BANK OF CANADA
BANQUE DU CANADA

Discussion Paper/Document d'analyse
2011-5

External Stability, Real Exchange Rate Adjustment and the Exchange Rate Regime in Emerging-Market Economies

by Olivier Gervais, Lawrence Schembri and Lena Suchanek

www.bank-banque-canada.ca

Bank of Canada Discussion Paper 2011-5

June 2011

External Stability, Real Exchange Rate Adjustment and the Exchange Rate Regime in Emerging-Market Economies

by

Olivier Gervais, Lawrence Schembri and Lena Suchanek

International Economic Analysis Department
Bank of Canada
Ottawa, Ontario, Canada K1A 0G9
Corresponding author: lsuchanek@bankofcanada.ca

ISSN 1914-0568

Acknowledgements

We would like to thank Jeannine Bailliu, Charles Engel, Wei Dong, Michael Francis, Sharon Kozicki, René Lalonde, Robert Lavigne, and participants at the 2009 Canadian Economics Association meetings, in seminars at the Kiel Institute for the World Economy, the Bank of England, the Bank of Canada and Carleton University for helpful comments, and Firas Abu-Sneneh and Amberly Jane Coates for excellent research assistance.

Abstract

In emerging-market economies, real exchange rate adjustment is critical for maintaining a sustainable current account position and thereby for helping to reduce macroeconomic and financial instability. The authors examine empirically two related hypotheses: (i) that real exchange rate flexibility and adjustment promotes external stability, and (ii) that a flexible nominal exchange rate facilitates real exchange rate adjustment. Based on an event-study analysis for a large set of emerging-market economies over the period 1975–2008, the authors find that real exchange rate adjustment has contributed significantly to reducing current account imbalances. The adjustment of current account deficits in countries with a fixed exchange rate regime does not typically occur through the classical adjustment mechanism, but as a consequence of exchange rate crises, where the nominal exchange rate collapses and there are substantial costs in terms of forgone output. Vector-error-correction results support the findings of the event study; namely, in the long run the real exchange rate movements facilitate current account adjustment.

JEL classification: F31, F32, F41
Bank classification: Exchange rate regimes; International topics; Development economics

Résumé

Dans les économies de marché émergentes, le taux de change réel doit pouvoir s'ajuster pour que le solde de la balance courante se maintienne à un niveau viable et pour aider à réduire l'instabilité macroéconomique et financière. Les auteurs examinent empiriquement deux hypothèses voisines : la première veut que la flexibilité et l'ajustement du taux de change réel favorisent la stabilité externe, et la seconde, qu'un taux de change nominal flexible facilite un tel ajustement. Sur la base d'une étude événementielle portant sur un vaste groupe d'économies émergentes et couvrant la période 1975-2008, les auteurs concluent que l'ajustement du taux de change réel a contribué de façon importante à atténuer les déséquilibres des balances courantes. Les déficits courants des pays dotés d'un régime de changes fixes ne se corrigent généralement pas par le jeu d'un ajustement classique, mais sous la pression d'une crise de change qui entraîne l'écroulement de ce régime et s'accompagne de pertes de production substantielles. Les résultats obtenus à partir d'un modèle vectoriel à correction d'erreurs corroborent les conclusions de l'étude événementielle, à savoir qu'à long terme, les mouvements du taux de change réel aident la balance courante à s'ajuster.

Classification JEL : F31, F32, F41
Classification de la Banque : Régimes de taux de change; Questions internationales; Économie du développement

1 Introduction

Unsustainably large global current account (CA) imbalances are widely seen as an important contributing factor to the recent global financial crisis and economic recession, and the lack of exchange rate adjustment to these imbalances is viewed as being partly responsible.[1] The concern about global imbalances helped instigate the reform of International Monetary Fund (IMF) surveillance activities that resulted in the 2007 Decision on Surveillance (IMF 2007).

In this Decision, the IMF made the maintenance of "external stability" the focus of its surveillance activities over members' exchange rate, fiscal, monetary and financial sector policies.[2] The IMF refers to "external stability" as a balance-of-payments position that does not, and is not likely to, give rise to disruptive exchange rate movements. The concept of external stability encompasses both the current and the capital account of the balance of payments, because CA imbalances may not cause disruptive exchange rate movements if they are complemented by sustainable capital inflows or outflows. In practice, however, the focus is primarily on CA imbalances and real exchange rate (RER) misalignment, because there is a well-documented theoretical relationship between them.

The purpose of this paper is to explore two related hypotheses:

(i) RER flexibility and adjustment promotes external stability (the main hypothesis), and

(ii) a flexible nominal exchange rate facilitates RER adjustment, because nominal wages and prices are sticky (corollary hypothesis).

Exploring these hypotheses is important, because they speak directly to exchange rate policy and the choice of exchange rate regimes. In particular, they address two key questions: first, does a relatively flexible RER enhance CA adjustment?[3] And second, if so, does a flexible exchange rate regime increase RER flexibility and thus promote smoother adjustment? Although the existing literature has tended to focus on the second hypothesis – the choice of nominal exchange rate regime – it is important to examine the first hypothesis: the critical role of the RER in the external adjustment process, especially for emerging-market economies (EMEs), since they are typically very open and dependent on trade.

[1] Obstfeld and Rogoff (2010) provide a recent survey of thought on the relationship between global imbalances and the financial crisis, arguing that they are related. García-Herrero and Koivu (2007) maintain that a more flexible nominal exchange rate would favour the adjustment of the trade balance.

[2] The fear of labelling member countries' exchange rates as "misaligned" in Article IV reports has hampered the effective implementation of the 2007 Surveillance Decision. Lavigne and Schembri (2009) argue that the focus of IMF surveillance over exchange rates should, instead, be on permitting timely and effective real exchange rate adjustment, to ensure that CA imbalances are restored to sustainable levels.

[3] We measure external imbalances by the CA/GDP ratio. The literature has proposed alternative measures, such as the level of external debt to GDP, foreign assets or reserves in terms of import months. Adjustment capacity has been measured by the change in imports following a shock (Iqbal and Erbaş 1997) and the first-order autocorrelation of the CA (Cheung and Lai 2007; Chinn and Wei 2008).

Theories of external adjustment in open economies (e.g., Obstfeld and Rogoff 1995) imply that adjustment to external imbalances can be most efficiently obtained via RER adjustment, rather than via income/output/expenditure adjustment. Relative price movements cause expenditure switching between domestic and foreign-produced goods, and can occur while the economy is operating at close to full employment.[4] In contrast, income and expenditure adjustment have proven to be much more costly in terms of forgone output and employment. In theory, market-driven RER adjustment will occur in response to a CA imbalance either via money-supply and price-level movements under a fixed exchange rate (i.e., the classical adjustment process) or via movements in a flexible exchange rate (i.e., the Meade-Friedman adjustment process). Friedman (1953) argues that a flexible exchange rate facilitates RER adjustment, because of the stickiness and slow adjustment of domestic wages and prices. Numerous examples exist of the high cost of the classical adjustment process: the United Kingdom's return to the gold standard in 1926, the West German boom of the 1960s, the Argentine experience with a currency board in the 1990s and the recent sovereign debt problems in Greece, Ireland and Portugal. Successful examples of the classical adjustment process are rare. Countries with a fixed nominal exchange rate and CA surpluses typically frustrate the RER adjustment process by sterilizing the impact on the domestic money supply. In countries with a CA deficit, RER adjustment under a fixed exchange rate often occurs as a consequence of an exchange rate crisis in which the nominal rate collapses and economic activity is severely disrupted.[5]

To examine the two hypotheses of interest, we adopt two complementary empirical methodologies. We first consider the role of RER movements during episodes of sizable CA adjustments using an event study for 22 EMEs from 1975–2008, following the methodology of Freund and Warnock (2005).[6] We also separately analyze CA surplus reversals, and examine the implications of splitting the sample into crisis versus non-crisis episodes, and into fixed versus floating exchange rate regimes. The question of exchange rate regimes has not been addressed in the event-study literature and this approach yields useful results.

Our empirical findings are consistent with the two hypotheses. First, we find that episodes of CA reversals from deficit to surplus have been associated with sizable RER depreciations. Moreover, the larger the CA reversal, the greater the depreciation. Second, there is a trade-off between the adjustment that comes via the RER and that through domestic income, demand and output. Put

[4] In the presence of local currency pricing (LCP), the pass-through of currency depreciation to the current account may be limited. For some countries, there is substantial evidence for LCP, at least in the short run, because most exchange rate movements are perceived as being temporary. In the long run, however, permanent exchange rate movements must affect the prices importers face, and they will either pass on the increased cost to consumers or purchase from an alternative domestic or foreign supplier to mitigate the impact of the exchange rate movement on their costs and prices.

[5] Countries have, on occasion, tried to reduce exchange rate overvaluation by compressing domestic demand and creating unemployed resources, but this is a very costly way to achieve real exchange rate adjustment.

[6] A change in the real exchange rate is likely to affect the trade balance through expenditure switching. In our study, we focus on the current account, since we are more interested in its evolution and adjustment. However, the two variables are closely linked and tend to move together. See Freund (2005) for more details.

differently, if the RER cannot adjust quickly (because of a fixed nominal exchange rate or slow adjustment of relative price levels), output/income have to take on a larger burden of the adjustment. Third, the adjustment is more painful in terms of output loss for countries that had a fixed exchange rate regime at the time of the reversal, and the RER eventually depreciates by more. Our results suggest that faster adjustment of external imbalances occurs either via the movement of a more flexible nominal ER, or, more dramatically, as a result of an exchange rate crisis. Given that a crisis is more costly in terms of lost output, because of financial disruption, this finding implies that a flexible ER allows a more rapid and more orderly adjustment of the CA, which is consistent with our second hypothesis.

We also examine the dynamic interaction of the CA, RER, and foreign and domestic income for the same sample of EMEs using a vector-error-correction model (VECM). To our knowledge, there have been no attempts in the literature to examine the long-run relationship between the CA and the RER for EMEs. We find that there exists a long-run cointegrating relationship between the CA and the RER, which is consistent with theory. The results, moreover, support our first hypothesis that, in the long run, the RER will adjust to reduce current account imbalances.

The paper proceeds as follows. Section 2 reviews the relevant theory and provides a brief literature review. Section 3 describes the event study and the VECM analysis and results, and section 4 provides some concluding remarks.

2 Theoretical Background and Related Empirical Results

The theory surrounding adjustment to CA imbalances began most notably with the price-specific-flow adjustment mechanism under the gold standard developed by David Hume in the 18th century. Since then there have been many developments, including the work of Viner (1937), Meade (1951), Friedman (1953), Mundell (1962), Dornbusch (1980) and Branson (1983), leading up to the Redux model of Obstfeld and Rogoff (1995). In all of these models, the RER moves to facilitate adjustment to a CA imbalance, regardless of whether the nominal exchange rate regime is fixed or flexible. For example, following a shock to external demand that creates a CA surplus, the RER will appreciate either through nominal exchange rate appreciation or through a rise in domestic inflation, thus reducing competitiveness and reducing exports, while favouring imports. Therefore, the main channel through which the RER helps bring about CA adjustment is through a relative price change that causes an "expenditure-switching" effect.[7] The expenditure-switching mechanism retains its validity in the Obstfeld and

[7] For some empirical evidence and evolution of the expenditure-switching effect, see Dong (2010).

Rogoff (1995) model provided that nominal prices are fixed in the producer country's currency and exchange rate pass-through is complete.[8]

Friedman (1953) argues that a flexible exchange rate would adjust in response to external real shocks and thus help insulate the domestic economy in the presence of sticky wages and prices. Friedman notes that the speed at which relative prices would adjust depends crucially on the exchange rate regime. Since then, a number of theories have confirmed Friedman's original intuition and it has become one of the strongest arguments in favour of flexible exchange rate regimes.[9]

In the Mundell-Fleming-Dornbusch model, floating exchange rates are superior to fixed exchange rates when real shocks are the dominant source of disturbance to the economy (Obstfeld and Rogoff 1996). With a shock to the demand or supply of domestic output, the prices of domestic goods and factors must adjust. Because these prices are sticky, especially downwards, the economy gradually, and often at great cost, adjusts to its new long-run equilibrium. The opposite is true for a floating exchange rate regime: following a real shock, the adjustment to a new equilibrium is immediate, reached by a movement of the exchange rate, which eliminates the need for a change in the price level. Note that if money or asset demand shocks were to dominate, then they would be fully and automatically eliminated by foreign exchange rate intervention under a fixed exchange rate regime, thus leaving the real economy unaffected. In practice, however, real shocks are more significant.

An empirical implication of these theories is that the adjustment of external imbalances across exchange rate regimes should differ. In particular, regimes that allow for faster movements in the RER should see a more rapid adjustment to external imbalances. Although theoretical models are based on RERs, there is limited evidence for our first hypothesis concerning the link between RER movements and the adjustment of real variables.[10] Arghyrou and Chortareas (2008) address the question of CA adjustment and the RER using a VECM. In particular, they focus on the diverging CAs of the individual euro area countries, the dynamics of CA adjustment and the role of the RER. They find that the RER has a substantial, but often non-linear, effect on CA adjustment.

[8] The J-curve implies that there might be an initial deterioration of the CA following a real depreciation, because the Marshall-Lerner condition may not hold in the short run. A real depreciation initially causes imports to be more expensive and exports less expensive, and, if volumes are predetermined, will reduce the CA. Eventually, the volume of exports will rise because of the lower relative price, causing the demand for exports to pick up and domestic consumers to switch their expenditure to domestic products and away from expensive imported goods and services.

[9] See Dornbusch (1980) for descendants of the Mundell–Fleming model. See Obstfeld and Rogoff (1996) and Corsetti and Pesenti (2001) for dynamic general-equilibrium models with nominal stickiness.

[10] One exception is Lee and Chinn (2002). They use structural VARs to analyze the behaviour of the RER, the CA and other variables following temporary and permanent shocks. They find that temporary shocks play a larger role in explaining variations in the CA, whereas permanent shocks are more important for explaining RER variation.

Freund and Warnock (2005) use an event-study approach to examine episodes of CA adjustment in advanced countries. They first determine episodes of CA deficit reversals using the criteria in Freund (2005), and then examine the behaviour of key variables during the reversal. They find that CA adjustment tends to be associated with slow income growth and a real depreciation.

With respect to the second hypothesis, the literature has considered the importance of exchange rate regimes for external adjustment and stability.[11] Chinn and Wei (2008) examine the importance of the nominal exchange rate regime for the adjustment process of the CA and find no robust relationship between the exchange rate regime and the rate of CA reversion.[12] In particular, they do not find a strong monotonic relationship between the flexibility of the exchange regime and the speed of convergence in RERs. However, these conclusions are somewhat misleading, because they assume that speedier adjustment is, in all cases, associated with less-costly adjustment. In practice, CA deficit adjustment under fixed exchange rate regimes does not occur via the classical adjustment process, but most often through exchange rate crises or forced devaluations, which are associated with large losses of employment and output. Moreover, their reduced-form regressions mask a large endogeneity problem and omit important control variables, including the degree of wage and price flexibility and the frequency and impact of exchange rate crises.

Broda (2004) assesses the Friedman hypothesis that a flexible exchange rate will help insulate domestic output to external real shocks. He finds that countries with more flexible regimes in the face of negative shocks tend to have smaller output movements and more immediate and larger real appreciations/depreciations. In contrast, countries with fixed regimes experience large and significant declines in output, and the RER depreciates slowly by means of a fall in prices.[13] Similarly, Hoffmann (2007) investigates responses of real GDP, the trade balance and the real exchange rate to world output and world real interest rate shocks. He also finds that external shocks are less contractionary under floating than under pegged exchange rates.

In their study of small open economies in interwar Europe, Choudhri and Kochin (1980) contend that there were three different currency regimes: the "gold countries" (i.e., the Netherlands, Belgium, Italy and Poland); Scandinavian countries that were initially on the gold standard but then allowed their currency to adjust during the Great Depression; and Spain, which followed a floating exchange rate. Spanish output and prices remained largely unaffected compared with countries following the gold standard during the Great Depression. Deflation was more significant in Scandinavian countries than in Spain (floating rates), but smaller than in countries

[11] A related literature has proposed methods for classifying exchange rate regimes. Levy-Yeyati and Sturzenegger (2005), for instance, construct a de facto classification based on exchange rates and international reserves. Similarly, Reinhart and Rogoff (2004) question the de jure IMF classification and develop a system of reclassifying historical exchange rate regimes, employing data on market-determined parallel exchange rates.

[12] The authors use the results of Reinhart and Rogoff (2004) to determine the importance of the exchange rate regime for the adjustment process of the CA.

[13] A few authors (for instance, Helpman 1981) argue that the exchange rate regime does not matter.

under the gold standard (fixed rates). With regards to output, negative output effects were more severe in gold standard countries than in Scandinavia.

3 Empirical Methodology

To study the relationship between the CA and the RER, we first follow Freund and Warnock (2005) and use an event study to assess the behaviour of the RER in episodes of CA reversions. We then use a VECM to examine the role of RER flexibility in CA adjustment.

3.1 Data and descriptive statistics

For the empirical analysis, we use quarterly data on the RER, CA and a number of control variables (Tables 1a–c). The real effective exchange rate (RER) is measured using a trade-weighted index of bilateral exchange rates, adjusted by relative consumer prices.[14] The RER is indexed to 100 in 2001Q4, and an increase in the RER corresponds to a real appreciation. The CA data have been seasonally adjusted and are expressed as a percentage of national GDP.[15] Data limitations restrict the sample to 22 EMEs over the period 1975 to 2008 (Tables 1a–c). For comparison purposes, we include G-7 countries, for which a larger data sample is available.

Consistent with our theoretical priors, CA reversals have generally been associated with large exchange rate movements. For instance, Argentina's CA reversal from a deficit of about 3 per cent in 2001Q1 to a surplus of 10 per cent by the end of 2002 was accompanied by a RER depreciation of 60 per cent. Likewise, the deterioration of Mexico's CA from a surplus of about 1.5 per cent in 1987 to a deficit of 6 per cent in 1993 was accompanied by a RER appreciation of 78 per cent.

Table 2 shows the correlations between the CA, RER, output and the government balance across the three samples: EMEs, G-7 countries and total. In all samples, the correlation of the RER with the CA is negative, implying that an appreciation is generally associated with a decrease in the CA. This result is consistent with findings in the CA crisis literature.[16] The correlation is more pronounced for EMEs. The low correlation in G-7 countries likely reflects the impact of other variables. To check the robustness of our results, we include some control variables in our analysis that have been used to explain CA movements.

Chart 1 plots the volatility of the CA versus the volatility of the RER. There seems to be a positive relationship between the flexibility of the RER and the variability of the CA, suggesting some evidence for our first hypothesis, that RER flexibility facilitates CA adjustment. To address the question of whether RER flexibility is associated with nominal exchange rate flexibility, we

[14] For simplicity, RER refers to both the real exchange rate and the real effective exchange rate.
[15] If only annual data are available for a certain time period, we linearly interpolate missing quarterly data for the RER and the CA.
[16] See Algieri and Bracke (2007) for empirical evidence using an event study.

plot the volatility of both the real and the nominal exchange rates in Chart 2. Nominal exchange rate flexibility is associated with RER flexibility. However, the correlation between the two variables ranges from -0.58 in Turkey to 0.99 in Malaysia. A negative correlation between the nominal exchange rate and RER movements implies that nominal exchange rate movements are not closely reflecting the differences in inflation rates, as the relative purchasing-power parity would suggest.

3.2 Event-study approach

To examine the validity of these hypotheses empirically, we first apply Freund and Warnock's (2005) event study to our broader set of EMEs. This kind of analysis is not new; for instance, Algieri and Bracke (2007) apply Freund and Warnock's methodology to a larger set of countries, including some EMEs. We extend this exercise to a larger set of emerging-market countries to yield new insights about the role of RER adjustment for CA adjustments for different groups of EMEs. An important contribution of our analysis is that we distinguish between crisis and non-crisis episodes, and between fixed and flexible exchange rate regimes at the time of the reversal. We also analyze CA surplus reversals. We then evaluate the behaviour of output growth and RER movements, the two main contributors to CA adjustment according to the existing literature. In a first step, we determine CA reversal episodes for our sample. Following Freund and Warnock (2005), the criteria for a CA reversal are:

(i) The CA deficit (surplus)-GDP ratio exceeds 2 per cent before the reversal.

(ii) The average deficit (surplus)-GDP ratio is reduced by at least two percentage points over three years (from the minimum to the centred 3-year average).

(iii) The CA deficit (surplus)-GDP ratio is reduced by at least one-third.

(iv) The maximum deficit (surplus)-GDP ratio in the five years after the reversal is not larger than the minimum in the three years before the reversal.

The first three criteria ensure that only large CA reversals are captured, whereas the fourth indicates that the reversal was sustained.

3.2.1 CA deficit reversals

Using these criteria on data for our set of EMEs from 1975–2008, we identify 55 episodes of CA deficit adjustment in 22 countries (Table 3).[17] Chart 3 documents the pattern of adjustment across the CA, the RER and GDP growth, with event time 0 corresponding to the year in which the CA balance is most negative.[18] On average, the CA deficit stood at -6.5 per cent of GDP at the time of reversal (at -3.9 per cent for G-7 countries, see Chart 4). In our sample, there is

[17] For comparison, episodes for G-7 countries are reported in Table 5.

[18] In theory, domestic demand should be used, instead of GDP, to explain import demand and the CA. Where available, we use domestic demand and find that the results are similar to those obtained using GDP (i.e., domestic demand increases during CA surplus reversals and decreases during CA deficit reversals). Thus, GDP is used to get a larger sample of countries.

considerable variation across episodes, ranging from relatively small deficits of 2 per cent in Argentina in 1980 to over 13 per cent in Ecuador in 1998. During these episodes, the CA improved by an average of 6 percentage points within the three years following the start of the reversal.

In the majority of cases, patterns of output growth and the RER movements are consistent with theory and other findings in the literature: in 70 per cent of the cases, the RER depreciated in the three years following the start of the CA deficit reversal. On average (for all identified episodes), the RER depreciated by about 9 per cent. However, in *all* 55 cases, countries experienced a total depreciation of, on average, 33 per cent.[19] These results provide ample proof that CA deficit reversals in EMEs have been accompanied by sizable real exchange rate depreciation. This result is consistent with findings in the literature, although the adjustment of the RER for EMEs seems to be more pronounced. Freund (2005), for instance, finds that, in industrialized countries, CA deficit reversals are accompanied by a real depreciation of about 10 to 20 per cent. Moreover, in our sample there seems to be a positive correlation between the size of the CA deficit reversal (within the first three years) and the size of the total depreciation over that period (Chart 5).

Further, in 70 per cent of episodes, CA deficit reversals have been accompanied by a decrease in real GDP growth, by an average of 1.6 percentage points.[20] This decrease seems to be in line with previous findings (Algieri and Bracke 2007), and is consistent with theoretical priors.

We examine whether there is evidence of a trade-off between adjustment through GDP contraction or through RER depreciation. Freund and Warnock (2005) argue that limited exchange rate adjustment leads to weaker output/income growth during CA deficit reversal. Indeed, we also find an inverse correlation between the extent of exchange rate adjustment and the slowdown in GDP growth (Chart 6). The evidence indicates a clear trade-off between CA adjustment that comes through either RER depreciation or weaker GDP growth. If exchange rate movements are limited, the CA position worsens further and the GDP reduction is more significant. Thus, RER flexibility is critical to low-cost (in terms of lost output) CA adjustment.

Significant current account deficit reversals are often the outcome of currency crises. Most of the countries in our sample have experienced currency crises. These crises may magnify the correlation between the CA and the RER.[21] We therefore split the sample into crisis (17) and non-crisis (24) episodes (Chart 7).[22] Not surprisingly, during crisis episodes, the CA reverts

[19] Total depreciation is defined as the percentage change between the maximum value of the RER in the three years leading up to the reversal minus the minimum value of the RER in the three years following the reversal.
[20] This is not the case for G-7 countries.
[21] The episodes determined in Tables 2 and 3 include crisis episodes as well as episodes of "normal" reversion of CA imbalances.
[22] We rely on several studies to determine crisis episodes for all countries in our sample: Frankel and Cavallo (2004); Kaminsky (2003); Calvo and Reinhart (2000); Calvo, Izquierdo and Mejía (2004). Crisis episodes determined in different papers for the same country overlap significantly.

faster and by more (7.9 percentage points within three years), and is accompanied by a much stronger currency depreciation (15 per cent in three years, and 34 per cent over the period as a whole). Also, GDP growth contracts substantially more during crisis episodes (2.54 percentage points).

To yield insight on our second hypothesis, we split the sample of CA deficit reversals into fixed and flexible exchange rate regimes at the time of the reversal. To identify regimes, we use the classification compiled by Levy-Yeyati and Sturzenegger (2005) for the specific countries at the time of the CA reversal. For robustness, we also use the Reinhart and Rogoff (2004) classification. Chart 8 shows the classification of countries used in this study from 1974–2000.[23] Some interesting results emerge (Chart 9): first, CA reversals occur earlier in countries with fixed ER regimes, at a CA-deficit-to-GDP ratio of 5.2 per cent compared with 6.5 per cent for floating ER regimes. Despite the deeper trough, the adjustment of the CA in floating ER regimes occurs sooner, suggesting that flexible ER regimes allow for faster resolution of external imbalances.[24] Second, on average, a significant RER depreciation precedes a CA deficit reversal in fixed exchange rate regimes, with sizable RER depreciations during the reversal. This observation suggests that, despite the fixed nominal rate, adjustment has to come through the RER – in most cases through a crisis and the collapse of the fixed ER regime. In this case, the adjustment through the RER is larger than for a flexible regime. And, most importantly, the cost in terms of GDP growth is significantly greater in countries with fixed exchange rate regimes: GDP growth drops from an average of 8.2 per cent two quarters before the reversal to -0.2 per cent a year after the reversal, compared with a drop from 5.8 per cent to 0.7 per cent in floating regimes. This finding implies that adjustment of external imbalances is more painful if there is limited nominal ER flexibility. The results support our second hypothesis that more flexible ER regimes facilitate the maintenance of external stability through a rapid and less costly adjustment of external imbalances. Moreover, countries with fixed exchange rate regimes typically experience CA deficit adjustment through large depreciation and substantial losses in GDP growth.

Using the Reinhart and Rogoff (2004) classification, the results differ somewhat, but the basic conclusions still hold. The CA takes much longer to revert in countries with fixed regimes, suggesting that flexible rates facilitate a more rapid adjustment. The RER depreciates more, by around 10 per cent within six quarters in flexible regimes, whereas the RER remains flat during the reversal for fixed regimes.

[23] These classifications are better able to capture *de facto* ER regimes compared with *de jure* regime classification such as in the IMF's official ER classification, published annually in its *Annual Report on Exchange Arrangements and Exchange Restrictions*. For a discussion of de facto and de jure exchange rate regime classification, see Bailliu, Lafrance and Perrault (2003).

[24] After three quarters, 2/3 of the deficit is resolved when the country is under a flexible exchange rate regime. On the other hand, only 1/3 of the deficit is reverted after three quarters when the country is under a fixed regime.

3.2.2 CA surplus reversals

Using the same criteria as described above, we identify 30 CA surplus reversal episodes (Table 4).[25] The results are broadly symmetric to the analysis of CA deficit reversals. On average, the surplus at the start of the reversal was 7.8 per cent of GDP (4.1 per cent in the G-7 countries, see Chart 4) and it fell by 8.9 percentage points within three years (Chart 3). Again, there is considerable variation across episodes, ranging from relatively small surpluses, of 2 per cent in Bolivia in 1990Q4, to 20 per cent in Russia in 2002Q2.

Within three years of the peak, the RER appreciated in 80 per cent of the cases. The average appreciation (including all episodes) was large (20 per cent, on average). Note that the appreciation is smaller for G-7 countries. Again, these results provide ample evidence for our first hypothesis (that CA adjustments are facilitated by RER movements), and evidence that RER movements can be large. Consistent with theory, GDP growth increased during 80 per cent of these episodes by an average of 1.7 percentage points.

We can again split our sample into countries that had a fixed or a flexible exchange rate regime at the time of the reversal (Chart 10).[26] On average, CA surpluses start to revert earlier in flexible regimes (at 7 per cent of GDP, compared with 9 per cent for fixed regimes). The major contributing factor to CA surplus reversion in fixed ER regime countries is rapid output growth, suggesting that nominal ER rigidity impedes adjustment through RER appreciation. As for countries with a flexible exchange rate regime, both RER appreciation and GDP growth contribute to the adjustment process. The results again provide evidence consistent with our second hypothesis: the RER does not adjust rapidly in fixed ER regimes; more of the adjustment comes through GDP growth.[27]

The event study has provided some insight into the characteristics of CA deficit and surplus reversals. Generally, CA adjustment is accompanied by significant RER movements and adjustment is less costly, in terms of lost output, under a flexible ER regime. However, a deficiency of the event-study approach is that it does not fully capture the empirical relationship between these variables over time, but only over discrete episodes. In the next section, we examine the time-series relationship between these variables to complement the event-study analysis.

[25] For comparison, episodes in G-7 countries are reported in Table 6.

[26] The sample size for this exercise is very small (4 fixed ER regimes and 10 floating ER regimes); the results should therefore be interpreted with caution.

[27] These main findings are robust to using the Reinhart and Rogoff (2004) ER regime classification (not shown). The CA reverts later and slower under a fixed ER regime. More of the adjustment occurs through RER appreciation under a floating ER regime.

3.3 VECM approach

To analyze the long-run relationship between the CA and the RER, we use a VECM approach. Since the data for these two series indicate that they are integrated of order one over the sample, the VECM allows the estimation of a cointegrating relationship without imposing a causal relationship between two endogenous variables. The main advantage of a VECM specification in the context of our research is that it allows us to empirically estimate the long-run relationship between the CA and the RER, as well as to determine the CA's reversion speed.[28] A second advantage of the VECM is that it allows feedback effects between the variables.[29]

3.3.1 Integration and cointegration

Unit root tests reject the hypothesis that the series are stationary, thereby implying that the variables are, in general, I(1).[30] The presence of unit roots in these two series leads us to test whether they are cointegrated. In 11 out of 22 cases we reject the null hypothesis of no cointegration at the 95 per cent confidence level, and 16 out of 22 at the 90 per cent confidence level (see Table 7). In this section, we focus on these 16 countries; in section 3.3.4 we test for cointegration in the remaining six countries by adding income differential variables to the cointegrating vector.

The finding that the CA and the RER are not cointegrated for a number of countries can be explained by several factors, beyond the fact that the test may have low statistical power on a relatively short sample. First, for some countries, this might be due to the omitted variable problem, which we address in section 3.3.4. Second, the CA and the RER might not adjust as expected in theory, because policies may impede the adjustment of either variable. For instance, in countries with fixed exchange regimes and sticky and/or regulated prices, the RER is likely to be inflexible, and therefore would adjust very slowly, if at all, to its long-run equilibrium value. Policy intervention is the likely explanation of the finding of no cointegration between China's CA and RER. Similarly, we find no strong evidence of cointegration for Malaysia, India and Thailand, countries that are known to intervene in their foreign exchange markets or use capital controls. Sterilization policies under a fixed exchange regime also hinder CA adjustment, since these policies do forestall adjustment of relative prices.[31]

---

[28] An alternative measure of the adjustment speed of the CA could be the size of the autoregressive coefficient (e.g., Chinn and Wei 2008). However, the autoregressive coefficient on the CA may be influenced by the number of different shocks that a country experiences, and therefore a test based on this coefficient fails to distinguish between alternative hypotheses. For example, an estimated low value of the autoregressive coefficient may indicate rapid adjustment due to flexible policies, or low CA persistence due to the absence of shocks.

[29] A reduced-form regression would estimate the effect of a depreciation of the exchange rate on the CA, given by the partial derivative. The VECM captures feedback effects, represented by the total derivative.

[30] CA is I(1) in 17 out of 22 cases (exceptions: Ecuador, India, Israel, South Korea and Poland). The RER is I(1) in 20 out of 22 cases (exceptions: Argentina and Israel). Panel unit root tests suggest that the CA is stationary, whereas there is some evidence for a unit root in the case of the RER.

[31] See Lavigne (2008) for more details on sterilization activities.

3.3.2 Specifying a VECM

We next specify a VECM between the CA and the RER that restricts the long-run behaviour of these two endogenous variables to converge to their cointegrating relationship while allowing for short-run adjustment dynamics. Given that the data are quarterly, the VECM is specified with lags of each variable as follows:[32]

$$\Delta CA_t = \alpha_{CA}\left(CA_{t-1} - \beta\ RER_{t-1}\right) + \sum_{i=1}^{s} \lambda_{1,i}\Delta CA_{t-i} + \sum_{i=1}^{r} \lambda_{2,i}\Delta RER_{t-i} + \varepsilon_{1,t}, \qquad (1)$$

$$\Delta RER_t = \alpha_{RER}\left(CA_{t-1} - \beta\ RER_{t-1}\right) + \sum_{i=1}^{r} \lambda_{3,i}\Delta RER_{t-i} + \sum_{i=1}^{s} \lambda_{4,i}\Delta CA_{t-i} + \varepsilon_{1,t}, \qquad (2)$$

where β represents the long-run equilibrium relationship between the CA and the RER, and α_{CA} and α_{RER} measure the speed of adjustment of the CA and the RER, respectively. In the long run, the CA should return to the level consistent with the level of the RER:

$$CA_t = \beta\ RER_t.$$

We estimate a two-equation VECM to allow for the joint endogeneity of the RER and the CA.[33] Theory predicts that β should be negative. Table 8 reports the estimated cointegrating vectors for the countries in the sample, normalized on CA_t. The persistence of the short-term variations in the CA depends on the value of α_{CA}; for instance, a value of α_{CA} near 0 will lead to very persistent adjustment dynamics.

3.3.3 Results

We first examine the long-run relationship between the CA and the RER. The estimated value of β has the expected negative sign for 14 out of 16 countries (Table 7). Thus, the result is consistent with the hypothesis of a negative long-term relation between the CA and the RER, and supports our hypothesis that RER movements are associated with CA adjustment. The result is also consistent with findings by Arghyrou and Chortareas (2008), although these authors consider only European countries. This finding holds despite our sample including episodes of crisis. Hence, the estimated negative coefficient captures the adjustment of a CA deficit via RER depreciation, regardless of whether it is as a result of a currency crisis or through smoother RER adjustment. There is, however, a wide dispersion in the size of the estimated β coefficient: it ranges from 0.06 for Brazil to 0.91 for Russia.

Turning next to the results for the short-run dynamics of our estimated equations (1) and (2), deviations from the cointegrating relationship can be corrected through the adjustment of the CA, or the adjustment of the RER. The speed of adjustment of the CA, α_{CA}, is negative and statistically significant for all countries, indicating that the CA responds significantly to past

[32] The estimated empirical model uses seasonally adjusted current account data. The estimation was also done using season dummies with raw current account data, and the results are not statistically different.

[33] Arghyrou and Chortareas (2008) use a similar VECM method to assess real exchange rate and CA dynamics.

deviations (Table 8).[34] The speed of adjustment in the RER equation, α_{RER}, is not statistically significant for most of the countries, meaning that there is little evidence for an adjustment of the RER toward its long-term equilibrium value.[35]

The adjustment speed α_{CA} also varies considerably across countries (Chart 11), ranging from 0.02 in Russia to 0.295 in South Korea. An α of 0.136 for Argentina, for instance, suggests that 13.6 per cent of the difference between the equilibrium and observed CA is eliminated within one quarter. This corresponds to a half life of the CA of 4.74 quarters, or one year and two months. The average adjustment speed of 0.134 is comparable to the results of Arghyrou and Chortareas (2008), who find an average CA adjustment speed of 0.18 for 11 European countries.

The interpretation of the size of α_{CA} is not straightforward. Ignoring crisis episodes, a higher adjustment speed would imply that a country adjusts rapidly to external imbalances. However, the adjustment of external imbalances can, in many cases, occur as a result of exchange rate crises. Therefore, the result that the CA adjusts rapidly might be driven by the fact that these countries experienced currency crises with rapid movements in the RER and the CA (such as in the case of South Korea). For other countries, the adjustment speed of the CA is quite low. This observation could have several possible explanations. First, some countries have limited nominal exchange rate flexibility, which will reduce real exchange rate adjustment and thus CA adjustment. For these countries, adjustment has to come through increased trade competitiveness by reducing relative unit labour costs and prices. If prices are sticky in the short run, convergence of the CA has to come through other variables than the RER, such as output/income levels. Consequently, countries with inflexible nominal exchange rates may face significant and persistent CA imbalances in the event of demand shocks. Second, we may attribute slow reversion of the CA to the fact that the CA likely adjusts through other variables that are not incorporated in our model.

3.3.4 Accounting for income growth differentials[36]

Theoretically, income growth differentials across countries should play an important role in the determination of the CA. Arghyrou and Chortareas (2008) estimate the cointegrating relationship between the CA, the RER and income growth differences. Here, we examine whether adding income differentials to the cointegrating vector can help explain the relationship between the CA and the RER for the six countries for which little evidence of a cointegrating relationship between the CA and the RER was found.

---

[34] The fact that the coefficient is statistically significant also implies that the RER Granger causes the CA in the long run, supporting our first hypothesis.

[35] The coefficient α_C has the expected sign and is significant for 5 out of 16 countries. This implies that, for most countries, it is the CA that adjusts to the long-run equilibrium, whereas the RER is the trend variable.

[36] The literature has suggested a list of variables that could be cointegrated with the RER. We test for the budget balance (Afonso and Rault 2008) and terms of trade, and account for episodes of crises using dummy variables. The test results are not reproduced, to save space, but are available from the authors.

Following Arghyrou and Chortareas (2008), we use G-7 national income as a proxy for foreign income. Although G-7 national income might be a better indicator of foreign demand for some countries than for others, we feel that it is a useful proxy because G-7 income represents about 52 per cent of world income. The cointegration test shows that we reject the null hypothesis of no cointegration between growth, GDP growth* (foreign demand; i.e., G-7 income), the CA and the RER in five out of the six countries (the exception being Turkey) (Table 9). This finding suggests that the level of income growth is an important determinant of CA reversion in these countries. Given our theoretical priors, we impose one cointegrating vector in the VECM.[37]

Table 10 reports the results for the estimated cointegrating vectors. The absolute values of the coefficients of GDP and GDP* are lower than those of the RER, with the exception of China, which is the opposite of that found by Arghyrou and Chortareas (2008). This finding suggests that, for the EMEs under consideration, RERs have been playing a more prominent role than relative incomes in long-run CA adjustment, whereas for European countries, relative incomes seem to have had a bigger impact on CA adjustment. This result is generally consistent with the findings in the event-study analysis: real exchange rates have to depreciate by more in EMEs than in industrialized countries in order to facilitate CA adjustment.

4 Conclusion

In this paper, we explore two related hypotheses: (i) that RER flexibility and adjustment is critical to maintaining external stability defined as a sustainable current account position (main hypothesis), and (ii) that a flexible nominal exchange rate facilitates RER adjustment and the maintenance of external stability (corollary hypothesis).

We adopt two complementary empirical methodologies. Using an event-study analysis for a large set of EMEs over the 1975–2008 period, we find evidence in favour of our first hypothesis: RER adjustment helps reduce CA imbalances and maintain external stability. CA reversions are typically accompanied by large RER movements, regardless of the exchange rate regime. However, the crucial distinction becomes how countries adjust to large CA deficits: the adjustment may come through an "orderly process" of gradual RER depreciation, or through a currency crisis and exchange rate collapse. Second, we find some evidence consistent with our second hypothesis that a flexible nominal ER facilitates RER adjustment and the maintenance of external stability. We find that (i) the adjustment is more painful in terms of output loss for countries that had a fixed exchange rate regime at the time of the reversal, especially if a currency crisis also occurs, (ii) the RER depreciates and output falls by more in crisis episodes

[37] The log of GDP is stationary. However, Hansen and Juselius (1995) have noted that not all individual variables included in the CI regression need be I(1). To find cointegration between non-stationary variables, only two of the variables have to be I(1). The variables should be chosen for their economic relevance, and not merely for their time-series properties.

(with fixed or intermediate ER regimes), and (iii) the CA reverts faster in countries with a flexible exchange rate regime and in countries that adjust through a currency crisis.

Our vector-error-correction modelling confirms that the negative relationship between the RER and the CA holds in the long run. The result is consistent with our first hypothesis, that CA adjustment is correlated with RER movements, regardless of the ER regime. Moreover, deviations from the long-run relationships are important determinants of CA reversion.

In sum, our findings support recent arguments that EMEs should permit their RERs to adjust to external imbalances by eschewing efforts to sterilize the impact of these imbalances on the domestic money supply and on domestic prices and wages. EMEs should also allow more nominal exchange rate flexibility in order to promote adjustment to external imbalances, thus avoiding crises and large costs in terms of lost output.

Going forward, it would be interesting to separately identify the contribution of nominal exchange rate and price adjustment to RER flexibility, and thus CA reversion. Further research could test for structural breaks in the estimated cointegration relationships to account for the fact that estimated coefficients change pre- and post-crisis, or before and after a country changes its nominal exchange rate regime.[38]

[38] Fujii (2002) studies a related question on purchasing-power parity and argues that long-run parameters in the cointegration relation do not change, but that the adjustment speed of some Asian countries changed after the Asian crisis.

References

Afonso, A. and C. Rault. 2008. "Budgetary and External Imbalances Relationship – A Panel Data Diagnostic." European Central Bank Working Paper No. 961.

Algieri, B. and T. Bracke. 2007. "Patterns of Current Account Adjustment – Insights from Past Experience." European Central Bank Working Paper No. 762.

Arghyrou, M. and G. Chortareas. 2008. "Current Account Imbalances and Real Exchange Rates in the Euro Area." *Review of International Economics* 16 (4): 747–64.

Bailliu, J., R. Lafrance and J-F. Perrault. 2003. "Does Exchange Rate Policy Matter for Growth?" *International Finance* 6 (3): 381–414.

Broda, C. 2004. "Terms of Trade and Exchange Rate Regimes in Developing Countries." *Journal of International Economics* 63 (1): 31–58.

Calvo, G., A. Izquierdo and L-F. Mejía. 2004. "On the Empirics of Sudden Stops: The Relevance of Balance-Sheet Effects." NBER Working Paper No. 10520.

Calvo, G. and C. Reinhart. 2000. "Fixing for Your Life." NBER Working Paper No. 8006.

Cheung, Y. and K. Lai. 2007. "Nominal Exchange Rate Flexibility and Real Exchange Rate Adjustment: New Evidence from Dual Exchange Rates in Developing Countries." Hong Kong Institute for Monetary Research Working Paper No. 9/2007.

Chinn, M. and S-J. Wei. 2008. "A Faith-Based Initiative: Does a Flexible Exchange Rate Regime Really Facilitate Current Account Adjustment?" NBER Working Paper No. 14420.

Choudhri, E. and L. Kochin. 1980. "The Exchange Rate and the International Transmission of Business Cycle Disturbances: Some Evidence from the Great Depression." *Journal of Money, Credit and Banking*, 12 (4): 565–74.

Corsetti, G. and P. Pesenti. 2001. "Welfare and Macroeconomic Interdependence." *The Quarterly Journal of Economics* 116 (2): 421–45.

Dong, W. 2010. "The Role of Expenditure Switching in the Global Imbalance Adjustment." Bank of Canada Working Paper No. 2010-16.

Dornbusch, R. 1980. *Open Economy Macroeconomics.* New York, NY: Basic Books.

Frankel, J. and E. Cavallo. 2004. "Does Openness to Trade Make Countries More Vulnerable to Sudden Stops, or Less? Using Gravity to Establish Causality." NBER Working Paper No. 10957.

Freund, C. 2005. "Current Account Adjustment in Industrial Countries." *Journal of International Money and Finance* 24 (8): 1278–98.

Freund, C. and F. Warnock. 2005. "Current Account Deficits in Industrial Countries: The Bigger They Are, the Harder They Fall?" NBER Working Paper No. 11823.

Friedman, M. 1953. "The Case for Flexible Exchange Rates." In *Essays in Positive Economics*, 157–203. Chicago, IL: University of Chicago Press.

Fujii, E. 2002. “Exchange Rate and Price Adjustments in the Aftermath of the Asian Crisis.” *International Journal of Finance and Economics* 7 (1): 1–14.

García-Herrero, A. and T. Koivu. 2007. “Can the Chinese Trade Surplus be Reduced Through Exchange Rate Policy?” Bank of Finland Institute for Economies in Transition Discussion Paper No. 6/2007.

Hansen, H. and K. Juselius. 1995. *CATS in RATS: Cointegration Analysis of Time Series.* Evanston, IL: Estima.

Helpman, E. 1981. “An Exploration in the Theory of Exchange-Rate Regimes.” *Journal of Political Economy* 89 (5): 865–90.

Hoffmann, M. 2007. “Fixed versus Flexible Exchange Rates: Evidence from Developing Countries.” *Economica* 74 (295): 425–49.

International Monetary Fund (IMF). 2007. “Bilateral Surveillance over Members’ Policies.” Executive Board Decision. Public Information Notice No. 07/69.

Iqbal, Z. and S. N. Erbaş. 1997. “External Stability Under Alternative Nominal Exchange Rate Anchors: An Application to the GCC Countries.” IMF Working Paper No. 97/8.

Kaminsky, G. 2003. “Varieties of Currency Crises.” NBER Working Paper No. 10193.

Lavigne, R. 2008. “Sterilized Intervention in Emerging-Market Economies: Trends, Costs, and Risks.” Bank of Canada Discussion Paper No. 2008-04.

Lavigne, R. and L. Schembri. 2009. “Strengthening IMF Surveillance: An Assessment of Recent Reforms.” Bank of Canada Discussion Paper No. 2009-10.

Lee, J. and M. Chinn. 2002. “Current Account and Real Exchange Rate Dynamics in the G-7 Countries.” International Monetary Fund Working Paper No. 02/130.

Levy-Yeyati, E. and F. Sturzenegger. 2005. “Classifying Exchange Rate Regimes: Deeds vs. Words.” *European Economic Review* 49 (6): 1603–35.

Obstfeld, M. and K. Rogoff. 1995. “Exchange Rate Dynamics Redux.” *Journal of Political Economy* 103 (3): 624–60.

--------. 1996. *Foundations of International Macroeconomics.* Cambridge, MA: MIT Press.

--------. 2010. “Global Imbalances and the Financial Crisis: Products of Common Causes.” Paper prepared for the Asia Economic Policy Conference, *Asia and the Global Financial Crisis*, 131–72. August. Available at <http://elsa.berkeley.edu/~obstfeld/globalimbalances2010.pdf>.

Reinhart, C. and K. Rogoff. 2004. “The Modern History of Exchange Rate Arrangements: A Reinterpretation.” *Quarterly Journal of Economics* 119 (1): 1–48.

Table 1a: Data Sources and Frequency for CA-to-GDP Ratio

Country	Time frame	Notes
Argentina	1976-2008	Annual from 1976-1991, World Bank
Bolivia	1977-2008	Annual from 1977-1994, World Bank
Brazil	1975-2008	Annual from 1975-1990, World Bank
Chile	1975-2008	Annual from 1975-1995, World Bank
China	1980-2008	Annual from 1980-2005, IIF
Colombia	1970-2008	Annual from 1970-1995, World Bank
Czech Republic	1990-2008	Annual from 1990-1992, IIF
Ecuador	1980-2008	Annual from 1980-1992 and 2003-2008, IIF
Hungary	1980-2008	Annual from 1980-1994, IIF
Indonesia	1980-2008	Annual from 1980-1989, IIF
India	1975-2008	Annual from 1975-1995, World Bank
Israel	1970-2008	Annual from 1970-1971, World Bank
South Korea	1976-2008	
Malaysia	1975-2008	Annual from 1975-1998, World Bank
Mexico	1981-2008	
Peru	1977-2008	Annual in 1977, World Bank
Philippines	1977-2008	
Poland	1980-2008	Annual from 1980-1999, IIF
Russia	1992-2008	Annual from 1992-1996, IIF
Thailand	1975-2008	Annual from 1975-1992, World Bank
Turkey	1974-2008	Annual from 1974-1986, World Bank
South Africa	1970-2008	

Note: All data are quarterly and from the IMF IFS, except where specified.

Table 1b: Data Sources and Frequency for REER

Country	Time frame	Notes
Argentina	1980-2008	Annual from 1980-1993, from IIF
Bolivia	1980-2008	
Brazil	1980-2009	Annual from 1980-1993, from IIF
Chile	1980-2008	
China	1980-2008	
Colombia	1980-2008	
Czech Republic	1980-2008	Annual from 1980-1989, from IIF
Ecuador	1980-2008	
Hungary	1980-2008	
Indonesia	1980-2008	Annual from 1980-1993, from IIF
India	1980-2008	Annual from 1980-1993, from IIF
Israel	1975-2008	
South Korea	1980-2008	Annual from 1980-1993, from IIF
Malaysia	1975-2008	
Mexico	1980-2008	Annual from 1980-1993, from IIF
Peru	1970-2008	
Philippines	1975-2008	
Poland	1980-2008	
Russia	1981-2008	Annual from 1981-1993, from IIF
Thailand	1994-2008	
Turkey	1994-2008	
South Africa	1975-2008	

Note: All data are quarterly and from the IMF IFS, except where specified. Quarterly data for Argentina and Brazil are from the BIS.

Table 1c: Data Sources and Frequency for GDP

Country	Time frame	Frequency	Notes
Argentina	1970-2008	Quarterly	Annual from 1981-1990
Bolivia	1970-2008	Annual	
Brazil	1970-2008	Quarterly	Annual from 1970-1990
Chile	1970-2008	Quarterly	Annual from 1970-1979
China	1970-2008	Annual	
Colombia	1970-2008	Annual	
Czech Republic	1995-2008	Quarterly	
Ecuador	1970-2008	Annual	
Hungary	1970-2008	Quarterly	Annual from 1970-1995
Indonesia	1970-2008	Quarterly	Annual from 1970-1993
India	1970-2008	Quarterly	Annual from 1970-2000, data from IIF
Israel	1970-2008	Quarterly	
South Korea	1970-2008	Quarterly	
Malaysia	1970-2008	Quarterly	Annual from 1970-1988
Mexico	1970-2008	Quarterly	Annual from 1970-1980
Peru	1970-2008	Annual	
Philippines	1982-2008	Annual	
Poland	1981-2008	Quarterly	Annual from 1981-1995
Russia	1996-2008	Quarterly	
Thailand	1970-2008	Quarterly	Annual from 1970-1983
Turkey	1970-2008	Quarterly	Annual from 1970-1987
South Africa	1970-2008	Quarterly	

Note: All data are from the IMF IFS, except where specified.

Table 2: Correlations between Main Variables (1970–2008)

Correlations in levels		
CA	**RER**	**GDP growth**
All countries	-0.103	0.022
G-7	-0.019	-0.018
EMEs	-0.097	0.052

Correlations in first differences		
CA	**RER**	**GDP growth**
All countries	-0.014	0.051
G-7	0.054	-0.033
EMEs	-0.019	0.115

Note: CA stands for the current account and RER for the real effective exchange rate.

Table 3: List of CA Deficit Adjustment Episodes in EMEs and Main Characteristics

Country	Date started	CA deficit at beginning	Change in CA (3 Years)	Change in RER from *t*0 to *t*3	Change in ER (max to min)	Change in average GDP growth
Argentina	1980Q4	-2.05	2.51	-66.34	-66.34	-3.79
	1998Q1	-5.16	1.95	8.7	-16.02	-3.84
Bolivia	1981Q4	-7.92	5.75	99.65	-69.47	-3.99
	1987Q4	-9.29	11.34	-20.27	-88.51	4.6
	1998Q2	-9.81	5.81	0.77	-15.04	-1.95
Brazil	1982Q4	-5.77	5.57	-35	-35	-0.5
	2001Q1	-4.71	6.03	-16.72	-57.05	0.45
Chile	1984Q2	-7.9	3.26	-38.9	-56.07	7
	1997Q4	-7.91	5.2	-11.53	-14.2	-5.24
China	1985Q4	-4.1	2.87	-14.42	-53.39	-1.47
Colombia	1983Q1	-7.85	4.44	-35.22	-37.13	4.33
	1997Q4	-5.45	6.52	-17.09	-27.93	-5.22
Czech Rep.	1997Q1	-8.19	3.93	4.62	-22.6	-8.98
	2003Q4	-7.89	4.46	14.35	-24.04	2.53
Ecuador	1980Q4	-5.43	4.51	2.46	-19.37	-3.99
	1987Q4	-10.68	7.19	0.3	-57.38	0.13
	1998Q3	-13.89	11.7	-6.44	-50.34	-2.64
	2001Q2	-4.25	2.91	15.33	-54.17	4.81
Hungary	1978Q4	-7.55	4.37	-9.18	-3.31	-3.31
	1987Q1	-5.56	1.97	-0.71	-22.73	1.83
	1994Q3	-10.5	6.62	4.75	-14.59	6.73
Indonesia	1983Q4	-8.36	4.19	-22.25	-25.39	-1.17
	1995Q4	-2.68	6.46	-34.91	-64.43	-6.59
	2004Q1	-3.21	5.56	13.81	-38.14	0.87
India	1990Q4	-3.02	2.6	-8	-12.09	-2.34
	1998Q1	-2.79	2.54	0.89	-11.09	-1.18
Israel	1985Q1	-5.41	5.47	-2.08	-18.66	3.27
	1994Q2	-7.69	4.06	10.19	-11.91	-0.2
	2000Q4	-3.31	4.8	-17.95	-20.79	-4.13
South Korea	1980Q1	-10.99	5.5	-1.82	-4.6	-4.6
	1991Q1	-3.67	2.87	-5.23	-19.2	-1.67
	1997Q1	-5.2	7.07	-12.36	-39.96	-5.01
Malaysia	1982Q4	-13.24	11.22	-4.09	-17.3	-2.22
	1995Q4	-9.56	23.42	-20.63	-27.81	-5.79
Mexico	1981Q4	-6.44	8.85	-27.93	-38.15	-8.4
	1994Q4	-7.06	5.15	-4.6	-47.55	-1.06
	2001Q1	-3.13	2.45	-8.15	-29.48	-4.21
Peru	1981Q4	-6.69	7.07	2.34	-26.66	-6.42
	1995Q4	-8.84	5.4	-1.49	-16.05	-2.41
	1997Q3	-6.29	4.93	-7.74	-12.99	-5.49
Philippines	1982Q4	-8.64	8.49	-15.02	-29.15	-7.82
	1997Q4	-6.13	2.2	-17.73	-32.76	-2.6

(continued)

Table 3 (concluded)

Poland	1978Q4	-10.84	4.85	-15.66	-38.28	0.05
	1993Q4	-4.7	2.58	22.76	-47.73	10.94
	1999Q4	-7.38	4.79	15.33	-27.55	-2.21
Russia	1998Q1	-4.56	20.25	-26.43	-44.89	4.9
Thailand	1983Q2	-4.99	3.3	-16.14	-17	0.76
	1995Q3	-10.06	20.85	-12.72	-34.74	-0.45
	2005Q2	-8.34	12.45	19.34	-18.3	-4.17
Turkey	1980Q4	-6.03	2.25	-10.83	-11.62	2.45
	1986Q1	-2.06	3.56	-15.95	-25.78	-0.17
	1993Q4	-3.26	2.25	10.4	-27.5	-9.48
S. Africa	1976Q1	-8.72	15.15	17.27	-19.91	-2.16
	1982Q1	-9.53	11.52	-19.82	-27.93	-4.23
	1997Q1	-2.34	1.59	-11.21	-24.27	-1.68
Average[39]		**-6.67**(-6.42)	**6.26** (6.09)	**-6.35**(-8.82)	**-31.17**(-32.64)	**-1.58**(-1.36)
Crisis		**-6.62**	**7.9**	**-15.24**	**-34.27**	**-2.54**
Non-crisis		**-6.74**	**5.44**	**1.32**	**-28.15**	**-0.86**

[39] The numbers in brackets correspond to the sample used in the graphs in Chart 8, which excludes any period for which the data for all three variables in the period *t*-3 to *t*+3 were incomplete.

Table 4: List of CA Surplus Adjustment Episodes in EMEs and Main Characteristics

Country	Date	Identified CA	Deterioration over 3 years in CA	Per cent appreciation from peak to year 3	Total appreciation around 6-year range	Change in growth rates (before/after)
Argentina	1989Q4	6.56	-8.38	143.11	143.11	3.68
	2002Q3	11.25	-7.04	14.99	169.66	11.33
Bolivia	1990Q4	2.05	-9.12	5.34	28.61	0.51
Brazil	2004Q2	2.06	-1.3	54.56	89.17	2.52
China	1991Q1	3.29	-4.4	-23.38	108.7	3.96
	1997Q4	3.91	-2.19	-1.23	33.02	-2.7
Colombia	1991Q4	5.21	-9.81	41.75	46.99	0.84
Czech Rep.	1991Q4	5.29	-8.29	25.24	74.5	
Ecuador	2000Q1	14.55	-19.22	117.52	118.2	1.85
Indonesia	2001Q1	4.78	-7.99	29.62	113.67	6.64
India	2004Q2	3.08	-4.62	9.07	14.23	3.52
Israel	1985Q3	16.63	-20.62	9.6	22.94	1.8
	1989Q3	2.59	-6.01	2.99	24.87	1.48
	1976Q3	6.96	-19.96	-36.54	104.63	-17.42
South Korea	1988Q1	9.15	-12.82	21.61	28.38	-0.53
	1998Q1	15.72	-12.88	32.36	66.56	-3.25
	2004Q1	4.68	-4.05	23.69	30.15	0.05
Malaysia	1987Q4	7.94	-9.95	-11.9	55.65	6.51
	1999Q3	17.68	-10.89	3.99	38.53	3.62
Mexico	1983Q4	3.96	-5	-14.36	88.78	-1.61
	1987Q4	3.06	-5.89	38.34	49.59	3.52
Peru	1979Q4	4.61	-10.83	9	41.68	3.75
Philippines	1986Q4	3.13	-6.61	1.12	49.3	9.82
Poland	1990Q4	5.66	-10.36	54.43	1277.67	-3.28
Russia	2000Q2	20.25	-12.2	33.47	81.44	4.37
	2005Q2	12.49	-5.91	23.29	51.97	0.92
Thailand	1998Q1	14.35	-11.68	9.13	53.23	0.01
	2001Q2	5.56	-2.82	2.15	14	6.07
S. Africa	1980Q1	11.9	-10.13	12.82	52.77	0.9
	1987Q3	6.78	-6.7	-3.44	58.17	1.68
Average[40]		**0.08**	**-0.09**	**19.79**	**63.88**	**1.92**

[40]The averages exclude Poland in 1990, to avoid distorting the values.

Table 5: List of CA Deficit Adjustment Episodes and Main Characteristics for the G-7

Country	Date started	CA deficit At beginning	Change in CA (3 years)	Change in REER from *t*0 to *t*3	Change in ER (max to min)	Change in average GDP growth
Canada	1981Q3	-0.05	0.05	7.18	-33.68	2.41
Canada	1992Q1	-0.04	0.03	-21.28	-26.17	2.72
Canada	1993Q4	-0.04	0.04	-7.97	-26.18	10.00
Canada	1997Q3	-0.02	0.05	-6.13	-12.37	11.79
France	1982Q3	-0.04	0.03	1.76	-16.12	3.47
France	2008Q3	-0.03	NA	NA	NA	NA
Germany	2000Q3	-0.02	0.05	7.29	-12.97	-1.42
Italy	1981Q1	-0.03	0.03	4.69	-7.83	2.56
Italy	1992Q3	-0.02	0.05	-24.68	-29.35	2.50
Italy	2008Q3	-0.03	NA	NA	NA	NA
US	1987Q2	-0.03	0.02	2.27	-32.85	7.34
US	2006Q3	-0.07	NA	NA	NA	NA
UK	1974Q2	-0.04	NA	NA	NA	NA
UK	1975Q3	-0.02	0.03	-5.64	-14.70	2.16
UK	1989Q3	-0.05	0.04	5.86	-23.63	6.09
UK	2006Q4	-0.04	NA	NA	NA	NA
UK	2008Q2	-0.02	NA	NA	NA	NA
Average		**-0.04**	**0.04**	**-3.33**	**-21.44**	**4.51**

Table 6: List of CA Surplus Adjustment Episodes and Main Characteristics for the G-7

Country	Date started	CA deficit at beginning	Change in CA (3 years)	Change in REER from *t*0 to *t*3	Change in ER (max to min)	Change in average GDP growth
Canada	2000Q4	0.03	-0.02	14.66	18.84	10.26
Canada	2002Q1	0.02	-0.01	24.01	26.03	8.61
Canada	2004Q1	0.02	-0.01	9.75	35.28	9.34
Canada	2005Q4	0.03	NA	NA	NA	NA
France	1997Q2	0.03	-0.02	-8.12	16	6.82
Germany	1989Q1	0.05	-0.06	-1.63	13.89	2.08
Germany	2006Q4	0.08	NA	NA	NA	NA
Italy	1996Q3	0.04	-0.03	5.46	15.16	4.87
Italy	1998Q2	0.03	-0.03	7.83	12.8	-0.56
Japan	1988Q3	0.04	-0.02	-6.54	47.63	0.8
Japan	1990Q4	0.03	0.01	24.71	45.88	-4.16
Japan	1991Q3	0.02	0.02	29.9	47.92	-5.27
Japan	1997Q3	0.05	-0.03	13.84	49.75	-1.76
Japan	1999Q1	0.02	0.01	-12.53	28.35	0.03
Japan	2000Q3	0.03	0.01	-17.92	28.35	1.06
Japan	2007Q3	0.05	NA	NA	NA	NA
UK	1981Q4	0.04	-0.04	-17.26	35.9	0.73
Average		**0.04**	**-0.02**	**4.73**	**30.13**	**2.35**

Table 7: Johansen Cointegration Tests (CA/GDP and RER)

Country	Hypothesized no. of CE(s)	Eigenvalue	Trace statistic	Critical value	Prob.**
Argentina	No cointegration	0.108	16.596	15.495	0.034
Bolivia	No cointegration	0.050	5.571	15.495	0.746
Brazil	No cointegration	0.108	18.633	15.495	0.016
Chile	No cointegration	0.080	16.377	15.495	0.037
China	No cointegration	0.052	7.888	15.495	0.477
Colombia	No cointegration	0.165	26.019	15.495	0.001
Czech Rep.	No cointegration	0.078	10.028	15.495	0.279
Ecuador	No cointegration	0.141	21.359	15.495	0.006
Hungary	No cointegration	0.117	15.812	15.495	0.045
Indonesia	No cointegration	0.095	15.120	15.495	0.057
India	No cointegration	0.081	13.872	15.495	0.087
Israel	No cointegration	0.147	25.535	15.495	0.001
South Korea	No cointegration	0.119	18.859	15.495	0.015
Malaysia	No cointegration	0.046	7.524	15.495	0.518
Mexico	No cointegration	0.202	28.142	15.495	0.000
Peru	No cointegration	0.096	14.032	15.495	0.082
Philippines	No cointegration	0.059	8.907	15.495	0.374
Poland	No cointegration	0.148	19.960	15.495	0.010
Russia	No cointegration	0.238	22.183	15.495	0.004
Thailand	No cointegration	0.094	14.361	15.495	0.074
Turkey	No cointegration	0.088	9.850	15.495	0.292
S. Africa	No cointegration	0.093926	14.42595	15.49471	0.072

Note: Shaded rows indicate that we reject the null hypothesis of no cointegration at the 10 per cent level.

Table 8: VECM Results (CA/GDP and log(RER), *t*-stats in [ ])

Country	α_{ca}	β_{RER}
Argentina	-0.13607***	0.080371***
	[-2.94695]	[4.54541]
Brazil	-0.08221***	0.061217**
	[-2.96081]	[2.26715]
Chile	-0.13516***	0.093885**
	[-2.74500]	[2.50483]
Colombia	-0.16395***	0.090283***
	[-4.72445]	[5.63032]
Ecuador	-0.23211***	0.00639
	[-3.90935]	[0.16578]
Hungary	-0.19155***	0.110034***
	[-3.64089]	[4.12421]
Indonesia	-0.15597***	0.119155***
	[-3.93306]	[6.50290]
India	-0.20918***	0.00442
	[-2.71235]	[0.58196]

Country	α_{ca}	β_{RER}
Israel	-0.128*	0.351295***
	[-1.89986]	[3.37410]
South Korea	-0.2953***	0.188198***
	[-3.80983]	[3.46311]
Mexico	-0.03694***	-0.091
	[-2.59578]	[-1.32468]
Peru	-0.1061***	0.010
	[-2.96635]	[0.25648]
Poland	-0.141***	0.004
	[-3.69769]	[0.73432]
Russia	-0.009154	0.908702
	[-0.45351]	[3.66746]
Thailand	-0.09502**	0.252644***
	[-2.23120]	[2.73295]
South Africa	-0.11733**	-0.056
	[-2.41479]	[-1.00602]

Table 9: Johansen Cointegration Tests (GDP growth, GDP growth*, CA/GDP, RER)

Country	Hypothesized no. of CE(s)	Eigenvalue	Trace statistic	Critical value	Prob.**
Bolivia	None *	0.36	65.96	47.86	0.00
China	None *	0.22	58.14	47.86	0.00
Czech Rep.	None *	0.61	69.42	47.86	0.00
Malaysia	None *	0.21	52.39	47.86	0.02
Philippines	None *	0.25	58.08	47.86	0.00
Turkey	None	0.18	44.32	47.86	0.11

Note: Shaded rows indicate that we reject the null hypothesis of no cointegration at the 10 per cent level.

Table 10: Cointegrating Vectors (GDP growth, GDP growth*, CA/GDP, RER, *t*-stat in [ ])

Country	α_{ca}	β_{RER}	β_{GDP}	β_{GDP^*}
Bolivia	0.004615*	-3.47959***	-0.43812***	0.384645***
	[1.66350]	[-6.70420]	[-6.25425]	[3.83404]
China	-0.00284*	0.031873	0.010044	0.159871***
	[-1.54592]	[0.31487]	[0.57973]	[4.48314]
Czech Rep.	-0.3878***	-0.14227***	0.002373*	-0.03072***
	[-4.20849]	[-4.34146]	[1.59733]	[-6.00841]
Malaysia	-0.0553***	0.345256***	0.038091***	-0.00019
	[-3.00999]	[4.51579]	[6.51268]	[-0.01276]
Philippines	-0.05896	0.07472***	-0.00594***	-0.00887**
	[-0.96907]	[2.38492]	[-3.86653]	[-1.99659]

Chart 1: Volatility of the CA versus Volatility of the RER (Standard Deviation, 1994–2008)

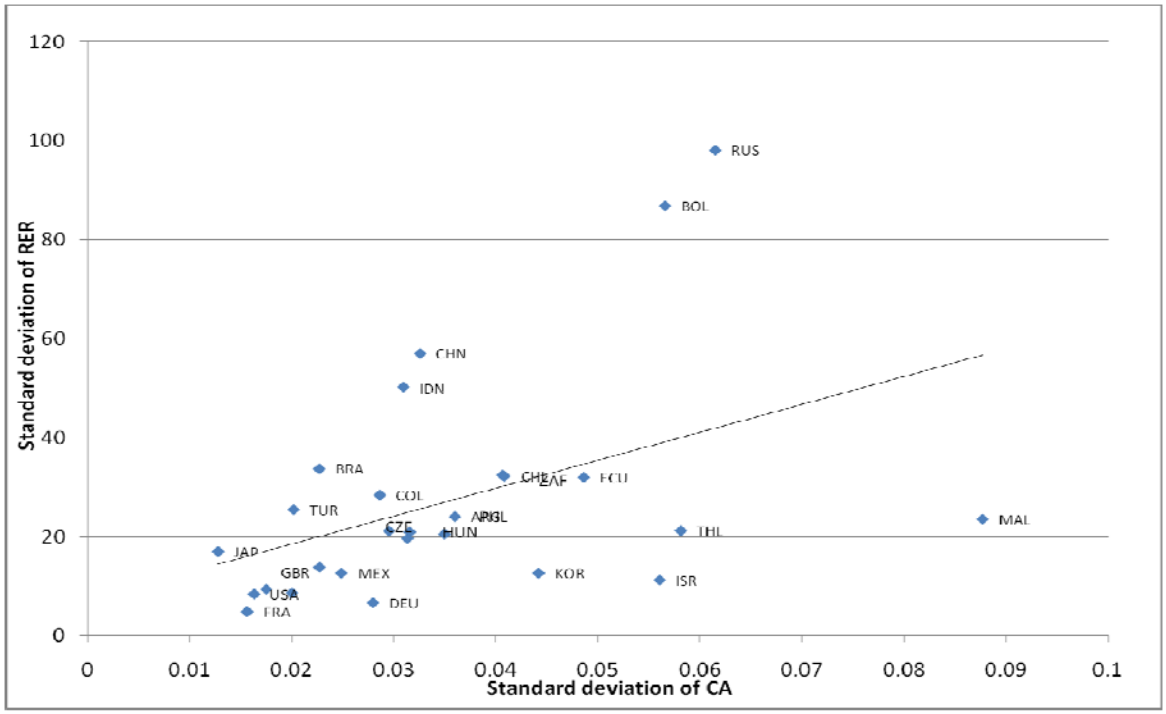


Chart 2: Volatility of the Real and the Nominal Exchange Rates (Standard Deviation, 1994–2008)

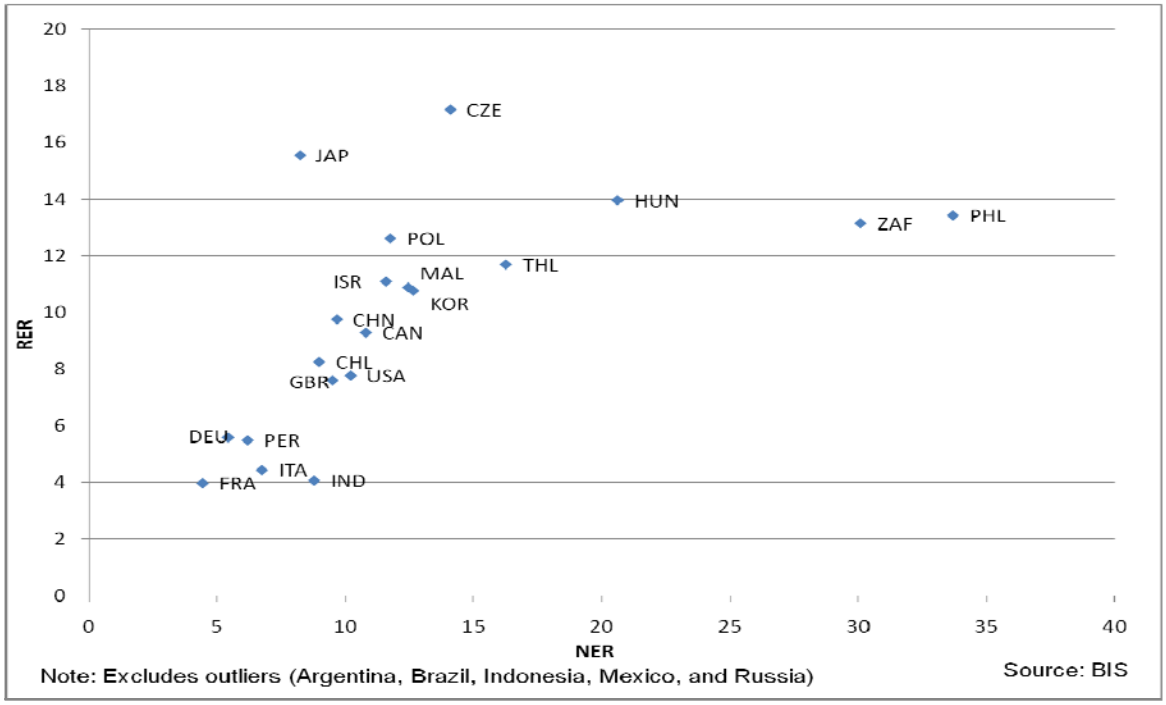
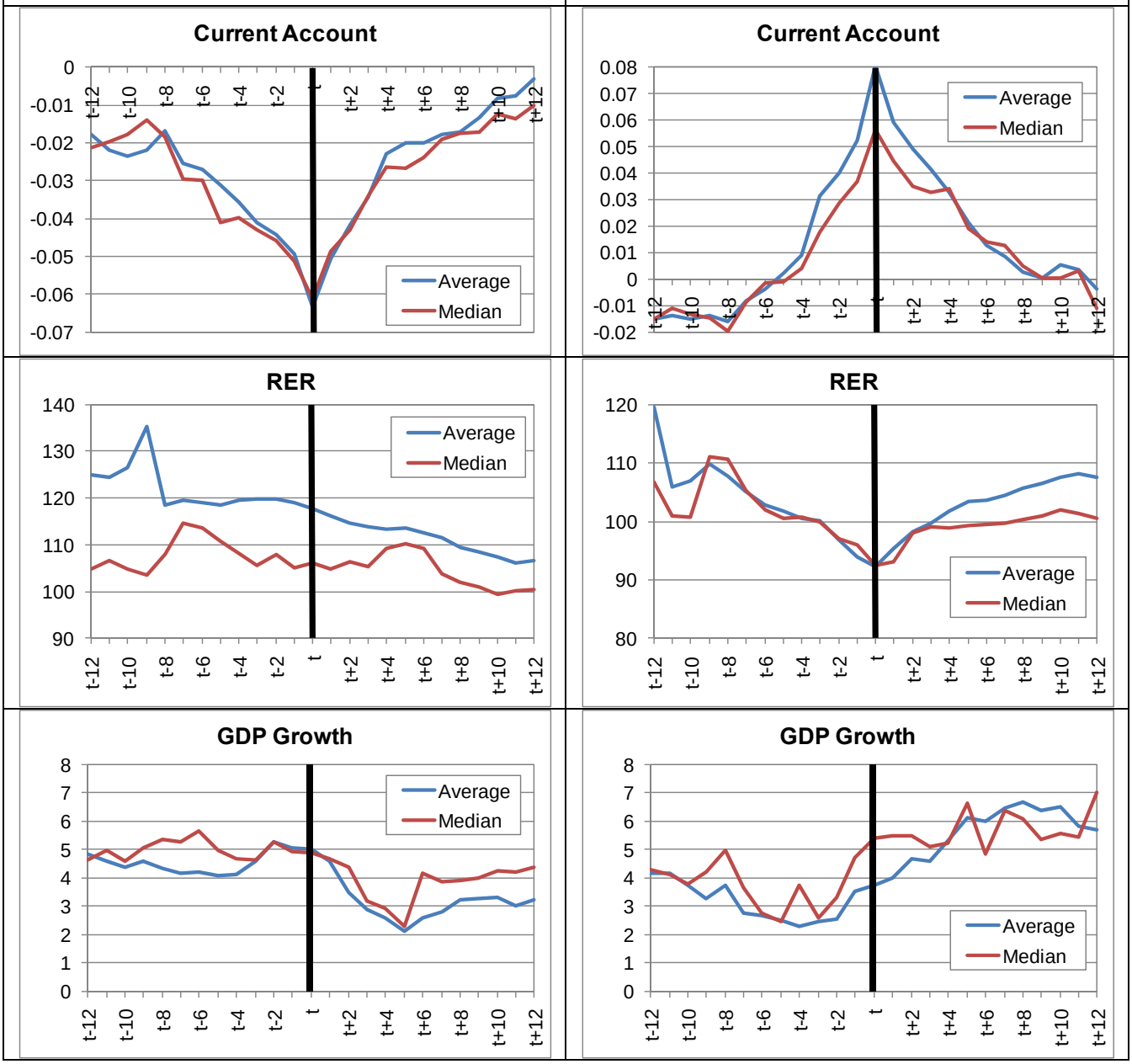


Chart 3: Event-Study Results for EMEs: Evolution of the CA, the RER, and GDP Growth during CA Deficit and Surplus Reversals [41]

Current Account Deficit Reversals (43 episodes) [42]	Current Account Surplus Reversals (29 episodes)



[41] We constructed envelopes as well as confidence intervals for the event study. However, both are relatively wide and add little information.

[42] Although we found 55 current account deficit reversals in our sample, we use only 43 episodes for which data are available for all three variables three years pre- and post-reversal.

Chart 4: Event-Study Results for the G-7: Evolution of the CA, the RER, and GDP Growth during CA Deficit and Surplus Reversals

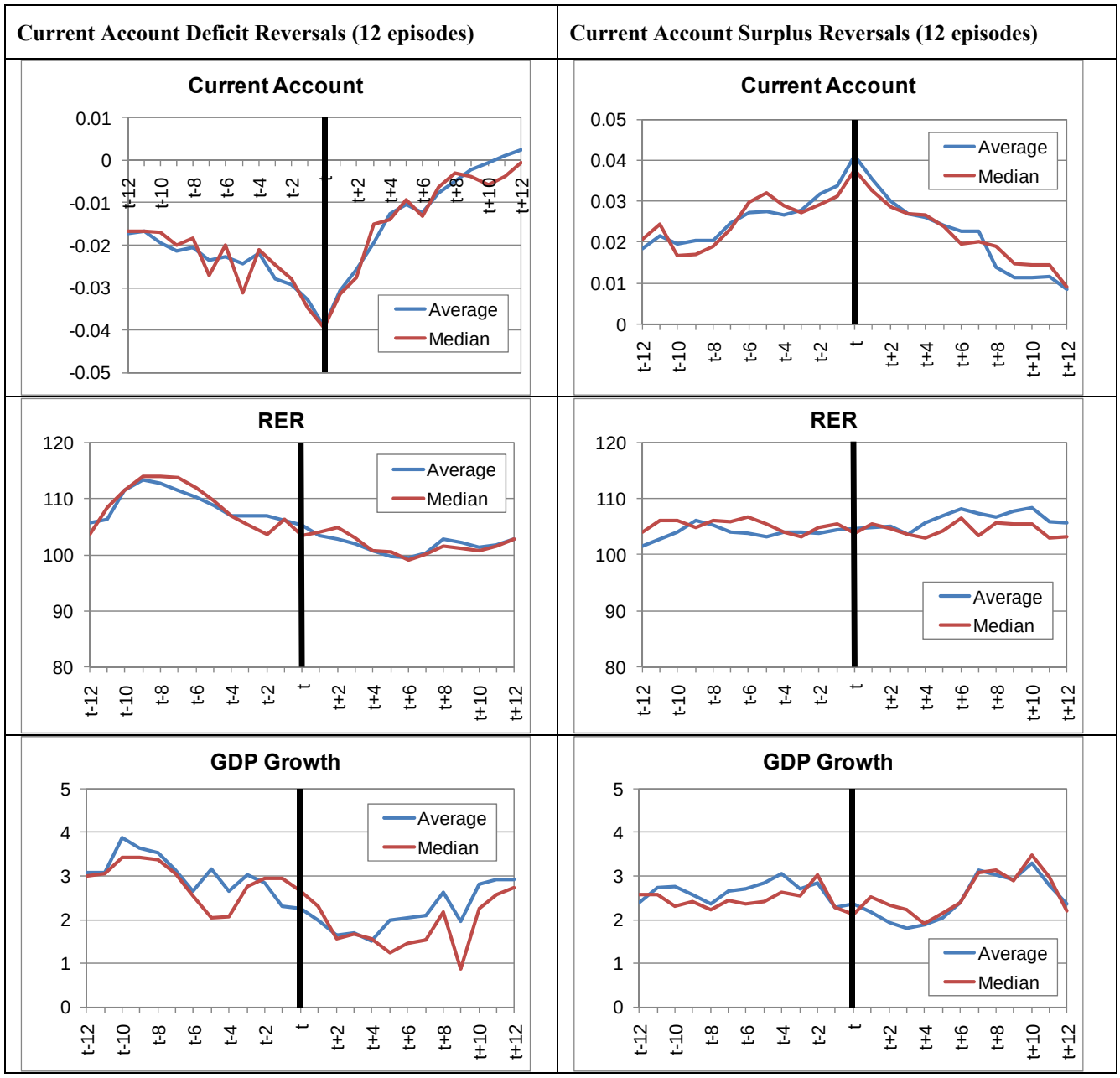


Chart 5: Total Depreciation[43] versus the Size of the CA Deficit Adjustment

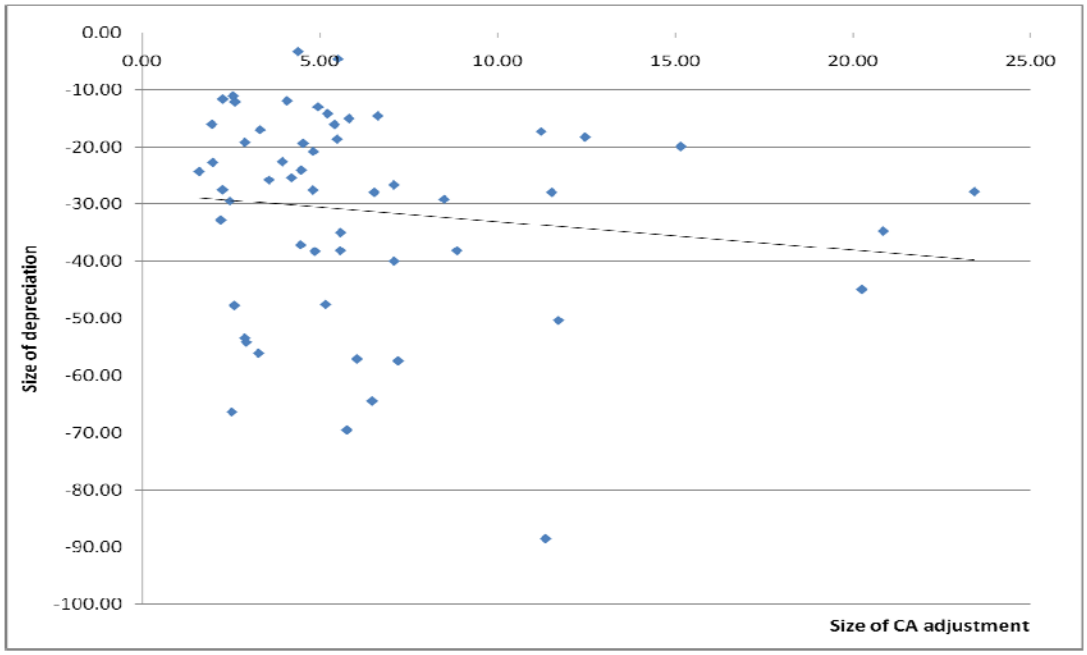
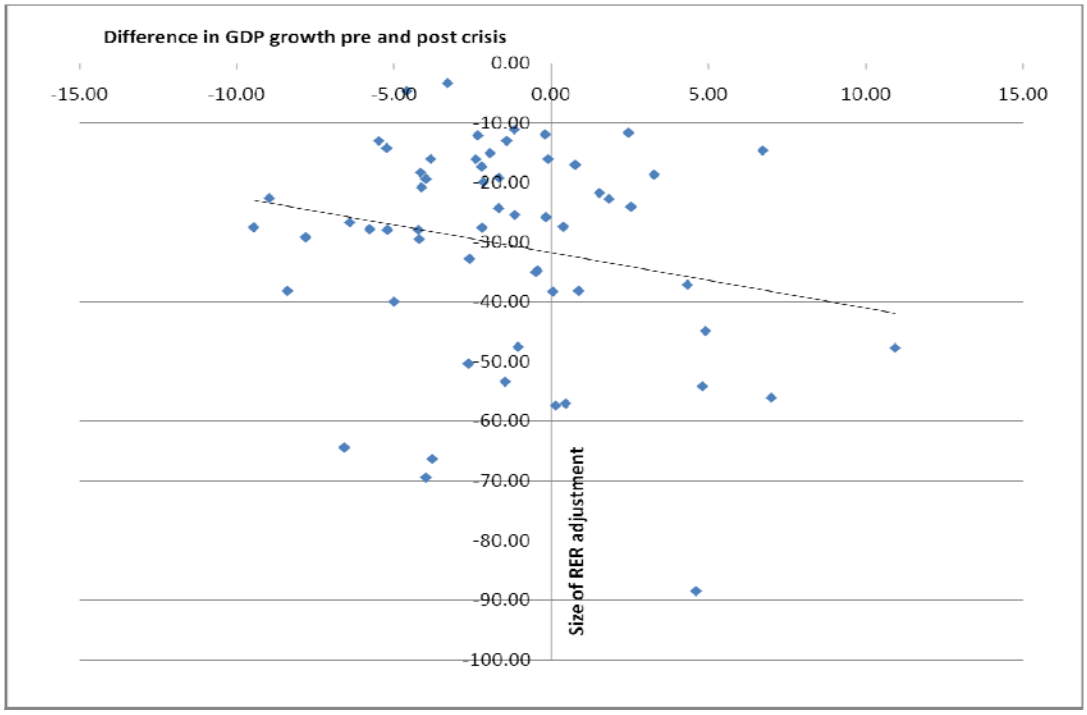


Chart 6: Total Depreciation versus the Change in GDP Growth



[43] Total depreciation is defined as the percentage change between the maximum value of the RER in the three years leading up to the reversal minus the minimum value of the RER in the three years following the reversal.

Chart 7: Event-Study Results: CA Deficit Reversals in EMEs: Crisis versus Non-Crisis Episodes

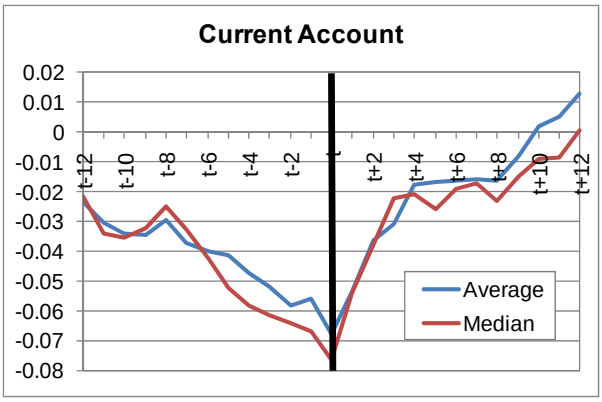
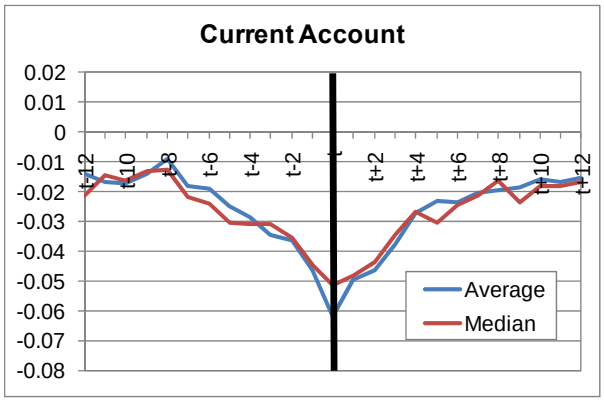
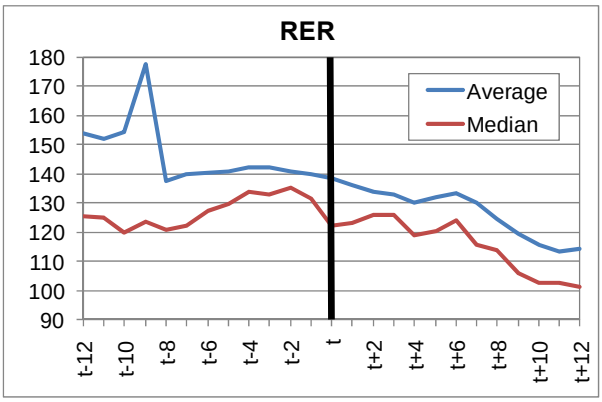
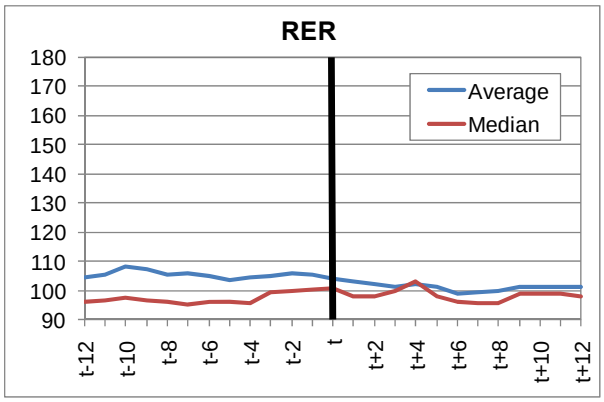
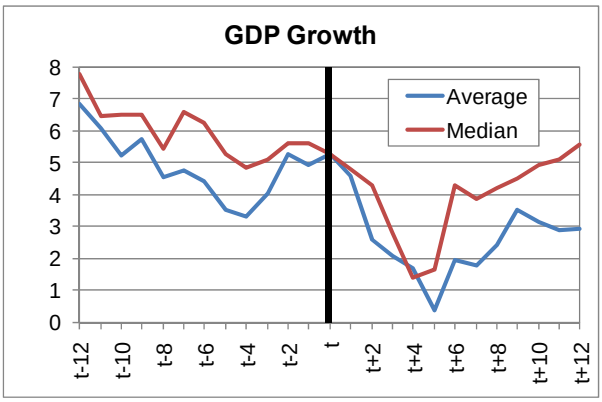
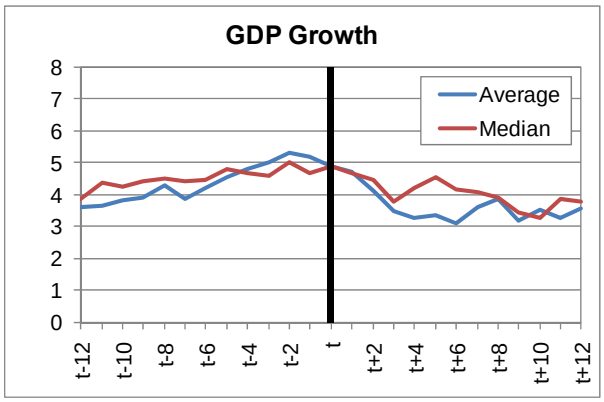
Crises episodes (17 episodes)	Non-crisis episodes (24 episodes)
	
	
	

Chart 8: Levy-Yeyati and Sturzenegger (2005) Classification and Crises

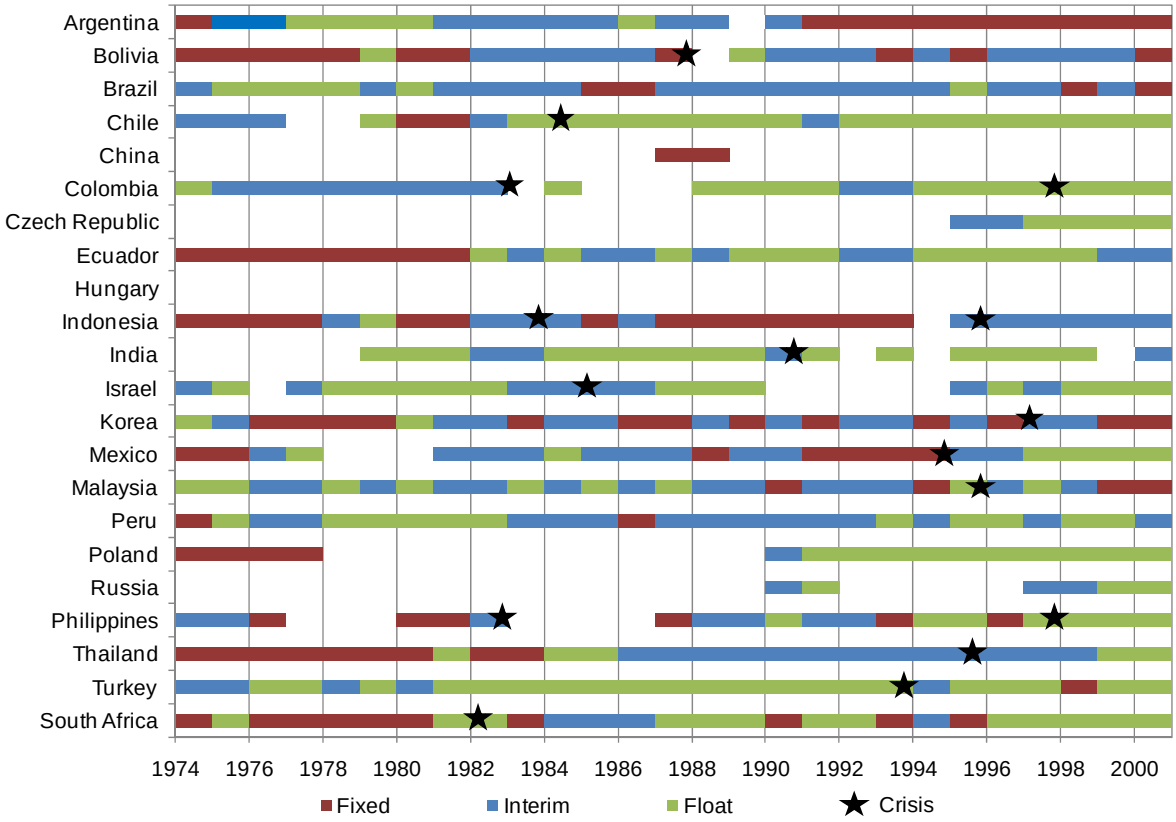


Chart 9: Event-Study Results: CA Deficit Reversals in EMEs: Fixed versus Flexible ER Regimes

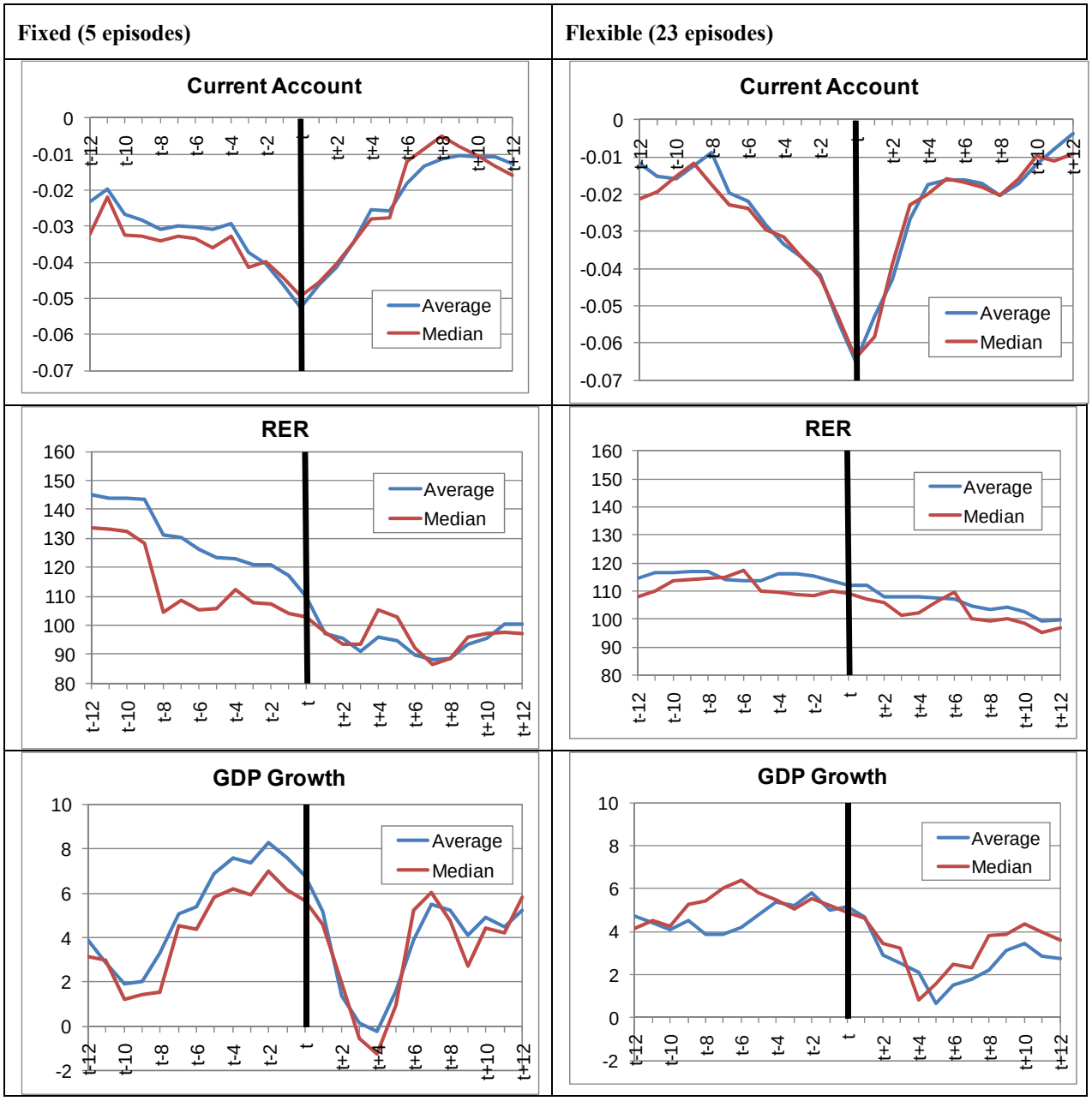
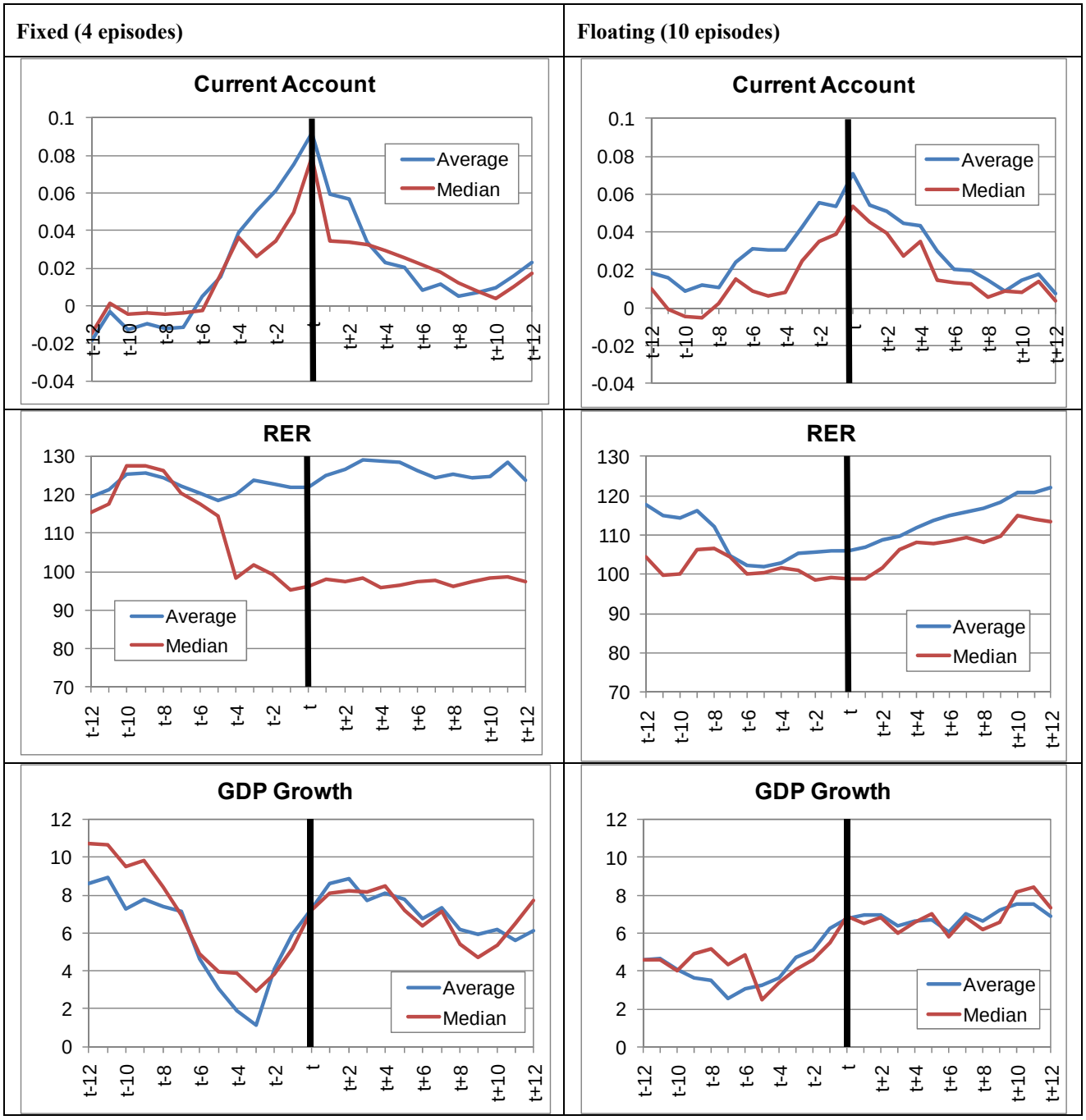


Chart 10: Event-Study Results: CA Surplus Reversals in EMEs: Fixed versus Floating ER Regimes[44]



[44] The sample size for this table is very small (4 fixed ER regimes and 10 floating ER regimes); the results should therefore be interpreted with caution.

Chart 11: Adjustment Speed of the CA to the Cointegration Relation α_{ca}