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 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 those 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.

JEL classification: F32, F37.

1 Introduction

Both advanced and emerging economies have experienced exponential growth of capital flows over the past twenty years. On the years 2000s, this growth was accompanied very large and mounting current account imbalances, raising concerns with respect to the potential adverse consequences of abrupt interruptions of those flows and current account reversals. In particular, the magnitude of exchange rate depreciation over the adjustment process has been an important element in the debate, 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 re-
sources through trade balance surpluses. Relative prices of tradable goods
would then have to fall, implying a terms of trade deterioration and cur-
rency 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 eas-
ily 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 de-
termining 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 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 an higher de-
gree of openness to trade decrease the probability of exchange rate crashes.
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 present 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 \((y^N_t)\) goods. They allocate their consumption \((C_t)\) between those two goods goods, by maximizing the following expected utility function:

\[
U = \sum \beta^t E \left[ u \left( C_t \right) \right],
\]

where \(\beta\) is the discount factor and \(c_t\) is the consumption basket. For simplicity, we assume Cobb-Douglas preferences, so that:

\[
C_t = \left( c^T_t \right)^\gamma \left( c^N_t \right)^{1-\gamma},
\]

where \(\gamma\) 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 \(p^N_t\) the price of nontradables, the household’s budget constraint can be rewritten as:

\[
b_{t+1} + c^T_t + p^N_t c^N_t = y^T_t + p^N_t y^N_t + R b_t,
\]

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:

\[
b_{t+1} \geq -k y^T_t.
\]

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

\[
c^N_t = y^N_t,
\]

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

\[
c^T_t = y^T_t + R b_t - b_{t+1}.
\]

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 is 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:

\[
\bar{c}^T = \left( \frac{R - 1}{R} \right) \left( \sum_{t=0}^{\infty} R^{-t} y_t^T + Rb_0 \right)
\] (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:

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

which is constant at \( p^N \) in this case with non binding credit constraint.

Defining the real exchange rate \( \varepsilon \) 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, it 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 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 (\( \bar{y}_T^T \)) that yields 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:

\[
\bar{c}^T = \bar{y}^T + (R - 1) b_0.
\] (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:

\[
(\bar{y}_0^T - y_0^T) R = y_1^T - \bar{y}^T.
\] (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:

$$\bar{b}_1 - b_0 = y_0^T - \bar{y}^T < 0.$$  \hspace{1cm} (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 $\bar{b}_2 - \bar{b}_1 = - (\bar{b}_1 - b_0)$. 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 impacts 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:

$$y_0^T < \frac{\bar{y}^T - b_0}{1 + k}.$$  \hspace{1cm} (12)

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

$$b_1 = -ky_0^T > \bar{b}_1.$$  \hspace{1cm} (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:

$$c_0^T = (1 + k) y_0^T + Rb_0. \hspace{1cm} (CC)$$  \hspace{1cm} (14)

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

The price of nontradables is now equal to:

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

which is then lower than the unconstrained level, which means a more depreciated real exchange rate: $\bar{\varepsilon}_0 > \bar{\varepsilon}$.

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

$$b_1 - b_0 > \bar{b}_1 - b_0,$$  \hspace{1cm} (16)
since \( b_1 > \bar{b}_1 \), by construction. Furthermore, the change the difference between the two value of the current account is captured by the drop in consumption. Using equation (6) to compute consumption when the endowment is equal to \( y_0^T \), and equation (9) for the consumption in the unconstrained economy, we have that:

\[
c^T - c_0^T = (b_1 - b_0) - (\bar{b}_1 - b_0),
\]

(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:

\[
\text{Openness}_t = \frac{c_t^T}{p_t^N c_t^N + c_t^T} = \gamma.
\]

(18)

Consider two economies, denoted O and C, differing on their degree of openness, with \( \gamma_O > \gamma_C \), i.e., O is more open than 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:

\[
\bar{y}_T^O = \frac{\gamma_O (1 - \gamma_C)}{\gamma_C (1 - \gamma_O)} (\bar{y}_T^C + (R - 1)b_{0C}) - (R - 1)b_{0O}.
\]

(19)

Suppose these economies are initially both consuming at the unconstrained consumption level with 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 shocks induce the same decrease in tradables consumption. Hence, they satisfy the condition:

\[
\bar{y}_0^O - \bar{y}_0^C = \frac{\bar{y}_T^O - \bar{y}_T^C}{1 + \bar{k}}.
\]
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 $\bar{c}_T^O > \bar{c}_T^C$. 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, 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 $p^N$ 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 $BO$ for the more open economy and at point $BC$ for the more closed one.

Despite the fact that the change in the consumption of tratables is equal for both economies ($\Delta c^T_O = \Delta c^T_C$), the more closed economy exhibits a larger decrease on the relative price of nontradable goods. This imply that the shock to the tratables 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 in 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 deviation below its mean. As common in the literature, we set the beginning of the sudden stops 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 exceed 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 \( CA \):

\[
k_{c,q} = (IR_{c,q} - IR_{c,q-1}) - CA_{c,q}.
\]

(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:

\[
\Delta k_{c,q} < \mu(\Delta k_{c,q}) - 2\sigma(\Delta k_{c,q}),
\]

(21)

where \( \mu \) and \( \sigma \) 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 lays 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 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

\footnote{All series are measured in constant 2005 dollars.}
are missing data for many emerging market economies, which may explain
the relatively few sudden stops 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.

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 con-
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 increase is higher than one standard deviation above the mean; ii) ends when the RER increase falls below one standard deviation.

The real exchange rate $\varepsilon$ of country $c$ in quarter $q$ is measured as the nominal 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 $c$:

$$\varepsilon_{c,q} = E_{c,q} \times \frac{CPI_{US,q}}{CPI_{c,q}}$$

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 $\mu$ and $\sigma$ represent the three years moving average and standard deviation, respectively.

The RER is a goods 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 $\Delta REER_{c,q}$, 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

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2Exchange rate data is taken from the IMF’s *International Financial Statistics* (IFS).
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 coincide 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 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 actually exported there are non negligible fixed cost 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 counties]”, 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 trade balance 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 before the beginning of a sudden stop, while an episode window is the period that goes from the beginning to the three quarters after its end. From the episode window, we extract the real and real effective exchange rate variations, whereas the trade openness is measured in the pre-episode window. By using the lagged data (i.e. pre-episode window) of trade openness, we try to reduce any 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 the independent distribution errors term across time, allowing the clustering of observations by country. Consequently, we assume 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

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>∆ RER</th>
<th>∆ REER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness</td>
<td>-0.00044**</td>
<td>-0.00228</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>∆ Capital Flows</td>
<td>-0.00000**</td>
<td>-0.00000</td>
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<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.03957*</td>
<td>0.38142</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.251)</td>
</tr>
</tbody>
</table>

| 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 date, Table 1 shows the result of a simple regression to try 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 at 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

<table>
<thead>
<tr>
<th>Dependent variable: Changes in current account/GDP</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness</td>
<td>0.00020**</td>
<td>0.00021**</td>
<td>0.00019**</td>
<td>0.00017**</td>
<td>0.00023*</td>
<td>0.00070***</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Δ RER</td>
<td>0.003949**</td>
<td>0.00565**</td>
<td>0.00734**</td>
<td>0.00306**</td>
<td>0.0220**</td>
<td>0.04012</td>
</tr>
<tr>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.015)</td>
<td>(0.016)</td>
<td>(0.014)</td>
<td>(0.035)</td>
<td></td>
</tr>
<tr>
<td>Δ Terms of Trade</td>
<td>0.14599**</td>
<td>0.13783**</td>
<td>0.13753**</td>
<td>0.14919***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.060)</td>
<td>(0.064)</td>
<td>(0.064)</td>
<td>(0.063)</td>
<td>(0.052)</td>
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</tr>
<tr>
<td>World Real Exports Growth</td>
<td>0.04000</td>
<td>0.17065***</td>
<td>0.16792**</td>
<td>0.19070***</td>
<td>0.13108*</td>
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</tr>
<tr>
<td>(0.039)</td>
<td>(0.063)</td>
<td>(0.066)</td>
<td>(0.078)</td>
<td>(0.077)</td>
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<tr>
<td>Exchange Rate Regime</td>
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<tr>
<td>(0.003)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Dollarization</td>
<td>0.00023</td>
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<td>(0.002)</td>
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</tr>
<tr>
<td>Levy Yeyati Dollarization</td>
<td>-0.00020</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMF Emerging Mk.t Dummy</td>
<td>0.01445**</td>
<td>-0.00132</td>
<td>-0.00157</td>
<td>-0.00242</td>
<td>0.01860</td>
<td></td>
</tr>
<tr>
<td>(0.006)</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td>(0.010)</td>
<td>(0.014)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy ’70s</td>
<td>0.01232</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.012)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy ’80s</td>
<td>0.01686</td>
<td>0.00572**</td>
<td>0.02724**</td>
<td>0.04501***</td>
<td>0.04292**</td>
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</tr>
<tr>
<td>(0.009)</td>
<td>(0.023)</td>
<td>(0.032)</td>
<td>(0.025)</td>
<td>(0.019)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy ’90s</td>
<td>0.00603</td>
<td>0.02732**</td>
<td>0.02742**</td>
<td>0.03888**</td>
<td>0.04159**</td>
<td></td>
</tr>
<tr>
<td>(0.007)</td>
<td>(0.013)</td>
<td>(0.015)</td>
<td>(0.015)</td>
<td>(0.016)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.00825</td>
<td>-0.00586</td>
<td>-0.00732</td>
<td>0.00489</td>
<td>-0.01113</td>
<td>-0.00321***</td>
</tr>
<tr>
<td>(0.006)</td>
<td>(0.008)</td>
<td>(0.009)</td>
<td>(0.013)</td>
<td>(0.020)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Observations 281 281 187 182 147 105
Nr of countries 93 93 87 85 67 52
R-squared 0.054 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 account and real exchange rate. We do that 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 deprec-
ation 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 change 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 is average change in the pre-episode window. World export growth, on its turn, 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 difference 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 and 1970s dummy are not included. In all other regression its coefficient is not significantly different from zero. Notice that, due to lack of data, the 1970s data contains mostly developed country, as can be seen in Figure 4. Hence, there is a correlation between the emerging markets and the 1970s dummies, which could be behind these results. Moreover, terms of trade changes also captures some of the difference in behavior between emerging markets and developed economies regarding current account reversal during sudden stops.

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

Previous findings have found that extent of financial dollarization played 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 then repeat for trade balance the empirical investigation we carried for current account. 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 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

<table>
<thead>
<tr>
<th>Dependent variable: Changes in trade balance/GDP</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness</td>
<td>0.00015</td>
<td>0.00018*</td>
<td>0.00017*</td>
<td>0.00012</td>
<td>0.00026*</td>
<td>0.00062***</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Δ RER</td>
<td>0.09549***</td>
<td>0.08514***</td>
<td>0.16356***</td>
<td>0.11430***</td>
<td>0.07062*</td>
<td>0.12658*</td>
</tr>
<tr>
<td>(0.035)</td>
<td>(0.037)</td>
<td>(0.047)</td>
<td>(0.047)</td>
<td>(0.042)</td>
<td>(0.072)</td>
<td>(0.095)</td>
</tr>
<tr>
<td>Δ Terms of Trade</td>
<td>0.27622***</td>
<td>0.26273***</td>
<td>0.23910***</td>
<td>0.26852***</td>
<td>0.26752***</td>
<td>0.26752***</td>
</tr>
<tr>
<td>(0.071)</td>
<td>(0.077)</td>
<td>(0.077)</td>
<td>(0.070)</td>
<td>(0.095)</td>
<td>(0.095)</td>
<td>(0.095)</td>
</tr>
<tr>
<td>World Real Exports Growth</td>
<td>0.02398</td>
<td>0.10017</td>
<td>0.10050</td>
<td>0.00877</td>
<td>0.03114</td>
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<tr>
<td>(0.063)</td>
<td>(0.084)</td>
<td>(0.079)</td>
<td>(0.122)</td>
<td>(0.101)</td>
<td>(0.101)</td>
<td>(0.101)</td>
</tr>
<tr>
<td>Exchange Rate Regime</td>
<td>-0.00738**</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
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<tr>
<td>Dollarization</td>
<td>-0.00477***</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Levy Yeyati Dollarization</td>
<td>0.00098</td>
<td>0.00098</td>
<td>0.00098</td>
<td>0.00098</td>
<td>0.00098</td>
<td>0.00098</td>
</tr>
<tr>
<td>IMF Emerging Mkt Dummy</td>
<td>0.01143</td>
<td>-0.00241</td>
<td>-0.00261</td>
<td>-0.00159</td>
<td>0.00579</td>
<td>0.00579</td>
</tr>
<tr>
<td>(0.088)</td>
<td>(0.088)</td>
<td>(0.088)</td>
<td>(0.088)</td>
<td>(0.088)</td>
<td>(0.088)</td>
<td>(0.088)</td>
</tr>
<tr>
<td>Dummy 70s</td>
<td>0.01600</td>
<td>0.01600</td>
<td>0.01600</td>
<td>0.01600</td>
<td>0.01600</td>
<td>0.01600</td>
</tr>
<tr>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>Dummy 80s</td>
<td>0.01257***</td>
<td>0.01657***</td>
<td>0.01792***</td>
<td>0.01619***</td>
<td>0.04107*</td>
<td>0.04107*</td>
</tr>
<tr>
<td>(0.006)</td>
<td>(0.023)</td>
<td>(0.023)</td>
<td>(0.023)</td>
<td>(0.022)</td>
<td>(0.022)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>Dummy 90s</td>
<td>0.01553</td>
<td>0.02661*</td>
<td>0.02647*</td>
<td>0.02835</td>
<td>0.02898</td>
<td>0.02898</td>
</tr>
<tr>
<td>(0.010)</td>
<td>(0.016)</td>
<td>(0.014)</td>
<td>(0.021)</td>
<td>(0.021)</td>
<td>(0.021)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.00580</td>
<td>-0.00335</td>
<td>-0.00532</td>
<td>0.01089</td>
<td>-0.01211</td>
<td>-0.05410***</td>
</tr>
<tr>
<td>(0.006)</td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.012)</td>
<td>(0.013)</td>
<td>(0.013)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>Observations</td>
<td>264</td>
<td>264</td>
<td>174</td>
<td>170</td>
<td>134</td>
<td>97</td>
</tr>
<tr>
<td>Nr of countries</td>
<td>88</td>
<td>88</td>
<td>81</td>
<td>76</td>
<td>62</td>
<td>46</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.045</td>
<td>0.059</td>
<td>0.140</td>
<td>0.156</td>
<td>0.139</td>
<td>0.192</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
4.2 Openness, RER depreciation and current account reversals during abrupt depreciations

We repeat for events of abrupt RER depreciation the empirical study carried on in the previous section for sudden stop events.

Table 4: Current account and openness during RER depreciation episodes

<table>
<thead>
<tr>
<th>Dependent variable: Changes in current account/GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>Openness</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Δ RER</td>
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<tr>
<td>Δ Terms of Trade</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>World Real Exports Growth</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Exchange Rate Regime</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Dollarization</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Levy Yeyati Dollarization</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>IMF Emerging Mkt Dummy</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Dummy ’70s</td>
</tr>
<tr>
<td></td>
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<td>Dummy ’80s</td>
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<td>Dummy ’90s</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Constant</td>
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<tr>
<td></td>
</tr>
</tbody>
</table>

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, we see that the results are very similar to those in sudden stop events. 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 significantly different from zero in all regression in Table 4, whereas it is positive and significant in all regressions in Table ??.

As for terms of trade variation, its coefficient is not significant in the regressions reported in columns (5) and
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 check 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 improvement. 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 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 presents the mechanism through which openness should affect the relation between current account changes and real exchange depreciation. 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 adjust through major relative price changes or through income effects.

References


