet and Eichengreen (2006)	1880-1998	56	223	n.a.	current account (-) gov. balance (-) per capita GDP (-)	reversal episodes are mainly concentrated in post-Bretton Woods era
Bagnai and Manzochi (1999a)	1965-1994	49	35	fiscal balance improves terms of trade improves economic growth slows	n.a.	"negative reversals", i.e. sudden deteriorations in current account, have different dynamics
Benhima and Havrylchyk (2006)	1975-2003	63	n.a.	n.a.	current account (-) per capita GDP (+) investment (-)	deviation of net foreign asset position from its equilibrium value helps predict reversals
Croke, Kamin and Leduc (2005)	1980- 1999	17	23	limited slowdown limited real depreciation	n.a.	no evidence of disorderly combinations of depreciation+ slowdown
Debelle and Galati (2005)	1974-2003	21	28	slowdown real depreciation	global growth (-) US interest rate (+)	no change in capital flows
de Haan et al. (2006)	1960-2004	29	41	recession and severe depreciation in half of the cases	current account (-) output gap (-) appreciation (-)	higher financial openness reduces likelihood of a reversal
Edwards (2005c)	1970-2001	~150	n.a.	large slowdown	current account (-) sudden stop (+)	open and large economies: larger slowdown
Edwards (2006b)	1970-2004	~150	n.a.	n.a.	n.a.	looks at sudden reduction of current account *surpluses*
Freund (2005)	1980-1997	25	25	slowdown real depreciation	current account (-) GDP growth (-) reserve growth (-)	average correction starts when deficit at 5% of GDP
Freund and Warnock (2006)	1980-2003	25	25	slowdown real depreciation	n.a.	more significant slowdown in case of large deficit
Guidotti et al. (2003)	1974-1999	~150	256	import collapse (mainly in Latin America) export increase (mainly in Asia)	n.a.	different export/import behaviour due to structural characteristics of economies
IMF (2007)	1960-2006	47 [c]	119	slowdown real depreciation	n.a.	the slowdown and depreciation partly offset each other
Komárek, Komárková , Melecký (2005)	1993-2000	23	31	negative but temporary effect of reversal on economic growth	n.a.	Central and Eastern Europe: reversals imply temporary halt in convergence process
Komárek and Melecký (2005)	1993-2001	59	76	GDP growth depressed by 1 p.p. in adjustment year in emerging economies	n.a.	current account reversals and currency crises have different effects (latter have no impact on growth)
Milesi-Ferretti and Razin (2000)	1970-1996	105	152	no systematic growth slowdowns	current account (-) terms of trade (+) global growth (-) reserves/imports (+) concessional debt (-) pegged exch. rate (-)	-

Notes: (a) For papers that do not specify the end of the sample, the table reports the last year in which a reversal took place. (b) Significant variables (5% level) and their sign in a probit model that estimates the likelihood of a current account adjustment. (c) Only deficit reversals; the authors also identify additional surplus reversals (i.e. sudden deterioration of the current account, starting from a surplus).

Appendix B: Country list and data

This Appendix briefly describes the database used in the analysis. Data are compiled for:

- *industrial countries:* all 12 euro area countries (until 1998) and the euro area as a whole (from 1999 onwards),[25] Australia, Canada, Denmark, Iceland, Japan, New Zealand, Norway, Sweden, Switzerland, United Kingdom, United States;
- *emerging market economies:* Argentina, Brazil, Bulgaria, Chile, China (mainland), China (Hong Kong), Czech Republic, Hungary, India, Indonesia, Israel, Mexico, Poland, Romania, Russia, Singapore, Slovak Republic, South Africa, South Korea, Thailand, Turkey, Venezuela.

The dataset includes the following data series:

- *current account*, *trade balance*, *exports* and *imports* in nominal US dollar terms, from the OECD Economic Outlook and the IMF International Financial Statistics;
- *nominal GDP* in national currency, from the OECD Economic Outlook and Main Economic Indicators and the IMF International Financial Statistics. To compute ratios to GDP (e.g. current account to GDP), the GDP data were converted to US dollars using the average bilateral exchange rate from the IMF International Financial Statistics;
- *reserves* in US dollar, taken from the IMF International Financial Statistics, line 1l.d ("total reserves minus gold);
- *real GDP*, *real private consumption*, *real government consumption* and *real private investment* in national currency, from the OECD Economic Outlook and Main Economic Indicators and from the Bank for International Settlements. For a few countries where only annual data are available, quarterly data are approximated by interpolation;
- *output gap* in percent of potential output, from the OECD Economic Outlook and the IMF World Economic Outlook;
- *consumer price index* from the IMF International Financial Statistics;
- *short- and long term interest rates* from the OECD Main Economic Indicators and the International Financial Statistics. As a rule, short-term rates refer to 3 months and long-term rates to 10 years. Real interest rates are approximated by subtracting the contemporaneous CPI inflation from the nominal rates;
- *house price index* from the ECB, the OECD Main Economic Indicators and the Bank for International Settlements. For some countries where only annual or half-yearly data are available, quarterly data are approximated by interpolation;
- *share price index* from the OECD Main Economic Indicators and the IMF International Financial Statistics;
- *money supply* in national currency from the ECB, the OECD Economic Outlook, and the IMF International Financial Statistics. The definition of money supply differs across countries and refers to either M2 and M3;

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25 Slovenia is not included as the dataset ends in 2006, i.e. before this country joined the euro area.

- *credit to the private sector* in national currency from the OECD Economic Outlook and the IMF International Financial Statistics;
- *general government balance* and *cyclically adjusted government balance* from the OECD Economic Outlook and IMF World Economic Outlook. As quarterly data are scarce and highly volatile, annual series are used and transformed to quarterly frequency through interpolation;
- *unemployment rate* from the IMF International Financial Statistics;
- *real GDP growth in the OECD* from the OECD Economic Outlook;
- *oil price* in US dollar (brent) from the OECD Economic Outlook;
- dummy variable that takes value 1 for *net oil-importers*, based on the sign of the country's oil trade balance as defined in the IMF World Economic Outlook;
- *exchange rate regime dummies*, in particular for pegs and for crawling pegs, based on Reinhart and Rogoff's (2004) classification.[26]

[26] Pegs correspond to groups 1-4 of Reinhart and Rogoff's (2004) fine grid, crawling pegs to groups 5-10.

Appendix C: Definition of adjustment episodes

Table C.1 presents the selection criteria used in the literature to define current account adjustment episodes. These criteria usually refer to the (i) initial balance, (ii) size of the improvement, (iii) time of the adjustment, and (iv) sustainability of the adjustment.

Table C.1: Selection criteria for current account adjustment episodes

Authors	1. Initial balance	2. Size of adjustment		3. Time of adjustment	4. Sustainability of adjustment
	(percent of GDP)	*(percent of GDP)*	*(share of initial def.)*	*(years)*	*(years)*
Adalet and Eichengreen (2006)	*no cond.*	2% or 3% [a]	1/3	3	3
Bagnai and Manzochi (1999a)	*statistical test for structural break in time series with unknown change point*				
Benhima and Havrylchyk (2006)	*no cond.*	3%	*no cond.*	3	3
Croke, Kamin and Leduc (2005)	-2%	2%	1/3	3	5
Debelle and Galati (2005)	-2%	2%	1/3	3	5
de Haan et al. (2006)	-2%	2%	1/3	3	5
Edwards (2005 b, 2005c)	no cond.	2% or 4% in 1 yr [a] and 5% in 3 ys	1/3	3	no cond.
Edwards (2006b)	+2% [e]	-2% in 1 yr [a] or -3% in 3 ys [e]	no cond.	1 or 3 [a]	no cond.
Freund (2005)	-2%	2%	1/3	3	5
Freund and Warnock (2006)	-2%	2%	1/3	3	5
IMF (2007) [f]	0%	2.5%	1/2	3	5
Komárek, Komárková , Melecký (2005)	no cond.	2.5%	no cond.	1	no cond.
Komárek and Melecký (2005)	no cond.	3% or 5%	no cond.	1	no cond.
Milesi-Ferretti and Razin (1997)	no cond.	3% or 5% [a,c]	no cond.	3	not specified [d]
Milesi-Ferretti and Razin (2000)	no cond.	3% or 5% [a]	1/3	3	not specified [d]
Sturzenegger et al. (2003)	no cond.	2% [b]	no cond.	2	no cond.

Notes: (a) The authors distinguish two types of reversals. (b) The authors also require, as an additional condition, that the country has experienced a sudden stop, measured as a 5% of GDP drop in net capital inflows during one year. (c) Additional condition that the current account deficit is below 10% of GDP after the adjustment. (d) Details not specified. (e) Definition of "surplus adjustments", i.e. deteriorations of current account starting from a surplus position. (f) The authors adopt a symmetric definition for surplus adjustments, i.e. sudden and persistent deterioration of the current account starting from a surplus position.

Table C.2 reviews how changes in these selection criteria may have an impact on the choice of episodes. Our baseline for the sensitivity analysis is based on the criteria of Freund (2005) and Croke, Kamin and Leduc (2005). In order to replicate the results of these authors, we apply their criteria only to industrial economies and only to post-1980 data. Under this baseline, marked in the shaded column in table C2, we identify 23 episodes, comparable to Freund's (2005) selection.

Columns to the left and right of the baseline show how variations in each criterion (in bold) change the number of selected episodes (in italics). In the experiment, we change each criterion individually, keeping all other criteria unchanged from the baseline. The selection of episodes turns out to be sensitive to all four criteria. The highest sensitivity is found for the initial balance criterion. If no condition were imposed, i.e. if all episodes of current account improvement were included, even starting from an already positive level, the number of episodes would increase to 42. If the initial balance were set at a deficit of 6 percent of GDP, a level comparable to that of the United States today, the number of episodes would shrink drastically to six (Australia 1990 Q1, Greece 1985 Q4, Ireland 1981 Q3, New Zealand 1975 Q3, Norway 1977 Q1, Portugal 1982 Q1). Also the sustainability criterion turns out to be a key determinant of the selection. Without any condition in terms of sustainability, the number of episodes would increase to 32. Under a very tight condition, e.g. requiring that the current account does not revert below its starting level over a period of 8 years, only 13 episodes would be selected.[27]

Table C.2: Number of episodes in function of the selection criteria [(a)]
Criteria in bold, number of episodes in italics

Criterion	Softening of the criteria ←			Baseline [(b)]	Tightening of the criteria →		
1. Initial balance (CA in % of GDP)	**no cond.** *42*	**0%** *29*	**-1%** *25*	**-2%** *23*	**-3%** *16*	**-4%** *11*	**-6%** *6*
2. Size of adjustment (CA in % of GDP)	**0.5%** *24*	**1%** *24*	**1.5%** *23*	**2%** *23*	**3%** *15*	**2%** *8*	**6%** *6*
3. Time of adjustment (years)	**6 yrs** *25*	**5 yrs** *25*	**4 yrs** *24*	**3 yrs** *23*	**2 yrs** *21*	**1½ yrs** *15*	**1 yr** *11*
4. Sustainability (years)	**no cond.** *32*	**3 yrs** *29*	**4 yrs** *24*	**5 yrs** *23*	**6 yrs** *20*	**8 yrs** *13*	**10 yrs** *11*

Note: (a) For subsample of industrial countries after 1980. (b) Criteria as in Freund (2000).

27 We have also experimented with alternative criteria that are not considered in the literature. These include the end-point of the current account after the adjustment and the rapidity of the improvement (requiring for instance that half of the adjustment takes place within the first year). Also these criteria have a considerable influence on the selection of episodes.

Appendix D: List of adjustment episodes and main characteristics

Table D: List of current account adjustment episodes and key characteristics

Country	Start of adjustment [a]			Current account [c] (percent of GDP)		Real GDP growth (annual perc. ch.)		Real eff. exch. rate (pc. ch.) [d]
	This paper	Freund (2005)	Edwards (2005b) [b]	Initial	Av. 2-3 yrs later	Av. 2-3 yr before	Av. 2-3 yrs later	
Industrialised countries								
Australia	1990 Q1	1989	-	-6.1	-3.7	4.1	0.8	6.2
Austria	1980 Q4	1980	-	-4.9	-0.6	2.6	1.6	-2.4
Belgium	1982 Q1	1981	-	-3.5	1.0	3.1	1.5	-18.3
Canada	1981 Q4	1981	-	-4.1	-0.3	3.1	3.4	6.1
	1993 Q4	1993	-	-3.9	-0.7	-0.7	2.6	-20.2
Denmark	1986 Q3	1986	-	-5.7	-2.2	3.7	-0.0	11.4
	1998 Q4	-	1997	-0.9	2.1	2.9	2.2	-2.2
euro area	2000 Q4	*n.a.*	*n.a.*	-1.5	0.4	2.8	0.8	-6.8
Finland	1976 Q4	-	1976	-3.6	0.8	2.6	4.1	1.6
	1992 Q1	1991	1993	-5.1	-0.7	1.9	1.7	-26.7
France	1983 Q1	1982	-	-2.5	-0.2	1.5	1.5	-9.7
	1991 Q1	-	-	-1.0	0.4	4.1	0.4	-0.3
Germany	1981 Q1	1982	-	-1.9	0.6	3.8	0.8	-10.7
Greece	1985 Q4	1985	1986	-7.8	-2.3	-0.1	0.6	-11.9
	1990 Q3	1990	-	-4.5	-1.4	2.6	0.9	9.6
Iceland	1982 Q4	-	-	-8.5	-4.0	5.0	3.2	-2.8
	1992 Q1	-	1993	-3.7	0.6	0.7	2.2	-8.3
Ireland	1982 Q1	1981	1982	-13.8	-5.6	3.1	2.3	7.3
	1991 Q2	-	-	-2.1	2.1	6.3	3.4	-1.8
Italy	1974 Q4	-	1975	-4.5	-0.6	4.5	4.1	-15.8
	1981 Q3	1981	-	-2.6	-0.7	5.0	1.9	8.7
	1992 Q4	1992	-	-2.4	1.5	1.9	2.3	-19.5
Japan	1974 Q4	-	-	-1.0	0.6	7.9	4.2	18.7
	1980 Q3	-	-	-1.5	0.7	5.2	2.4	-11.8
Netherlands	1980 Q2	-	-	-0.7	2.4	1.9	-0.7	-9.0
New Zealand	1975 Q3	-	1975	-12.8	-5.6	9.0	-2.5	-12.5
	1986 Q1	1984	1986	-8.6	-3.2	4.4	1.7	10.2
Norway	1977 Q3	-	1978	-14.5	-2.3	5.3	4.9	-5.4
	1988 Q2	1986	1989	-4.7	1.4	3.9	2.3	2.3
	1999 Q1	-	-	-0.7	13.7	5.1	2.5	-0.8
Portugal	1977 Q2	-	1977	-6.7	-1.2	-0.8	4.6	-15.0
	1982 Q1	1981	1982	-14.1	-5.3	4.8	-0.8	0.7
Spain	1976 Q4	-	1977	-4.0	0.2	3.5	0.9	6.6
	1983 Q2	1981	-	-2.6	1.2	0.6	2.4	-10.9
	1992 Q2	1991	-	-3.9	-1.3	3.9	1.6	-9.0
Sweden	1982 Q4	1982	-	-2.6	0.1	1.0	3.2	-13.2
	1992 Q4	1992	1994	-2.9	1.2	0.2	3.6	-16.0

continued on next page

Table D *(continued)* : List of current account adjustment episodes and key characteristics

Country	Start of adjustment [a]			Current account [c] *(percent of GDP)*		Real GDP growth *(annual perc. ch.)*		Real eff. exch. rate *(pc. ch.)* [d]
	This paper	Freund (2005)	Edwards (2005b) [b]	Initial	Av. 2-3 yrs later	Av. 2-3 yr before	Av. 2-3 yrs later	
Industrial countries *(continued)*								
Switzerland	1974 Q3	-	-	-0.1	5.0	3.4	-1.5	24.4
	1980 Q4	-	-	-0.5	3.4	1.5	-0.2	-3.7
United Kingdom	1974 Q4	-	-	-3.9	-0.9	5.0	2.3	-8.6
	1989 Q3	-	-	-5.5	-2.6	4.7	-0.6	6.5
United States	1987 Q2	-	-	-3.4	-2.1	5.0	3.5	-25.1
Emerging market economies								
Argentina	2000 Q4	*n.a.*	*n.a.*	-0.8	1.3	1.1	-2.1	-27.7
Brazil	2001 Q3	*n.a.*	*n.a.*	-5.0	0.1	1.7	2.7	-2.4
Chile	1998 Q3	*n.a.*	*n.a.*	-6.6	-1.0	7.9	3.7	-1.6
	2003 Q2	*n.a.*	*n.a.*	-1.8	1.3	3.2	6.1	-5.6
Czech Republic	1997 Q4	*n.a.*	*n.a.*	-6.4	-3.0	5.3	2.2	16.2
Hong Kong	1981 Q3	1980	*n.a.*	-8.0	-3.0	9.8	7.3	-21.1
	1997 Q3	-	*n.a.*	-7.4	3.4	4.1	4.0	10.0
Hungary	1995 Q1	*n.a.*	*n.a.*	-8.4	-3.9	-1.4	3.2	-4.0
India	1992 Q2	*n.a.*	*n.a.*	-2.0	-1.0	5.6	6.5	-24.4
	1999 Q1	*n.a.*	*n.a.*	-1.6	-0.7	6.6	5.1	-0.4
Indonesia	1996 Q4	*n.a.*	*n.a.*	-3.4	2.2	7.9	-5.2	-36.7
Israel	1983 Q2	1982	*n.a.*	-11.0	-1.8	3.5	3.6	5.8
	1996 Q3	-	*n.a.*	-5.7	-1.8	3.7	2.9	7.8
	2002 Q4	-	*n.a.*	-0.6	2.3	3.8	4.4	-18.0
Mexico	1982 Q1	*n.a.*	*n.a.*	-7.3	2.7	8.7	0.2	-28.0
	1994 Q4	*n.a.*	*n.a.*	-7.8	-0.8	2.9	4.5	-21.5
Romania	1999 Q1	*n.a.*	*n.a.*	-7.9	-4.5	-3.6	4.0	35.1
Russia	1998 Q2	*n.a.*	*n.a.*	-2.2	15.1	-4.2	6.8	-22.8
Singapore	1982 Q1	1980	*n.a.*	-11.2	-5.0	9.3	7.2	11.2
	1993 Q3	-	*n.a.*	-16.2 [c]	-1.7 [c]	6.8	8.6	9.5
Slovak Republic	2002 Q1	*n.a.*	*n.a.*	-8.2	-2.9	0.7	4.8	27.9
South Africa	1976 Q2	1980	*n.a.*	-6.7	-0.0	7.7	1.0	-18.2
	1982 Q4	-	*n.a.*	-5.5	-1.1	8.0	1.7	-4.6
South Korea	1980 Q4	1980	*n.a.*	-8.5	-4.0	8.8	9.2	8.2
	1997 Q1	-	*n.a.*	-4.8	7.0	8.7	2.5	-17.2
Thailand	1996 Q3	*n.a.*	*n.a.*	-9.0	6.8	9.6	-4.0	-11.9
Turkey	1994 Q1	*n.a.*	*n.a.*	-4.2	-0.7	3.6	7.1	-18.0
	2001 Q1	*n.a.*	*n.a.*	-4.4	-1.4	-0.1	7.3	2.9
Venezuela	1999 Q2	*n.a.*	*n.a.*	-1.3	5.7	4.0	1.1	61.6

Notes: (a) n.a. indicates that country is not in data sample (b) Additional episodes in Edwards that are not included in this table: Finland (1977, 1993), New Zealand (1976, 1988), Norway (1979, 1980), Portugal (1978, 1983, 1984, 1985 and 1986). (c) Trade balance for Singapore. (d) Change between average two-three years before adjustment to average two-three years after adjustment.

Appendix E: Robustness of the cluster analysis

The baseline cluster analysis is conducted on the basis of changes in two variables, real GDP growth and the real effective exchange rates, over a reference period of two-three years before to two-three years after the start of the adjustment. This Appendix explores how the classification changes if one allows for other variables or other reference periods. The table below presents the results for each episode. At the bottom of the table, there is an indication how many of the 71 episodes change groups for each of the alternative reference periods and variables.

When the reference period is changed, the following findings stand out:

- with a reference period closer to the adjustment (first and second year), 19 episodes would change classification. One example is the adjustment in the United States from 1987 Q2 onwards. It is part of group 3 in the baseline (mixed adjustment with both lower growth and an exchange rate depreciation), but changes to group 2 under the shorter horizon (only exchange rate depreciation). This suggests that this episode was mainly characterised by exchange rate depreciation if the reference period is narrowly centred on the time of adjustment, but was accompanied also by lower growth over a somewhat longer horizon.
- if the reference period is chosen further out (third and fourth year), 11 episodes would change classification.

The addition of variables to the cluster analysis yields the following results:

- adding exports (as a share of GDP) as a separate variable does not change the classification much, with only 13 episodes changing groups. A similar result holds when imports are added as a separate variable (not reported in the table due to space constraints). This suggests that consideration of export versus import behaviour would not fundamentally change the classification of episodes.
- adding real domestic demand growth would also not have a large impact on the classification, as 14 episodes would change groups. Similar results hold for the main components of domestic demand, notably private consumption and private investment (not reported in the table). The result is intuitive, as movements in real domestic demand are highly correlated with real GDP growth, which is already included as a variable in the baseline cluster.
- adding consumer price inflation would lead to a new classification for 13 episodes. This relatively low number suggests that inflation developments are relatively similar within each of the baseline groups.
- adding real long-term interest rates would have a significant impact on the classification, as 24 episodes would change groups (similar results hold for nominal and for short-term interest rates). This reflects considerable disparity in inflation developments within each baseline group.
- adding the government balance would also change the groups significantly, with 25 episodes changing classification.
- finally, consideration of global growth as an additional variable would lead to a new classification for 21 episodes.

Table E: Classification of episodes according to various cluster specifications

Classifications that differ from the baseline are marked in bold

Country	Time	Baseline [a]	Other reference periods		Additional variables					
			0-2 yrs	3-4 yrs	Exports % GDP	Dom. dem.[b]	CPI inflat.	R. int. rate[c]	Gov. balance	Global growth
Industrialised countries										
Australia	1990 Q1	1	1	1	1	1	1	**3**	1	1
Austria	1980 Q4	1	1	1	1	1	1	**3**	1	1
Belgium	1982 Q1	3	**2**	3	3	3	**2**	**2**	3	3
Canada	1981 Q4	1	1	1	1	1	1	1	1	**2**
	1993 Q4	2	2	2	2	2	2	2	2	2
Denmark	1986 Q3	1	1	1	1	1	1	**3**	**2**	1
	1998 Q4	1	1	1	1	1	1	**3**	**2**	**2**
euro area	2000 Q4	1	**2**	1	1	1	1	**3**	**3**	1
Finland	1976 Q4	1	1	1	**2**	1	1	**2**	1	**2**
	1992 Q1	3	**2**	3	3	3	**2**	**2**	3	3
France	1983 Q1	2	2	2	**1**	2	2	2	**1**	2
	1991 Q1	1	1	1	1	1	1	**3**	**3**	1
Germany	1981 Q1	3	**2**	3	**1**	**1**	**1**	3	3	**1**
Greece	1985 Q4	2	**3**	2	**1**	2	2	*n.a.*	**1**	2
	1990 Q3	1	1	1	1	1	1	*n.a.*	1	1
Iceland	1982 Q4	1	**2**	**2**	1	1	1	*n.a.*	1	**2**
	1992 Q1	2	**1**	2	2	2	2	*n.a.*	**1**	**1**
Ireland	1982 Q1	1	1	1	1	1	1	**3**	1	1
	1991 Q2	1	1	1	1	1	1	**3**	1	1
Italy	1974 Q4	3	3	**2**	**2**	**2**	**2**	**2**	3	**1**
	1981 Q3	1	1	1	1	1	1	1	1	1
	1992 Q4	2	2	2	2	2	2	2	2	2
Japan	1974 Q4	1	1	1	1	1	1	**3**	1	1
	1980 Q3	3	**2**	**1**	**1**	**1**	**1**	3	3	**1**
Netherlands	1980 Q2	3	3	**1**	3	**1**	**1**	3	3	**1**
New Zealand	1975 Q3	3	3	3	3	3	3	3	*n.a.*	3
	1986 Q1	1	1	1	1	1	1	**3**	*n.a.*	**2**
Norway	1977 Q3	1	1	1	1	1	1	**2**	1	**2**
	1988 Q2	1	1	1	1	1	1	**3**	**3**	1
	1999 Q1	1	1	1	1	1	1	**3**	**2**	1
Portugal	1977 Q2	2	2	2	2	2	2	2	*n.a.*	2
	1982 Q1	1	1	1	1	**3**	1	**3**	1	**2**
Spain	1976 Q4	1	1	1	1	1	1	**3**	1	**2**
	1983 Q2	2	2	2	2	2	2	2	**1**	2
	1992 Q2	3	**1**	**1**	**1**	**1**	**1**	**2**	3	**1**
Sweden	1982 Q4	2	2	2	2	2	2	2	**1**	2
	1992 Q4	2	2	2	2	2	2	2	**3**	2
Switzerland	1974 Q3	1	1	1	1	1	1	1	*n.a.*	1
	1980 Q4	1	**3**	1	1	1	1	**3**	*n.a.*	1

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Table E *(continued)* : Classification of episodes according to various cluster specifications
Classifications that differ from the baseline are marked in bold

Country	Time	Baseline [a]	Other reference periods		Additional variables					
			0-2 yrs	3-4 yrs	Exports % GDP	Dom. dem.[b]	CPI inflat.	R. int. rate[c]	Gov. balance	Global growth
Industrialised countries *(continued)*										
United Kingdom	1974 Q4	3	**1**	**1**	**1**	**1**	**1**	3	3	**1**
	1989 Q3	1	1	1	1	1	1	**3**	1	1
United States	1987 Q2	3	**2**	3	3	**2**	**2**	**2**	3	3
Emerging market economies										
Argentina	2000 Q4	3	3	3	3	3	3	*n.a.*	3	3
Brazil	2001 Q3	1	1	**2**	1	**2**	1	*n.a.*	**2**	1
Chile	1998 Q3	1	**3**	**3**	1	**3**	1	*n.a.*	**3**	1
	2003 Q2	2	2	2	2	2	2	*n.a.*	2	2
Czech Republic	1997 Q4	1	1	1	1	1	1	*n.a.*	**2**	1
Hong Kong	1981 Q3	3	3	3	3	*n.a.*	*n.a.*	*n.a.*	*n.a.*	3
	1997 Q3	1	1	1	1	1	1	*n.a.*	1	1
Hungary	1995 Q1	2	2	2	2	2	2	*n.a.*	2	2
India	1992 Q2	2	2	2	2	2	2	*n.a.*	2	2
	1999 Q1	1	1	1	1	1	1	*n.a.*	1	1
Indonesia	1996 Q4	3	3	3	3	*n.a.*	3	*n.a.*	3	3
Israel	1983 Q2	1	1	1	1	1	**3**	*n.a.*	**2**	**2**
	1996 Q3	1	1	1	1	1	**3**	*n.a.*	1	1
	2002 Q4	2	2	**1**	2	2	2	*n.a.*	**1**	2
Mexico	1982 Q1	3	3	3	3	3	3	*n.a.*	3	3
	1994 Q4	2	**3**	2	2	2	2	2	**3**	2
Romania	1999 Q1	1	1	1	**2**	**2**	1	*n.a.*	**2**	1
Russia	1998 Q2	2	2	2	2	2	2	*n.a.*	2	2
Singapore	1982 Q1	1	1	1	1	1	1	*n.a.*	**2**	**2**
	1993 Q3	1	1	1	**2**	1	1	*n.a.*	**2**	**2**
Slovak Republic	2002 Q1	1	1	1	1	**2**	1	*n.a.*	**2**	1
South Africa	1976 Q2	3	3	3	3	3	3	3	*n.a.*	3
	1982 Q4	3	**1**	3	**1**	3	3	3	3	3
South Korea	1980 Q4	1	**2**	1	1	1	1	*n.a.*	1	1
	1997 Q1	3	3	3	3	3	3	3	3	3
Thailand	1996 Q3	3	3	3	3	3	3	3	3	3
Turkey	1994 Q1	2	**3**	2	2	2	2	*n.a.*	**1**	2
	2001 Q1	2	2	2	2	2	2	*n.a.*	2	**1**
Venezuela	1999 Q2	1	1	1	1	1	1	*n.a.*	1	1
Number of episodes that change classification vis-à-vis the baseline										
All episodes			19	11	13	14	13	24	25	21

Notes: (a) The baseline cluster analysis uses changes in two variables (real GDP growth and real effective exchange rate) over a reference period of the second and third year post-adjustment compared to second and third year pre-adjustment. (b) Real domestic demand growth. (c) Long-term interest rate.

Appendix F: Event-study analysis by group

Chart F: Adjustment dynamics in the three groups

Median values from 16 quarters before to 16 quarters after the start of adjustment

Balance of payments and terms of trade

Trade balance
(percent of GDP)

Exports, value [(a)]
(percent of GDP)

Imports, value [(a)]
(percent of GDP)

Terms of trade [(b)]
(start of adjustment = 100)

Exports, volume [(a)]
(annual percent change)

Imports, volume [(a)]
(annual percent change)

Domestic demand and main components

Real domestic demand [(c)]
(annual percent change)

Real private consumption [(c)]
(annual percent change)

Real private investment [(c)]
(annual percent change)

Saving and investment

Investment rate
(investment as percent of GDP)

Saving rate
(saving as percent of GDP)

Internal adjustment — External adjustment — Mixed adjustment

continued on next page

Chart F *(continued)*: Adjustment dynamics in the three groups

Median values from 16 quarters before to 16 quarters after the start of adjustment

Government balance

General government balance
(percent of GDP)

Gen. govt balance, cyclically adjusted
(percent of GDP)

Prices

Consumer prices
(annual percent change)

Real short-term interest rates
(percent)

Real long-term interest rates [c]
(percent)

Share prices
(annual percent change)

House prices [c]
(annual percent change)

External variables

Global real GDP
(annual percent change)

Real short-term interest rate in US
(percent)

Oil price
(US dollar per barrel)

Internal adjustment — External adjustment
Mixed adjustment

Note: (a) Exports of goods and services. (b) Terms of trade are defined as export prices over import prices. (c) Only industrial countries

Appendix G: Further details of the logit estimation

This Appendix provides further detail on the estimation of the logit model. The tables below show estimation results for specifications that are identical or similar to those in the literature, in particular Adalet and Eichengreen (2005), Debelle and Galati (2005), de Haan et al. (2006) and Freund (2005).[28] For authors reporting more than one specification, we select the one with the highest pseudo-R^2 value.[29]

Table G1: Adalet and Eichengreen (2006) specification

Estimated probit coefficients and estimated difference between coefficients, with significance tests

	(1) Without adjustment types: estimated coefficients [(a)]	(2) With adjustment types					
		Estimated coefficients [(a)]			Difference between coefficients [(a,b)]		
		Internal	External	Mixed	Internal vs external	Internal vs mixed	External vs mixed
Current account [(d)]	-0.330 **	-0.339 **	-0.295 **	-0.307 **	-0.044	-0.032	0.012
	(0.019)	*(0.039)*	*(0.041)*	*(0.048)*	*(0.439)*	*(0.569)*	*(0.852)*
Government balance	-0.027 *	0.055 **	-0.168 **	0.016	0.224 **	0.039	-0.184 **
	(0.165)	*(0.019)*	*(0.489)*	*(0.025)*	*(0.000)*	*(0.167)*	*(0.000)*
US interest rates	0.144 **	0.199 **	0.005	0.190 **	0.195 **	0.009	-0.186 **
	(0.018)	*(0.023)*	*(0.032)*	*(0.029)*	*(0.000)*	*(0.785)*	*(0.000)*
US real GDP growth	-0.036	0.045	-0.153 **	-0.075	0.198 **	0.120 **	-0.078
	(0.028)	*(0.037)*	*(0.052)*	*(0.047)*	*(0.001)*	*(0.026)*	*(0.240)*
Peg	-0.192	-0.336	-0.914 **	0.530 **	0.577	-0.867 **	-1.444 **
	(0.166)	*(0.235)*	*(0.383)*	*(0.247)*	*(0.187)*	*(0.006)*	*(0.001)*
Openness	0.042 *	-0.028	0.106 **	0.056	-0.134 **	-0.084 *	0.050
	(0.022)	*(0.030)*	*(0.035)*	*(0.036)*	*(0.002)*	*(0.054)*	*(0.296)*
Number of observations	2422	2422					
Pseudo R^2	0.19	0.17					
Joint test for equality of all coefficients [(c)]					112.21 **	26.66 **	367.99 **
					(0.000)	*(0.000)*	*(0.000)*

Notes: * denotes significance at 10% level, ** at 5% level. (a) Standard error in brackets. (b) p-value in brackets. (c) χ^2 statistic, p-value in brackets. (d) Trade balance in Adalet and Eichengreen (2002). Variables included in Adalet and Eichengreen that are not included here: GDP per capita (not available in the dataset), gold standard, interwar and Bretton Woods dummies (not relevant for post-1973 sample).

[28] Small differences with the specifications in the literature arise from the fact that the dataset is different (e.g. quarterly instead of annual data) and that a few of the explanatory variables used in the literature are not available in our dataset, and hence omitted here.

[29] For Adalet and Eichengreen (2005), who have several specifications with the same pseudo-R^2 value, we select the first specification.

Table G2: Debelle and Galati (2005) specification

Estimated probit coefficients and estimated difference between coefficients, with significance tests

	(1) Without adjustment types: estimated coefficients [a]	(2) With adjustment types					
		Estimated coefficients [a]			Difference between coefficients [a,b]		
		Internal	External	Mixed	Internal vs external	Internal vs mixed	External vs mixed
Current account	-0.285 **	-0.334 **	-0.229 **	-0.269 **	-0.106 **	-0.066 **	0.040
	(0.018)	*(0.023)*	*(0.029)*	*(0.029)*	*(0.001)*	*(0.039)*	*(0.278)*
Real effective exchange rate	-0.012 **	-0.027 **	-0.005	0.001	-0.022 **	-0.029 **	-0.006
	(0.003)	*(0.004)*	*(0.005)*	*(0.004)*	*(0.000)*	*(0.000)*	*(0.272)*
Real GDP growth	-0.011	-0.021	-0.061 **	0.058 **	0.040	-0.079 **	-0.119
	(0.016)	*(0.021)*	*(0.024)*	*(0.026)*	*(0.148)*	*(0.009)*	*(0.319)*
US real interest rate	0.1599 **	0.226 **	0.0242	0.1726 **	0.202 **	0.053 *	-0.148 **
	(0.017)	*(0.022)*	*(0.029)*	*(0.026)*	*(0.000)*	*(0.074)*	*(0.000)*
OECD real GDP growth	-0.018	0.177 **	-0.224 **	-0.125 *	0.401 **	0.302 **	-0.099
	(0.040)	*(0.055)*	*(0.070)*	*(0.066)*	*(0.000)*	*(0.000)*	*(0.282)*
Pseudo R^2	0.19	0.12					
Joint test for equality of all coefficients [c]					72.41 **	53.43 **	37.06 **
					(0.000)	*(0.000)*	*(0.000)*

Notes: * denotes significance at 10% level, ** at 5% level. (a) Standard error in brackets. (b) p-value in brackets. (c) χ^2 statistic, p-value in brackets. Variables included in Debelle and Galati (2005) that is not included here: composition of financial flows.

Table G3: de Haan et al. (2006) specification

Estimated probit coefficients and estimated difference between coefficients, with significance tests

	(1) Without adjustment types: estimated coefficients [a]	(2) With adjustment types					
		Estimated coefficients [a]			Difference between coefficients [a,b]		
		Internal	External	Mixed	Internal vs external	Internal vs mixed	External vs mixed
Average current account [d]	-0.067 **	-0.104 **	-0.039	-0.025	-0.065	-0.079	-0.014
	(0.026)	*(0.034)*	*(0.060)*	*(0.046)*	*(0.332)*	*(0.148)*	*(0.847)*
Average output gap [d]	0.190 **	0.208 **	0.069	0.229 **	0.139	-0.020	-0.160 *
	(0.047)	*(0.062)*	*(0.103)*	*(0.081)*	*(0.235)*	*(0.836)*	*(0.215)*
Appreciation [e]	0.017	0.006	0.060	0.012	-0.054	-0.006	0.048
	(0.020)	*(0.027)*	*(0.041)*	*(0.034)*	*(0.258)*	*(0.892)*	*(0.356)*
Current account*peg [f]	-0.4062 **	-0.297 **	-0.4712 **	-0.5312 **	0.174	0.234 **	0.060
	(0.063)	*(0.077)*	*(0.110)*	*(0.088)*	*(0.133)*	*(0.015)*	*(0.618)*
Current account*crawl [g]	-0.215 **	-0.181 **	-0.368 **	-0.137 **	0.188 **	-0.044	-0.231 **
	(0.037)	*(0.045)*	*(0.073)*	*(0.065)*	*(0.019)*	*(0.556)*	*(0.014)*
Output gap*peg [f]	0.140 *	0.022	0.507 **	0.085	-0.485 **	-0.063	0.421 **
	(0.075)	*(0.099)*	*(0.140)*	*(0.116)*	*(0.002)*	*(0.649)*	*(0.012)*
Output gap*crawl [g]	-0.248 **	-0.277 **	-0.334 **	-0.0895	0.057	-0.187	-0.244 *
	(0.056)	*(0.074)*	*(0.115)*	*(0.096)*	*(0.667)*	*(0.103)*	*(0.095)*
Appreciation*peg [f]	-0.284 **	-0.279 **	-0.453 **	-0.218 *	0.174 *	-0.061	-0.235 **
	(0.065)	*(0.081)*	*(0.098)*	*(0.088)*	*(0.087)*	*(0.541)*	*(0.031)*
Appreciation*crawl [g]	0.0040	0.010	0.0401	-0.0599	-0.030	0.070	0.100
	(0.029)	*(0.038)*	*(0.054)*	*(0.051)*	*(0.629)*	*(0.248)*	*(0.163)*
Pseudo R^2	0.11	0.10					
Joint test for equality of all coefficients [c]					29.46 **	23.63 **	53.79 **
					(0.000)	*(0.005)*	*(0.000)*

Notes: * denotes significance at 10% level, ** at 5% level. (a) Standard error in brackets. (b) p-value in brackets. (c) χ^2 statistic, p-value in brackets. (d) Average over three year-period. (e) Change in the real effective exchange rate over a two year-period. (f) Peg is a dummy that takes value 1 for a peg, defined as categories 1-4 of Reinhart and Rogoff's (2004) fine classification. (g) Crawl is a dummy that takes value 1 for a crawling peg, defined as categories 5-10 of Reinhart and Rogoff's (2004) fine classification.

Table G4: Freund (2005) specification

Estimated probit coefficients and estimated difference between coefficients, with significance tests

	(1) Without adjustment types: estimated coefficients [a]	(2) With adjustment types					
		Estimated coefficients [a]			Difference between coefficients [a,b]		
		Internal	External	Mixed	Internal vs external	Internal vs mixed	External vs mixed
Current account	-0.280 **	-0.313 **	-0.228 **	-0.261 **	-0.085 *	-0.052	0.034
	(0.021)	*(0.029)*	*(0.038)*	*(0.036)*	*(0.053)*	*(0.229)*	*(0.496)*
Real GDP growth	-0.021	-0.014	-0.063 *	0.027	0.049	-0.042	-0.090 *
	(0.021)	*(0.030)*	*(0.034)*	*(0.037)*	*(0.260)*	*(0.348)*	*(0.059)*
Appreciation [d]	-0.004	0.052 **	-0.035 *	-0.073 **	0.087 **	0.125 **	0.038
	(0.011)	*(0.015)*	*(0.019)*	*(0.019)*	*(0.000)*	*(0.000)*	*(0.141)*
Appreciation, lagged [e]	0.0003	-0.030 **	-0.0022	0.0484 **	-0.028	-0.079 **	-0.051 **
	(0.011)	*(0.015)*	*(0.019)*	*(0.016)*	*(0.211)*	*(0.000)*	*(0.033)*
Reserve growth	-0.004 *	-0.007 *	-0.008 *	0.003	0.001	-0.010 **	-0.011 *
	(0.002)	*(0.004)*	*(0.005)*	*(0.004)*	*(0.882)*	*(0.036)*	*(0.051)*
Government balance	-0.046 **	0.007	-0.176 **	0.001	0.183 **	0.006	-0.177 **
	(0.016)	*(0.022)*	*(0.027)*	*(0.028)*	*(0.000)*	*(0.855)*	*(0.000)*
Real interest rates	-0.0005	-0.0014	0.0004	-0.0004	-0.002	-0.001	0.001
	(0.001)	*(0.002)*	*(0.001)*	*(0.001)*	*(0.299)*	*(0.626)*	*(0.619)*
Pseudo R^2	0.12	0.12					
Joint test for equality of all coefficients [c]					61.46 **	39.17 **	38.50 **
					(0.000)	*(0.000)*	*(0.000)*

Notes: * denotes significance at 10% level, ** at 5% level. (a) Standard error in brackets. (b) p-value in brackets. (c) χ^2 statistic, p-value in brackets. (d) Change in real effective exchange rate over one year. (e) Appreciation lagged by one year.

Chart G: Estimated probabilities from the multinomial logit (1975Q1 - 2006Q4)

Probability of adjustment	Relative probabilities of three types of adjustment

Industrial economies

Australia

Austria [(a)]

Belgium [(a)]

Canada

Denmark

euro area

Finland [(a)]

Out of sample
Probability of adjustment
Start of an adjustment episode
Cut-off value
Internal adjustment
Mixed adjustment
External adjustment

continued on next page

Chart G *(continued)* : Estimated probabilities from the multinomial logit (1975Q1 - 2006Q4)

Probability of adjustment	Relative probabilities of three types of adjustment

Industrial economies

France [a]

Germany [a]

Greece [a]

Iceland

Ireland [a]

Italy [a]

Japan

Out of sample
Probability of adjustment
Start of an adjustment episode
Cut-off value
Internal adjustment
Mixed adjustment
External adjustment

continued on next page

Chart G *(continued)* : Estimated probabilities from the multinomial logit (1975Q1 - 2006Q4)

Probability of adjustment	Relative probabilities of three types of adjustment

Industrial economies

Netherlands [a]

New Zealand

Norway

Portugal [a]

Spain [a]

Sweden

Switzerland

Out of sample | Start of an adjustment episode | Internal adjustment | External adjustment
Probability of adjustment | Cut-off value | Mixed adjustment

continued on next page

Chart G *(continued)* : Estimated probabilities from the multinomial logit (1975Q1 - 2006Q4)

Probability of adjustment	Relative probabilities of three types of adjustment

Industrial economies

United Kingdom

United States

Emerging market economies

Argentina

Brazil

China

China, Hong Kong

Chile

Out of sample
Probability of adjustment
Start of an adjustment episode
Cut-off value
Internal adjustment
Mixed adjustment
External adjustment

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Chart G *(continued)* : Estimated probabilities from the multinomial logit (1975Q1 - 2006Q4)

Probability of adjustment	Relative probabilities of three types of adjustment

Emerging market economies

Czech Republic

Hungary

India

Indonesia

Israel

Mexico

Poland

Out of sample
Probability of adjustment
Start of an adjustment episode
Cut-off value
Internal adjustment
Mixed adjustment
External adjustment

continued on next page

Chart G *(continued)* : Estimated probabilities from the multinomial logit (1975Q1 - 2006Q4)

Probability of adjustment	Relative probabilities of three types of adjustment

Emerging market economies

Romania

Russia

Slovak Republic

South Africa

South Korea

Thailand

Turkey

Out of sample
Probability of adjustment
Start of an adjustment episode
Cut-off value
Internal adjustment
Mixed adjustment
External adjustment

Notes: (a) For euro area countries, estimations until 1998 only.

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