Current Account and Real Exchange Rate changes: the impact of Trade Openness

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Abstract

This article investigates the impact of trade openness on the relation between real exchange rate depreciation and current account. First, using data for developed and emerging economies for the period 1970–2011, we identify events of sudden stops of capital flows and of abrupt real exchange rate depreciations. Then, we investigate the relation between openness, real exchange rate depreciations, and changes in current account and in trade balance over these events. We find that, controlling for real exchange rate changes, more open economies experience a larger increase in current account and in trade balance. In other words, our results indicate that improvements in current account and in trade balance are accompanied by smaller real exchange rate depreciation in more open economies.

Keywords: trade openness, sudden stops, real exchange rate depreciation.
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1 Introduction

Both advanced and emerging economies have experienced exponential growth of capital flows over the past twenty years. Throughout the 2000s, this growth was accompanied by very large and mounting current account imbalances, raising concerns with respect to the potential adverse consequences

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of abrupt interruptions of those flows and current account reversals. In particular, the magnitude of exchange rate depreciation over the adjustment process has been a key element of discussion, reviving the famous debate between John Maynard Keynes and Bertil Ohlin over the payment of war debts in Germany during the 1920s, known as the “Transfer Problem”.

In the transfer problem debate, Keynes argued that, in order to pay for the war damages in foreign currency, Germany would have to raise the resources through trade balance surpluses. Relative prices of tradable goods would then have to increase, implying a real exchange rate depreciation. According to Ohlin, however, the decline in Germany’s disposable income due to the external payments would entail an increase in trade balance with lesser relative price changes. The mechanism is that, with lower income, the country would buy less of “the goods which go easily between them”, using Ohlin’s words, thereby improving trade balance. Clearly, the efficiency of this mechanism depends on the share of those goods in the consumption basket, that is, on the degree of openness of the economy.

The reversion of large current account imbalances refers to the same type of adjustment mechanism, where the magnitude of real exchange rate depreciation may be mitigated by the income effect, particularly in more open economies. We take this question to the data: do more open economies endure lesser real exchange rate depreciation when facing current account reversals? Many different variables affect the relation between real exchange rates and trade balances, and it would be a daunting, if not impossible task to control for all of them. To circumvent this problem, we focus our analysis on episodes of sudden stops of financial flows and of abrupt changes in real exchange rates. In the case of sudden stops, it is reasonable to think that, on average, other shocks affecting trade balance and real exchange rates would assume a lesser role, so that the observed real exchange rate change would be associated to the trade balance movement. By the same token, in events of abrupt exchange rate depreciation, the corresponding change in trade balance can be taken as mostly related to the observed exchange rate depreciation.

Empirical research recognizes the importance of openness to trade in determining the country’s vulnerability to sudden stops. For example, Calvo, Izquierdo, and Mejia (2004) present evidence that more open economies, understood as countries with larger supply of tradable goods, are less prone to sudden stops in capital flows. Cavallo and Frankel (2008), on their turn, show how this relationship is even stronger when taking into account the endogeneity of the openness to trade measure.

The currency crises literature equally stresses the importance of trade openness. Examining the factors that help predict the occurrence of these extreme episodes, Milesi-Ferretti and Razin (2000) find that a higher degree of openness to trade decreases the probability of exchange rate crises. Moreover, they also show how more open economies are characterized by a faster growth in the aftermath of a currency crisis. Similar findings are presented in Glick and Hutchison (2011), where greater trade integration reduces a country's financial fragility and the likelihood of a currency crisis by increasing both the ability and willingness to service external obligations. Indeed, a greater export ratio decreases the likelihood of sharp reversals of capital flows, as the country is more able to service its foreign currency denominated debt.

All in all, the literature has established the importance of trade openness in the country's vulnerability to sudden stops and currency crises. We take a new perspective by investigating the role of trade openness on the relationship between trade balance and real exchange rate *during* these episodes. More specifically, we analyze the role played by trade openness on the relation between trade balance and real exchange rate during sudden stops and abrupt real exchange rate depreciation episodes, for advanced economies and emerging markets.

We build a theoretical framework that captures the role of trade openness on the relation between current account reversals and real exchange rate changes. We model a small open economy in which sudden stops can occur due to binding collateral constraints on the country's external debt. We show that the effect of this sudden stop differs according to the degree of openness of the economy. In particular, more open economies experience a lower exchange rate depreciation.

We then examine the empirical implications of this model for a sample of both advanced and emerging economies during the period 1970–2011. We first identify sudden stops and abrupt real exchange rate depreciation episodes by following a standard methodology used in the sudden stops literature.

We show that during sudden stops more open economies endure lower depreciation of the real exchange rate. We also provide evidence that trade openness has a positive impact on trade balance and current account variations during episodes of sudden stops and of abrupt exchange rate depreciation. The direct implication of these findings is that more open economies seem to be able to reach equilibrium in the balance of payments with lower real exchange rate depreciation.

The outline of the paper is as follows. In Section 2 we present a theoretical framework that establishes how openness affects exchange rate depreciation under sudden stops. Section 3 describes the data, while the empirical results are presented in Section 4. Section 5 concludes.

2 Theoretical Framework

This section presents a simple theoretical framework that shows how, during sudden stops, more open economies experience lesser real exchange rate depreciations. The formal specification of the model follows the small open economy literature with tradable and nontradable goods sectors (see Mendoza, 2005; Bianchi, 2011; Korinek and Mendoza, 2013).

2.1 Set-up

The economy is populated by a continuum of identical households that receive in every period an endowment of tradable (y_t^T) and nontradable (y_t^N) goods. They allocate their consumption (C_t) between those two goods goods, by maximizing the following expected utility function:

$$U = \sum \beta^t E\left[u\left(C_t\right)\right], \tag{1}$$

where β is the discount factor and C_t is the consumption basket. For simplicity, we assume Cobb-Douglas preferences, so that:

$$C_t = \left(c_t^T\right)^{\gamma}\left(c_t^N\right)^{1-\gamma}, \tag{2}$$

where γ is the share of tradable goods in consumption.

Households can invest in a foreign asset denominated in units of tradable goods. This asset matures in one period and pays a fixed gross interest rate R. Taking the price of tradables as the numeraire and denoting as p_t^N the price of nontradables, the household's budget constraint can written as:

$$b_{t+1} + c_t^T + p_t^N c_t^N = y_t^T + p_t^N y_t^N + Rb_t, \tag{3}$$

where b_{t+1} represent the amount of bonds held by the household at time t. Notice that debtor countries present a negative value of b.

We assume that this economy faces a borrowing constraint. More specifically, we assume foreign creditors restrict the loans to the country so that the amount of debt cannot exceed a fraction k of tradable income. In this case, the credit constraint is represented by:

$$b_{t+1} \geq -ky_t^T. \tag{4}$$

The market clearing condition in the nontradables sector is given by:

$$c_t^N = y_t^N, \tag{5}$$

which we substitute into the budget constraint in equation (3) to rewrite it as:

$$c_t^T = y_t^T + Rb_t - b_{t+1}. \tag{6}$$

We are interested in investigating the impacts of sudden stops, which we will represent as a shock to the tradable good endowment in a credit constrained economy, as in Mendoza (2005). Hence, we start by describing the equilibrium when the credit constraint in not binding, and then we analyze the effect of a shock to the tradable endowment (y_t^T). Finally, we show how the effect of a sudden stop differs according to the degree of openness of the economy.

2.2 Non-binding credit constraint

For simplicity, we assume that the nontradable output is constant over time, $y_t^N = \bar{y}^N$ for all t, and that $\beta R = 1$. Given these assumptions, when the credit constraint does not bind the equilibrium simply reflects the perfect consumption smoothing of tradable goods: $c_t^T = \bar{c}^T$ for all t. Assuming the no-Ponzi game condition, the intertemporal budget constraint (6) implies the following value for the constant tradables consumption:

$$\bar{c}^T = \left(\frac{R-1}{R}\right)\left(\sum_{t=0}^{\infty} R^{-t} y_t^T + R b_0\right) \tag{7}$$

Consumers maximize utility when relative price of nontradables is equal to the marginal rate of substitution between the two types of goods. The equilibrium price of nontradables is then given by:

$$p_t^N = \left(\frac{1-\gamma}{\gamma}\right)\frac{c_t^T}{\bar{c}^N}, \tag{8}$$

which is constant at $\bar{p}^N$ in this case with non binding credit constraint.

Defining the real exchange rate ε as the ratio between the price of tradable goods, our numeraire, and the price of nontradables (p^N), we have that $\varepsilon_t = \frac{1}{p_t^N}$. Hence, real exchange rate is also constant ($\bar{\varepsilon}$) in this unconstrained economy.

Let us see the effect of a negative shock to the tradable endowment. We will construct a wealth neutral shock, so that it should not affect the consumption paths when the credit constraint in equation (4) is not binding. Following Mendoza (2005), we first define a sequence of time invariant tradables endowment ($\bar{y}^T$) that yield the same present value of the actual arbitrary time varying sequence of tradables income. According to this definition, tradables consumption under no credit constraints from equation (7) can be written as:

$$\bar{c}^T = \bar{y}^T + (R-1)\, b_0. \tag{9}$$

Let us suppose that current account is balanced when the economy is hit the wealth neutral negative shock. It is defined as a negative shock to tradables income at date 0 that is offset by positive shock at date 1, so that the present value of the tradable output remains unchanged. In order to keep the present value of the sequence of the tradables income constant, the endowment shock needs to satisfy the following condition:

$$\left(\bar{y}^T - y_0^T\right) R = y_1^T - \bar{y}^T. \tag{10}$$

If the shock to y_0^T is not large enough to trigger the credit constraint, consumption allocation and the price of nontradables remain unchanged. Indeed, at date 0 the country will consume the same level of tradables, $c_0^T = \bar{c}_t^T$, thanks to the increased foreign debt:

$$\bar{b}_1 - b_0 = y_0^T - \bar{y}^T < 0. \tag{11}$$

At date 1, the positive shock that offsets the one occurred at date 0 will allow the country to maintain a constant consumption and to reimburse the increase in debt of the previous period, so that $\bar{b}_2 - \bar{b}_1 = -\left(\bar{b}_1 - b_0\right)$. In such a situation, the effect of the shock is only reflected on the current account, with the country facing a deficit at date 0 and a surplus at date 1.

2.3 Binding credit constraint: sudden stop episode

We now analyze the impact of an unanticipated shock to the endowment of tradable goods that triggers the liquidity constraint, that is, a shock that would induce a debt level $\bar{b}_1$ that does not satisfy the credit constraint in equation (4), so that $\bar{b}_1 < -ky_0^T$. Notice that, given the change in debt induced by the endowment shock in equation (11), it must be the case that:

$$y_0^T < \frac{\bar{y}^T - b_0}{1+k}. \tag{12}$$

In this case, equation (4) is binding, so that:

$$b_1 = -ky_0^T > \bar{b}_1. \tag{13}$$

where $\bar{b}_1$ is the indebtedness level that would be necessary to keep consumption constant, as defined in the previous subsection. The consumption of tradables at date 0 is then given by:

$$c_0^T = (1+k)\, y_0^T + Rb_0. \quad (CC) \tag{14}$$

which is clearly smaller that the original consumption smoothing plan: $c_0^T < \bar{c}^T$.

The price of nontradables is now equal to:

$$p_0^N = \left(\frac{1-\gamma}{\gamma}\right) \frac{c_0^T}{\bar{c}^N} < \bar{p}^N, \tag{15}$$

which is then lower than the unconstrained level, which means a more depreciated real exchange rate: $\varepsilon_0 > \bar{\varepsilon}$

Notice that, with the binding credit constraint, the current account is larger than in the case of the unconstrained economy:

$$b_1 - b_0 > \bar{b}_1 - b_0, \tag{16}$$

since $b_1 > \bar{b}_1$, by construction. Furthermore, the difference between the two values of the current account is captured by the drop in consumption. Using equation (6) to compute the consumption when the endowment is equal to y_0^T, and equation (9) for the consumption in the unconstrained economy, we have that:

$$\bar{c}^T - c_0^T = (b_1 - b_0) - \left(\bar{b}_1 - b_0\right), \tag{17}$$

In sum, when an unanticipated shock triggers the credit constraint to bind, which represents a sudden stop episode, the consumption of tradable goods decreases, the real exchange rate depreciates, and the current account deficit is smaller than it would be under no credit constraint.

2.3.1 The importance of Openness

We define the degree of openness of an economy as the share of tradable goods in consumption, which, given consumer preferences represented in equation (2), can be expressed as:

$$Openness_t = \frac{c_t^T}{p_t^N \bar{c}^N + c_t^T} = \gamma. \tag{18}$$

Consider two economies, denoted O and C, with different degrees of openness, such that O is more open than C, i.e. $\gamma_O > \gamma_C$. Both economies have the same constant endowment of nontradable goods. As for the tradables endowment, its present value is larger in the more open economy, and the difference is such that the real exchange rate is the same in the two economies when they are not credit constrained. From equations (8) and (9), the condition is that:

$$\bar{y}_O^T = \frac{\gamma_O\left(1-\gamma_C\right)}{\gamma_C\left(1-\gamma_O\right)}\left(\bar{y}_C^T + (R-1)b_{0C}\right) - (R-1)b_{0O}. \tag{19}$$

Suppose both economies are initially consuming at the unconstrained consumption level with a balanced current account, when they are hit by an unexpected, wealth-neutral, negative shock in tradables endowment that triggers the budget constraint. What will be the effect on the tradable consumption, nontradable prices and real exchange rate?

Since the shock is wealth-neutral, the negative shock at date 0 is compensated in each economy by a positive shock in period 1 satisfying the condition in equation (10). Moreover, in order to trigger the credit constraint, tradable endowment must satisfy inequality (12). Finally, to facilitate the comparison between the two economies, we assume that the shock induce the same decrease in tradables consumption. Hence, they satisfy the condition: $y_{0O}^T - y_{0C}^T = \frac{\bar{y}_O^T - \bar{y}_C^T}{1+k}$.

Figure 1: Equilibrium price for open and closed economies

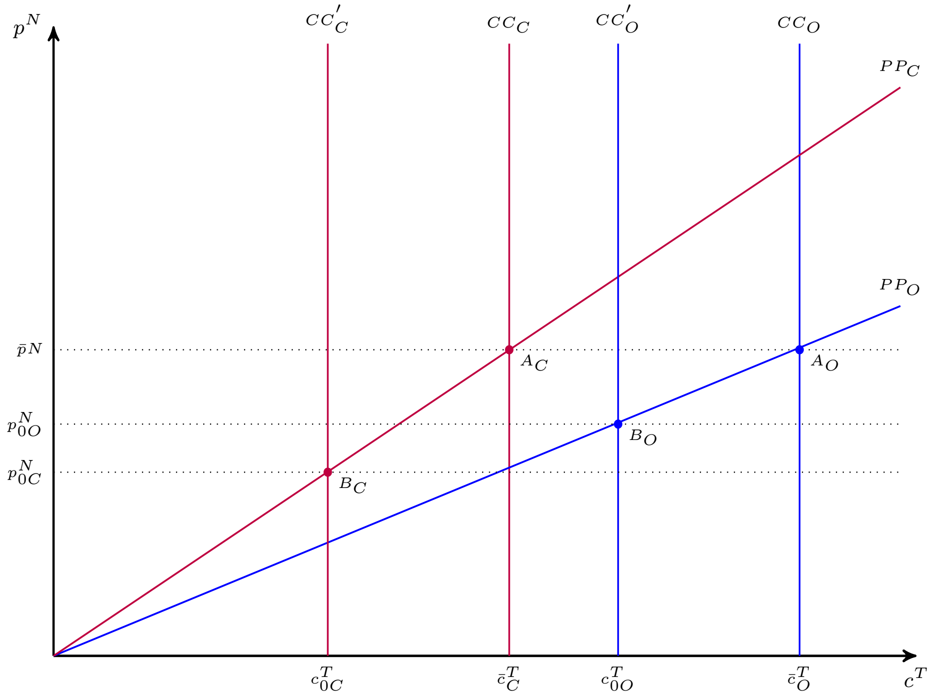


Figure 1 illustrates the effect of sudden stops for economies characterized by a different degree of openness. The vertical lines CC_O and CC_C represent the budget constraint in the unconstrained economy, which establish the tradables consumption $\bar{c}^T$ as in equation (9). Given our assumption that the present value of tradables endowment is higher in the more open economy (see equation (19)), we have that $\bar{c}_O^T > \bar{c}_C^T$. Notice that the budget constraints do not depend on the price of nontradable, therefore those are vertical lines on the graph.

Optimal consumption allocation across sectors relates consumption of tradables to the price of nontradables, as established by equation (8). They are represented by lines PP_O and PP_C in the figure, for the more open and the more closed economies, respectively. According to the equation (8), nontradables price is a positive function of tradables consumption, and prices are more sensitive to tradables consumption in more closed economies. Hence, the PP_C schedule is steeper than the PP_O one in the graph.

In both economies, the equilibrium price of nontradables is obtained at the intersections between the CC and PP line, represented by points A_O and A_C in the graph. By construction, the price of nontradables $\bar{p}^N$ is the same in both economies.

With the tradable endowment shock that triggers the credit constraint, consumption is given by equation (14), represented by the vertical lines CC'_O and CC'_C. The new equilibrium is at point B_O for the more open economy and at point B_C for the more closed one.

Despite the fact that the change in the consumption of trabables is equal for both economies ($\Delta c^T_O = \Delta c^T_{0C}$), the more closed economy exhibits a larger decrease on the relative price of nontradable goods. This implies that the shock to the tradables endowment at date 0 generates a larger real exchange rate depreciation for the less open economy. Thus, during sudden stops, for a given variation of the current account, more open economies endure a lower real exchange rate depreciation.

Going back to the Keynes-Ohlin debate, we could say, in light of this argument, that Ohlin would be right for economies with a high degree of openness. The credit constraint that is triggered by the endowment shock decreases the disposable income, depressing consumption of both types of goods. Nontradables prices have then to decrease to reestablish equilibrium in the nontradables market. The more open the economy, the larger is the decrease in total tradables consumption and the smaller the decrease in nontradables consumption for a given decrease in available income. Hence, the lesser the relative price changes.

We investigate whether the data meets this argument. More specifically, we verify whether real exchange rate depreciations are smaller in more open economies when they are hit by sudden stops. We also look at the issue from the opposite perspective, that is, in events of large real exchange rate depreciations, whether the increase current accounts and trade balances are larger in more open economies.

3 Event analysis and data

The first step is to identify sudden stops and exchange rate depreciation episodes, which are the events on which our empirical investigation will be based. We use quarterly data from the IFS-IMF database for a sample of 128 developed and emerging economies for the period 1970-2011. Notice that we do not have data for all countries and all periods, so that we may missed some of the episodes of abrupt RER depreciation and sudden stops that actually occurred over the period.

3.1 Sudden stop episodes

We identify sudden stops by adapting the methodology implemented by Calvo et al. (2004) to quarterly data. We define an episode as a sudden stop when the year-over-year change of quarterly net capital flows falls two standard deviations below its mean. As common in the literature, we set the beginning of the sudden stop as the first quarter in which the fall in capital flows is larger than one standard deviation below its mean and end once the fall in net capital flows is smaller than one standard deviation.

In line with Calvo et al. (2004), and contrary to other studies (i.e. Guidotti et al., 2004; Edwards, 2004; Calderón and Kubota, 2013), we do not normalize the changes in capital flows by GDP or exclude the episodes for which the shock does not exceeds a certain threshold of GDP. By limiting sudden stops episodes to events for which the change in net capital flows exceed a certain threshold (for example Guidotti et al., 2004, fix this threshold at 5% of GDP), we might exclude episodes that occurred in countries characterized by a low capital flows volatility or by less open economies.

Our methodology differs from Calvo et al. (2004) in three main aspects. First, we measure capital flows on a quarterly, rather than on a yearly basis and compute the year-over-year changes to avoid seasonal fluctuations. Second, we compute the 3 years moving average and standard deviation of capital flows and not their historical average and standard deviations. By limiting the time horizon for the computation of the mean and the standard deviation, we provide a better instrument to detect "unexpected" reductions in net capital flows. Finally, whenever we identify two sudden stops episodes separated by only one quarter, we consider them as a unique episode.

We proxy the capital inflows k of country c in quarter q as the quarterly change in international reserves IR minus the quarterly current account CA:[1]

$$k_{c,q} = (IR_{c,q} - IR_{c,q-1}) - CA_{c,q}. \tag{20}$$

The year-over-year changes in capital flows are simply defined as $\Delta k_{c,q} = k_{c,q} - k_{c,q-4}$. We then identify sudden stops whenever the following condition is met:

$$\Delta k_{c,q} < \mu(\Delta k_{c,q}) - 2\sigma(\Delta k_{c,q}), \tag{21}$$

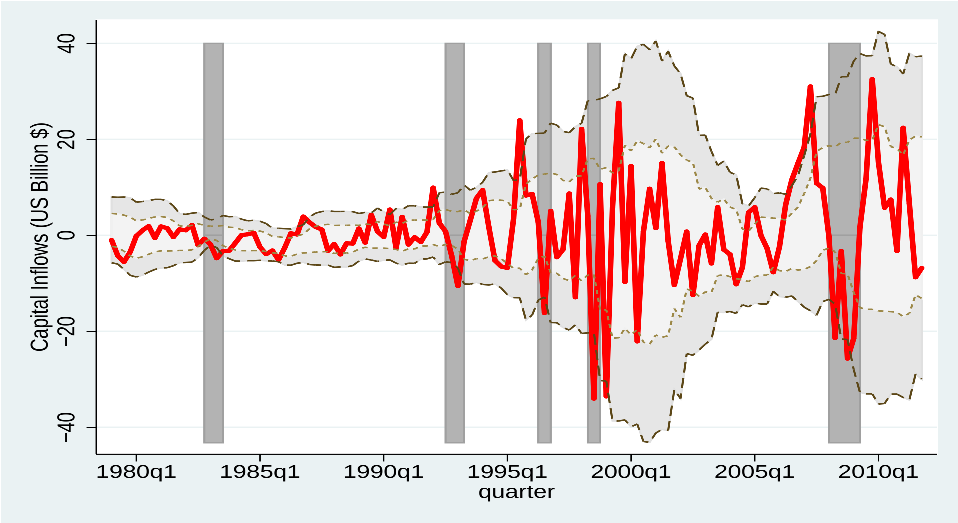
where μ and σ represent the three years moving average and standard deviation, respectively.

As an example, the grey areas in Figure 2 depicts the sudden stops identified for Brazil from 1979 to 2011. The solid line plots $\Delta k_{c,q}$, while values that lay two (one) standard deviations below the three years moving average are depicted by the dashed (short dashed) line. During this period, Brazil experienced five sudden stops.

Using this methodology we identify, during the period 1970-2011, 329 sudden stop episodes for a sample of 128 countries: 205 of them occurred in

[1] All series are measured in constant 2005 dollars.

Figure 2: Sudden stops in Brazil, 1981-2011



emerging markets and developing countries (as classified by the IMF World Economic Outlook) and 124 in advanced economies. Figure 3 shows the dispersion of sudden stops across countries. Before the 1990s, however, there are missing data for many emerging market economies, which may explain the relatively fewer sudden stopes among those countries for the first twenty years of our sample. For the period 1990–2011, we observe 174 sudden stops in capital flows among emerging and developing countries and 83 developed economies. As expected, these events are much more common in emerging markets.

Figure 3: Sudden stop episodes across countries (1970-2011)

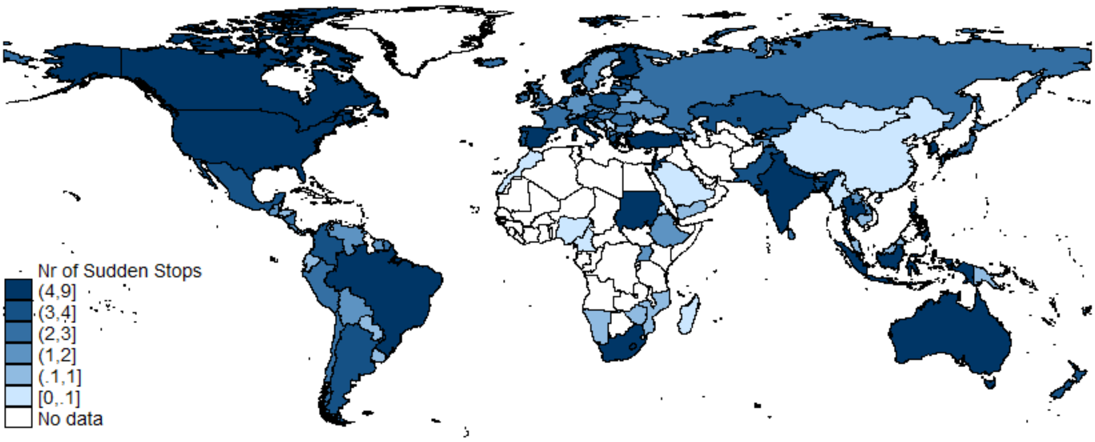
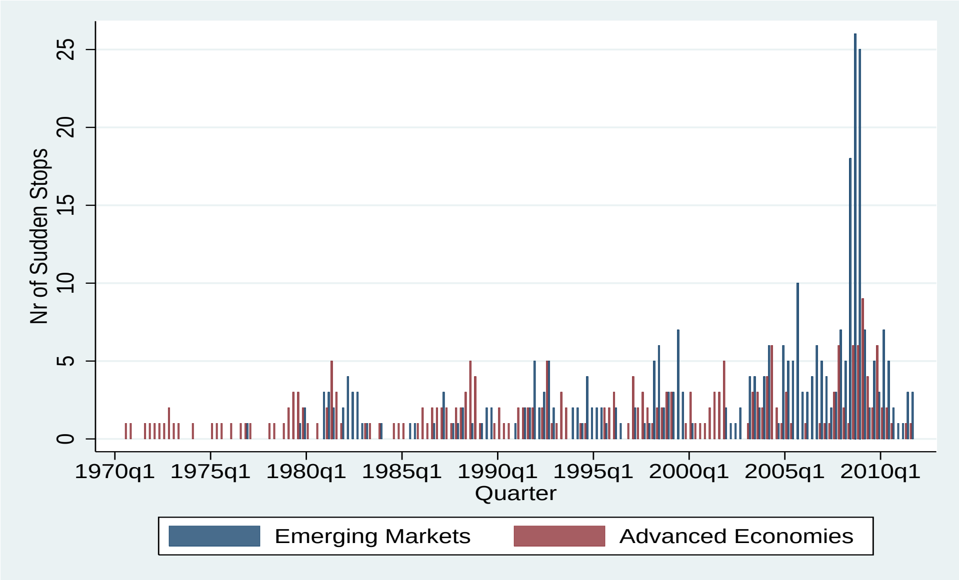


Figure 4: Frequency of sudden stops, 1970-2011



In Figure 4 we observe several sudden stop episodes among advanced economies during the European Monetary System crisis (1990 and 1992) and the Asian crisis (1998). In emerging markets these episodes are concentrated around the Mexican (1994 to 1995), Asian (1997), Russian (1998) and Argentinean (2001) crises. A large number of sudden stops in both emerging and developed economies is detected over the late 2000s, in the midst of the world financial crisis.

Calvo et al. (2004) find that more closed economies or those with a higher degree of dollar denominated debt have a higher probability of experiencing sudden stops. Following Rey and Martin (2006), we split our sample of advanced economies and of emerging markets in terms of their openness to trade. We measure trade openness as the average over the whole period of exports plus imports as a ratio of GDP. We then classify as more open economies those for which the openness ratio is above the median of its group. Figures 5 and 6 confirm that, indeed, more closed economies experience an higher number of sudden stops among both advanced economies and emerging markets, during the period 1970-2011.

Figure 5: Frequency of sudden stops in advanced economies, 1970-2011

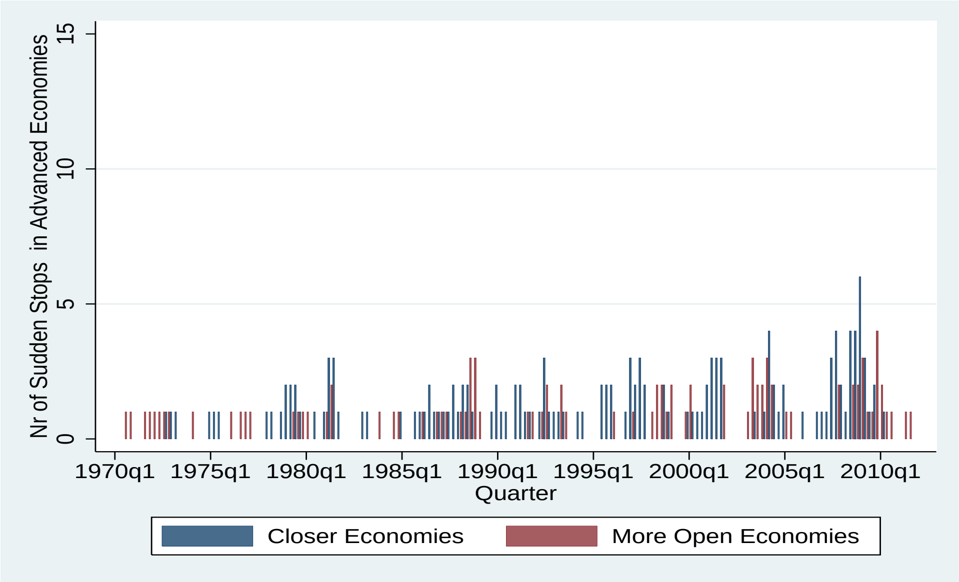
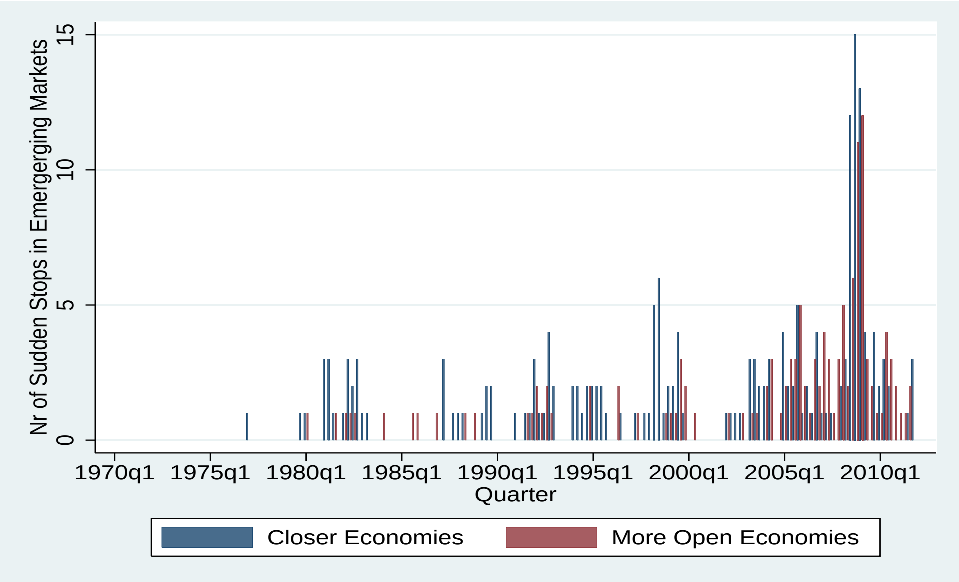


Figure 6: Frequency of sudden stops in emerging markets, 1970-2011



3.2 Episodes of abrupt real exchange rate depreciation

Little attention has been dedicated in the literature to identifying episodes of abrupt depreciation of both the real exchange rate (RER). Empirical studies in exchange rate variations commonly focus their attention on nominal exchange rate movements and, more specifically, on currency crises (see, among others, Milesi-Ferretti and Razin, 2000; Laeven and Valencia, 2012).

We identify abrupt depreciations of the RER using the same methodology followed for the identification of sudden stops, described in the previous subsection. More precisely, a RER depreciation occurs when the year-over-year increase in quarterly real exchange rate is larger than two standard deviations above its mean. Moreover, the episode window of a RER depreciation: i) begins once the RER depreciation is higher than one standard deviation above its mean; ii) ends when the RER increase falls below one standard deviation of its mean.

The real exchange rate ε of country c in quarter q is measured as the nominal exchange exchange rate E, defined as domestic currency per unit of U.S. dollar, multiplied by the ratio between the consumer price index in the U.S. and in country c[2]:

$$\varepsilon_{c,q} = E_{c,q} * \frac{CPI_{US,q}}{CPI_{c,q}} \tag{22}$$

We then compute the yearly change of the quarterly RER as: $\Delta\varepsilon_{c,q} = ln(\varepsilon_{c,q}/\varepsilon_{c,q-4})$. Finally, we consider an abrupt RER depreciation as an episode for which: $\Delta\varepsilon_{c,q} > \mu(\Delta\varepsilon_{c,q}) + 2\sigma(\Delta\varepsilon_{c,q})$, where μ and σ represent the three years moving average and standard deviation, respectively.

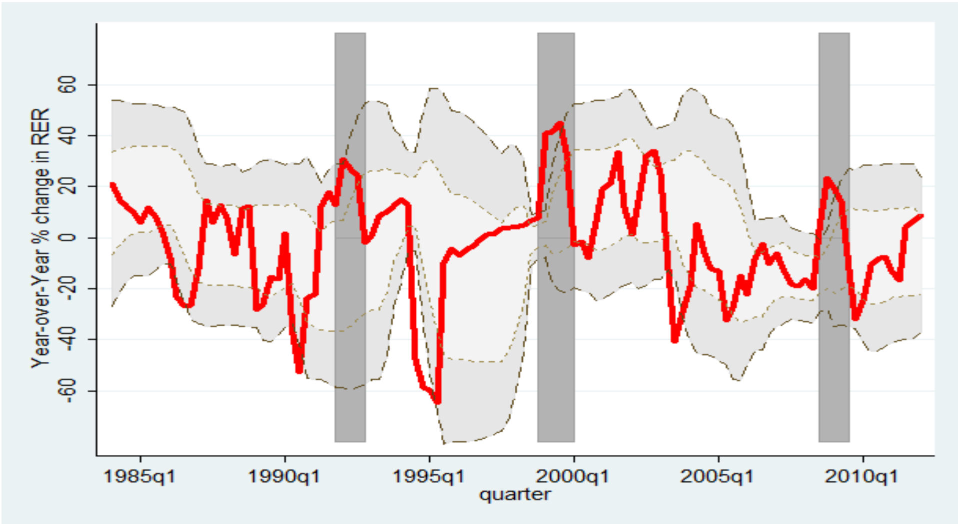
The RER is a good measure of the relative price incentives for trade with the U.S. Countries, however, have several trade partners, and the U.S. is not always the main one. Hence, we also proceed with the identification of REER depreciation episodes. Indeed, since the REER measures the value of a currency against a weighted average of foreign currencies, these events might provide a more clear idea of the impact of a depreciation on the trade balance and the current account of the country. The only drawback of using these data is that their availability is restricted to a smaller sample of countries and mainly for a shorter time horizon (from 1995 to 2011).

The IMF defines the REER so that an increase in the value represents a real appreciation of the home currency. To facilitate a comparison of the results obtained for RER and REER we compute the year-over-year change of the quarterly REER as $\Delta REER_{c,q} = ln(REER_{c,q-4}/REER_{c,q})$. Consequently, a positive variation of the REER represents a real depreciation of the home country. We identify abrupt REER depreciation following the same methodology used for the identification of RER depreciations.

The gray areas in Figure 7 are the abrupt RER depreciation episodes identified for Brazil from 1981q1 to 2011q4. The solid line plots $\Delta RER_{c,q}$, while values that lay one and two standard deviations above the three years moving average are depicted by the lower and the upper dashed lines. During

[2]Exchange rate data is taken from the IMF's *International Financial Statistics* (IFS).

Figure 7: ΔRER and depreciation episodes in Brazil (1981-2011)



this period, Brazil experienced four abrupt RER depreciation episodes. The abrupt RER depreciation episode that took place from 1998q3 to 1999q4, for example, begins once the change in RER jumps one standard deviation above the mean (1998q3), overtaking two standard deviations in 1999q1. The episode window ends when the RER variation bounces back to a value below one standard deviation from the mean (1999q4).

Figure 8 presents the same analysis, while looking at REER depreciation episodes. Comparing the two figures, we see that RER and REER changes follow the same pattern and the depreciation episodes coincides in *almost* all cases, but not all of them: the REER presents an abrupt depreciation episode in 2002 that is not captured the RER. Also, between 1994 and 1995, the real appreciation of the Brazilian currency was not followed by an appreciation of the real effective rate. This event could have had a negative impact on the bilateral trade between Brazil and the US and only a marginal effect on the overall values of imports and exports of the country. Hence, although RER does not perfectly reflect REER, it is a reasonable proxy for it.

In a broad set of 64 developed and developing countries, for the period 1970–2011, we find 295 real exchange rate depreciation episodes and 227 real effective exchange rate depreciation events. Figure 9 shows how these episodes are spread across countries, whereas Figures 10 and 11 depict their frequency over time. Comparing these two figures we see a high concentration of RER depreciations episodes in some periods, while REER depreciations events are spread over time.

Figure 8: ΔREER and depreciation episodes in Brazil (1981-2011)

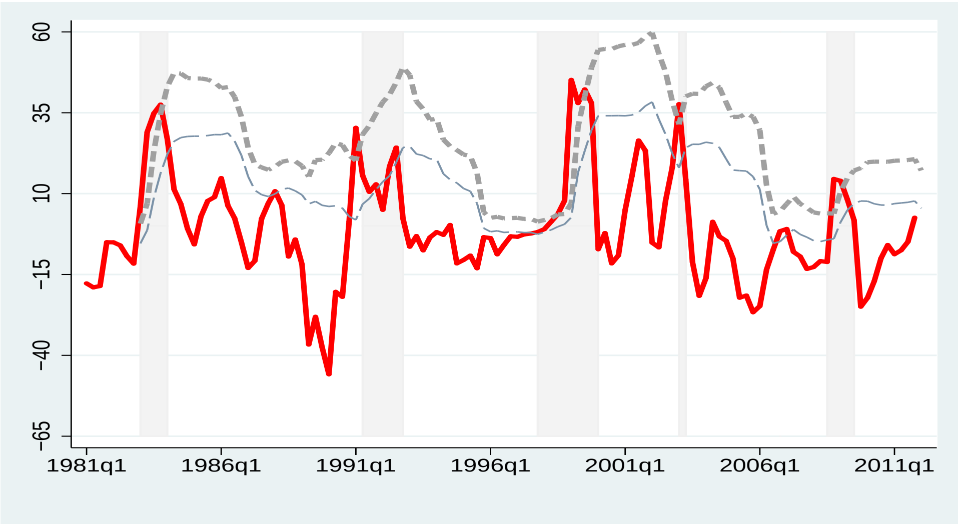
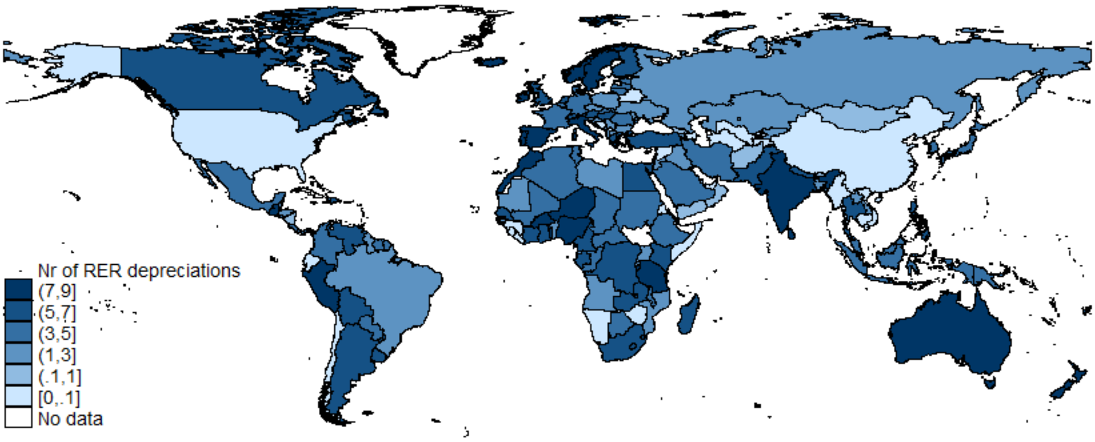


Figure 9: RER depreciation episodes across countries (1970-2011)

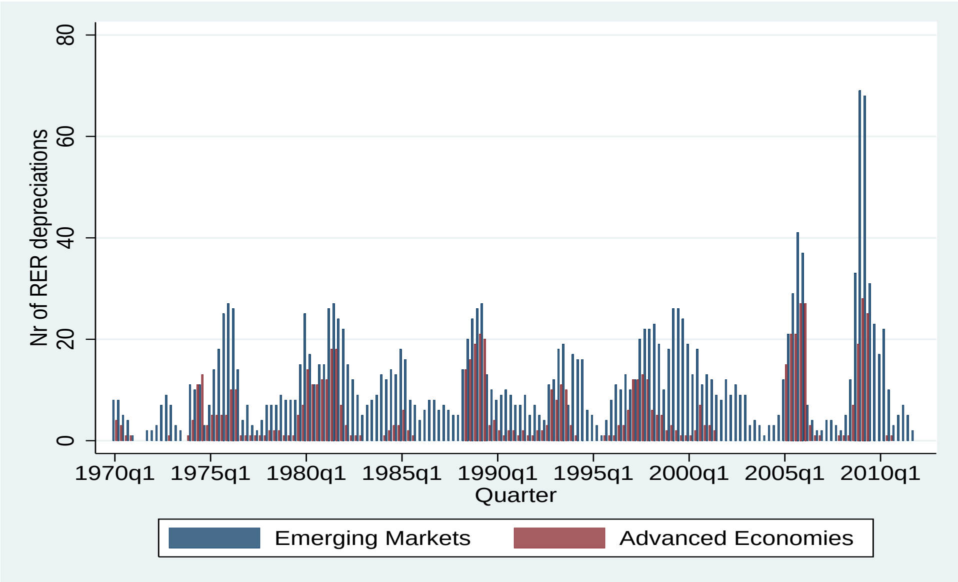


4 Empirical results

We investigate the impact of openness to trade on RER depreciation, current account and trade balance during episodes of sudden stops and of abrupt RER depreciation. Notice that our empirical analysis in based on cross section data in which each observation refers to an episode of either sudden stop or abrupt RER depreciation. Our main independent variable is the degree of trade openness, which we measure as the sum of goods exports and imports divided by GDP.

It is worth mentioning that our measure of openness is not exactly the

Figure 10: Frequency of RER depreciation episodes, 1970-2011

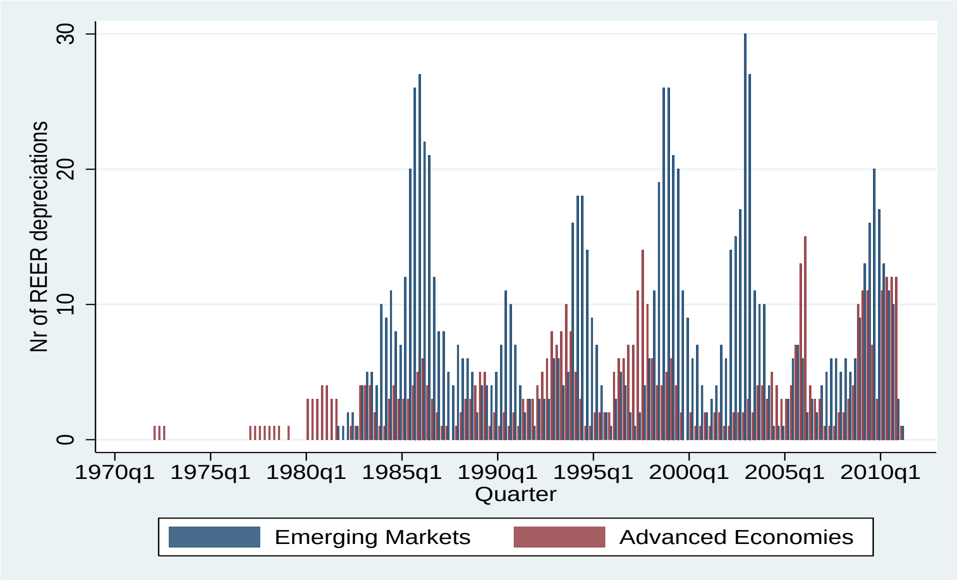


theoretical definition of openness, which we had defined as the share of tradables in consumption. Literally, tradable goods should be the sum of all good that could potentially be exported and the imported goods. We know, however, that there is a big difference between being *potentially* exported, and being *actually* exported. For a potentially exportable good to be exported there are non negligible costs involved, and a fast growing literature certifies that these fixed costs do prevent a large fraction of tradable goods to be actually traded. The tradable goods in the theoretical model refer to "goods which go easily between [the countries]", again, paraphrasing Ohlin. Hence, the sum of imports and exports is a good proxy for this kind of goods.

4.1 Openness, RER depreciation and current account reversals during sudden stops

Building on the extensive literature on sudden stops, our goal here is check the impact of openness on RER depreciations and current account adjustment during episodes of sudden stops in capital inflows. We start by looking at the correlation between openness and RER changes, controlling for the intensity of the sudden stop. We define a pre-episode window as the observations in the year preceding the beginning of a sudden stop, while an episode window is the period that goes from the beginning of the episode to the three quarters after its end. From the episode window, we extract the real exchange rate variations, whereas the trade openness is measured in the

Figure 11: Frequency of REER depreciation episodes, 1970-2011



pre-episode window. By using the lagged data (i.e. pre-episode window) of trade openness, we try to reduce endogeneity concerns with exchange rate variations.

In our cross-sectional analysis, some countries may appear more than once, when they suffer more than one sudden stop over the time range of our study. Therefore, in all our regressions we relax the assumption of independent distribution errors term across time, allowing the clustering of observations by country. We assume instead that the error term is i.i.d. across countries, but not necessarily for different observations within the same economy. All reported standard errors are adjusted for clustering.

Table 1: RER depreciation and openness during sudden stops

Dependent Variable:	Δ RER	Δ REER
Openness	-0.00044**	-0.00228
	(0.000)	(0.000)
Δ Capital Flows	-0.00000**	-0.00000
	(0.000)	(0.000)
Constant	0.03957*	0.38142
	(0.020)	(0.251)
Observations	285	176
Nr of countries	93	60
R-squared	0.026	0.099

Robust standard errors in parentheses. ** p<0.05, * p<0.1.

As a first glance at the data, Table 1 shows the result of a simple regression that tries to capture the correlation between openness and RER changes in episodes of sudden stops. In line with our expectations, we do find a negative correlation between trade openness and RER changes during sudden stops, while controlling for the change in capital flows, which is a measure of the intensity of the sudden stops. When we use the real effective exchange rate, the coefficient of openness is still negative, but not significant. The data set is much smaller when we use REER, which could be one possible explanation for these non significant coefficients. These results suggest that more open economies, when hit by sudden stops, endure a lower real exchange rate depreciation.

One problem with just looking are RER changes is that government intervention in the foreign currency market may, at least partially, prevent current account adjustment from occurring, and therefore we would observe smaller RER devaluations. If governments in more open countries are, for some reason, more prone to intervene to prevent depreciations, these interventions could be driving the results, instead of the mechanism described in the theoretical model.

Table 2: Current account and openness during sudden stops

Dependent variable: Changes in current account/GDP

	(1)	(2)	(3)	(4)	(5)	(6)
Openness	0.00020**	0.00021**	0.00019**	0.00017**	0.00023*	0.00070***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ RER	0.03940**	0.03816**	0.03733**	0.03906**	0.03290**	0.04042
	(0.017)	(0.017)	(0.015)	(0.016)	(0.014)	(0.035)
Δ Terms of Trade			0.14599**	0.13783**	0.13753**	0.14919***
			(0.060)	(0.064)	(0.063)	(0.052)
World Real Exports Growth		0.04030	0.17065***	0.16792**	0.19970**	0.13108*
		(0.039)	(0.063)	(0.066)	(0.078)	(0.077)
Exchange Rate Regime				-0.00442		
				(0.003)		
Dollarization					0.00023	
					(0.002)	
Levy Yeyati Dollarization						-0.00020
						(0.001)
IMF Emerging Mkt Dummy		0.01445**	-0.00132	-0.00157	-0.00242	0.01860
		(0.006)	(0.007)	(0.007)	(0.010)	(0.014)
Dummy '70s		0.01232				
		(0.012)				
Dummy '80s		0.01168	0.06972***	0.07254**	0.07401***	0.04292**
		(0.009)	(0.023)	(0.032)	(0.025)	(0.019)
Dummy '90s		0.00603	0.02732**	0.02712**	0.03288**	0.04159**
		(0.007)	(0.013)	(0.013)	(0.015)	(0.016)
Constant	0.00825	-0.00586	-0.00732	0.00489	-0.01115	-0.06321***
	(0.006)	(0.008)	(0.009)	(0.013)	(0.013)	(0.020)
Observations	281	281	187	182	147	105
Nr of countries	93	93	87	85	67	52
R-squared	0.051	0.077	0.138	0.130	0.143	0.212

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

It is more appropriate, actually, to investigate directly whether openness to trade has an impact of the relation between current accounts and real exchange rates. We do so by checking whether openness affects current account, once RER changes are controlled for. As shown in the first column of Table 2, in events of sudden stops, both trade openness and RER depreciation have a positive and significant effect on current account, as predicted by the theory.

Columns (2) to (6) in the table present the results of regressions adding additional controls to make sure that the result in column (1) is not being driven by omitted variables. We control for terms of trade and world exports growth, since these two variables would have a direct impact on trade balance. Terms of trade variation might be subject to endogeneity issues, so we take its average change in the pre-episode window. World export growth, on the other end, should not be endogenous to a specific country sudden stop episode, so we compute its average during the episode window. The coefficient for both variables is positive and significant, as expected: improvements in the terms of trade and higher world exports have a positive impact on trade balance, thus increasing the current account balance.

We add a dummy for emerging markets to capture possible differences between developed and emerging economies. These two type of economies differ in a number of ways, including the level of external debt, risk, trade patterns, among others, which could potentially affect how their current accounts respond to RER changes. We also control for time with three decade dummies, for the 1970s, 1980s and 1990s.

The impact of the emerging markets dummy is positive and significant in column (2), where terms of trade variation is not included. In all other regression its coefficient is not significantly different from zero.

In column (4) we control for exchange rate regime, using the classification suggested by Reinhart and Rogoff (2004), but its coefficient is not significantly different from zero.

Previous studies have found that the extent of financial dollarization plas an important role in triggering sudden stop episodes. We then include it as an additional explanatory variable of current account changes. Following Alesina and Wagner (2006), we measure debt dollarization as the currency mismatch in the government's balance sheet. This is computed as the ratio between net liability of the monetary authority denominated in the foreign currency and the amount of (fiat) money in circulation. However, the results in columns (5) and (6) do not indicate a significant impact of dollarization on current account changes in sudden stop events.

It is important to note that the coefficient of openness is robust to the inclusion of all the control variables described in the previous paragraphs. The results indicate that more open economies are able to achieve a higher improvement in their current account balances for a given RER depreciation.

Trade balance is an important part of current account, and current account reversals are achieved mainly by improvements in the trade balance. We thus re-do our empirical investigation using trade balance as dependent variable. The results, presented in Table 3. are qualitatively similar, with some important differences. First, exchange rate depreciation has a stronger impact on trade balance changes than in current account changes, as captured by the larger coefficient of this variable in the trade balance regressions in Table 3 compared to the current account regressions in Table 2. The same is true for terms of trade changes: they have a stronger impact on changes in trade balances than in current accounts.

Conversely, openness seems to predict better changes in current account than in trade balance. The coefficient of openness is estimated with less precision in the trade balance regression, besides having smaller values.

Finally, exchange rate regimes and dollarization, which do not have a significant impact on current account balance changes, have a negative and significant impact on trade balance changes. The results in columns (4) and (5) of Table 3 indicate that countries with more fixed exchange rates and with a higher share of dollar denominated debt have a smaller improvement of trade balances during sudden stops.

Table 3: Trade balance and openness during sudden stops

Dependent variable: Changes in trade balance/GDP

	(1)	(2)	(3)	(4)	(5)	(6)
Openness	0.00015	0.00018*	0.00017*	0.00012	0.00026*	0.00062***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ RER	0.09549***	0.08514**	0.10358**	0.11420**	0.07062*	0.12658*
	(0.035)	(0.037)	(0.047)	(0.047)	(0.042)	(0.072)
Δ Terms of Trade			0.27692***	0.28273***	0.22953***	0.28052***
			(0.071)	(0.077)	(0.070)	(0.095)
World Real Exports Growth		0.02398	0.10017	0.10050	0.08877	0.03114
		(0.063)	(0.084)	(0.079)	(0.122)	(0.101)
Exchange Rate Regime				-0.00738**		
				(0.003)		
Dollarization					-0.00457***	
					(0.001)	
Levy Yeyati Dollarization						0.00098
						(0.001)
IMF Emerging Mkt Dummy		0.01143	-0.00241	-0.00261	-0.00159	0.00579
		(0.008)	(0.008)	(0.008)	(0.010)	(0.014)
Dummy '70s		0.01600				
		(0.012)				
Dummy '80s		0.01257**	0.06165**	0.07792***	0.06110***	0.04107*
		(0.006)	(0.023)	(0.029)	(0.022)	(0.022)
Dummy '90s		0.01553	0.02661*	0.02647*	0.02835	0.02898
		(0.010)	(0.016)	(0.014)	(0.021)	(0.021)
Constant	0.00580	-0.01035	-0.00932	0.01069	-0.01211	-0.05840***
	(0.006)	(0.009)	(0.009)	(0.012)	(0.013)	(0.018)
Observations	264	264	174	170	134	97
Nr of countries	88	88	81	78	62	46
R-squared	0.045	0.059	0.140	0.156	0.139	0.192

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

We have shown that during sudden stops, countries more open to trade will achieve the same changes in current account and trade balance with a lower depreciation of their exchange rates. We estimate quantitatively this effect. In our sample, the degree of openness to trade varies significantly across countries, having a mean of 84% and a standard deviation of 58%. Given the coefficients presented in column (3) of Tables 2 and 3, a country with a degree of openness equal to the mean will have to depreciate its currency by less than 1% in order to obtain an increase of its current account over GDP equal to 2.6% (1.75% for the case of trade balance). For countries with a lower degree of openness, say, equal to the 1st quartile (48%), a real exchange rate depreciation of more than 5% / 3.8% is needed in order to obtain the same variation in the current account / trade balance.

4.2 Openness, RER depreciation and current account reversals during abrupt depreciations

We follow the same empirical strategy to study for events of abrupt RER depreciation.

Table 4: Current account and openness during RER depreciation episodes

Dependent variable: Changes in current account/GDP

	(1)	(2)	(3)	(4)	(5)	(6)
Openness	0.00014**	0.00013**	0.00015**	0.00015**	0.00020*	0.00062***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ RER	0.05825***	0.05419**	0.05790*	0.05848*	0.05014	0.13995***
	(0.022)	(0.022)	(0.032)	(0.033)	(0.030)	(0.039)
Δ Terms of Trade			0.09022*	0.09069*	0.08246	0.08012
			(0.049)	(0.050)	(0.052)	(0.086)
World Real Exports Growth		0.01250	0.03879	0.03987	-0.01570	-0.03582
		(0.047)	(0.088)	(0.085)	(0.066)	(0.082)
Exchange Rate Regime				-0.00048		
				(0.004)		
Dollarization					-0.00003	
					(0.001)	
Levy Yeyati Dollarization						0.00213***
						(0.001)
IMF Emerging Mkt Dummy		0.01367***	0.01798**	0.01814**	0.01680	0.00844
		(0.005)	(0.007)	(0.007)	(0.010)	(0.014)
Dummy '70s		-0.00009				
		(0.008)				
Dummy '80s		-0.00131	0.00376	0.00402	-0.00544	0.02036
		(0.010)	(0.017)	(0.017)	(0.016)	(0.024)
Dummy '90s		-0.00062	0.00878	0.00947	0.00037	0.00966
		(0.009)	(0.012)	(0.012)	(0.009)	(0.014)
Constant	-0.00252	-0.00861	-0.01552	-0.01476	-0.01041	-0.05535**
	(0.005)	(0.009)	(0.012)	(0.015)	(0.014)	(0.027)
Observations	318	318	194	192	149	93
Nr of countries	93	93	92	92	73	52
R-squared	0.045	0.062	0.082	0.083	0.078	0.165

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4 presents the results of the regressions explaining current account changes in events of abrupt changes in exchange rates. Comparing to the results in Table 2, important similarities are noticed. Current account improvement tends to be larger when RER depreciation is larger and when the economy is more open to trade. These effects are significant and robust to the inclusion of the following control variables: the terms of trade variation, the world exports growth, exchange rate regime, the degree of dollarization, emerging market dummies, and decade dummies.

There are, though, some noteworthy difference between the results for the two types of events. Terms of trade changes and world exports growth seem to explain less changes in current account balances among abrupt exchange rate devaluation events, compared to sudden stop events. More specifically, the coefficient of world exports growth is not significatively different from zero in all regression in Table 4, whereas it is positive and significant in the regressions presented in Table 2. As for terms of trade variation, its coefficient is not significant in the regressions reported in columns (5) and (6) of Table 4, that is, when dollarization level is controlled for.

Table 5: Trade balance and openness during RER depreciation episodes

Dependent variable: Changes in trade balance/GDP

	(1)	(2)	(3)	(4)	(5)	(6)
Openness	0.00020***	0.00018***	0.00022***	0.00021***	0.00029**	0.00032
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ RER	0.05333**	0.05393**	0.04026	0.05181	0.11216***	0.08134***
	(0.023)	(0.026)	(0.031)	(0.034)	(0.026)	(0.027)
Δ Terms of Trade			0.16002***	0.16477***	0.13644***	0.14633*
			(0.041)	(0.044)	(0.046)	(0.079)
World Real Exports Growth		-0.02353	0.02386	0.03289	0.01100	0.10255
		(0.064)	(0.084)	(0.087)	(0.085)	(0.122)
Exchange Rate Regime				-0.00677*		
				(0.004)		
Dollarization					-0.00084	
					(0.001)	
Levy Yeyati Dollarization						0.00203***
						(0.001)
IMF Emerging Mkt Dummy		0.01418**	0.02214**	0.02358**	0.02150*	0.00843
		(0.007)	(0.010)	(0.010)	(0.012)	(0.023)
Dummy '70s		0.00933				
		(0.013)				
Dummy '80s		-0.01342	0.00825	0.01460	-0.01857	0.01056
		(0.014)	(0.014)	(0.015)	(0.012)	(0.022)
Dummy '90s		-0.01334	0.00136	0.00719	0.00750	0.01257
		(0.011)	(0.012)	(0.013)	(0.009)	(0.015)
Constant	-0.00368	-0.00693	-0.02045*	-0.00730	-0.02352*	-0.03775
	(0.006)	(0.010)	(0.011)	(0.013)	(0.014)	(0.037)
Observations	502	502	260	253	162	110
Nr of countries	128	128	114	112	70	61
R-squared	0.020	0.030	0.094	0.104	0.121	0.085

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In Table 5 we present the results obtained under the same specifications as in Table 4, but looking this time at the impact of trade openness on the trade balance variation. Here, again, RER depreciation and openness have a positive and significant impact on trade balance, and this impact is robust to the inclusion of a number of control variables. The changes in terms of trade, whose coefficient is not significant explaining current account changes in columns (5) and (6) of Table 4, have a positive and significant impact on trade balance improvement in all specifications of the empirical model, as shown in columns (3) to (6) of Table 5.

5 Concluding remarks

The empirical investigation carried out in this paper aims to verify whether openness to trade facilitates current account reversal. To this end, we identify events of sudden stops of capital flows and of abrupt real exchange rate depreciations, and we check whether openness helps explaining current account and trade balance improvements. In line with our expectation, we find that the degree of openness have a positive effect on changes in current account and on trade balance.

Our results indicate that more open economies can rebalance their current account and trade balance with smaller domestic currency devaluations after an external shock, such as a sudden stop or currency crisis. Hence, more open economies would be better able to surpass external shocks that entails the need of current account reversals.

We present a theoretical framework that highlights the mechanism through which openness should affect the relation between current account changes and real exchange depreciation. It should be noted that in Notice that, according to our simple framework, the size of the RER depreciation has not impact on welfare. Welfare changes depend on the size of the income shocks that cause the sudden stop, but not on how the economy adapts to it. More specifically, if it adjusts through major relative price changes or through income effects.

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