Currency Devaluation and Stock Market Response: An Empirical Analysis

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Abstract

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JEL classification: G14, G15

Keywords: currency devaluation, stock market response, macroeconomic factors

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Abstract

We study local stock market reaction to currency devaluations by a country's central bank. Using daily data, we examine the returns of stock markets in 27 countries around 85 announcements of devaluations. Our analysis indicates that devaluations are often anticipated by the local stock markets and that there are significant negative abnormal returns even one year prior to the announcement of the devaluation. This negative trend persists for up to 30 days following the announcement. However, one year after the devaluations, the average abnormal returns are significantly positive, suggesting a reversal in trend. On average, the dollar value of the equity market declines by less than the currency devaluation, and devaluations typically have a more negative effect on developing country stock markets. Guided by the theoretical literature, we conduct a cross-sectional analysis of the relation between the local stock market's abnormal returns and key macroeconomic variables. We find that stock markets drop more if the currency had a greater past real depreciation, if inflation is high, or if the capital account has decreased more.

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I. Introduction

Equilibrium models of international asset pricing (e.g., Adler and Dumas, 1983) suggest that deviations from purchasing power parity translate into currency risk for equity returns in global markets. For countries that follow a floating exchange rate system, this currency risk may be measured as the coefficient of the regression of the stock returns on the currency returns (Adler and Dumas, 1984; and Jorion, 1990). However, for many countries that follow a fixed or managed floating exchange rate system, currency prices remain constant or in a very narrow band until the central bank announces a devaluation. Models of international asset pricing (e.g., Stulz, 1981; and Adler and Dumas, 1984) predict that such devaluations will have a significant impact on asset prices, and to the extent that the real cash flows of the firms in these countries are affected by the devaluations, the security prices will also change (a competitive effect for example). We empirically examine the impact of devaluation announcements on stock markets to see how these international asset pricing models, as well as models of devaluations, fit the data.

We have two objectives in this paper. First, we examine the reaction of stock markets around currency devaluations using daily returns and an event study framework. This analysis helps explain how international equity markets respond to such events. We use a large sample of 85 devaluation events from 27 countries from 1980-2004. To ensure that the returns we observe around devaluations are not driven by normal market fluctuations, we estimate abnormal returns.

We find a significant equity market decline prior to and immediately after the announcement of a devaluation. On average the dollar value of the equity market drops by 4.21 percent 30 days before the devaluation was announced, and by 3.11 percent one day after the announcement is made. While abnormal returns on average continue to be negative for up to 255

trading days after the first announcement, they become positive thereafter, perhaps because of remedial efforts by central banks and international agencies.

Our second objective is to examine what economic variables explain the direction and magnitude of the stock market reaction around currency devaluations, motivated by the prior literature (e.g., Krugman, 1998; Kaminsky and Reinhart, 1999; Obstfeld, 1994; and Corsetti, Pesenti, and Roubini, 1999). We use a number of macro-economic variables to examine if they can explain the size of the stock market's decline upon the announcement of the devaluation. These tests are guided by Frankel and Rose (1996) who consider which macroeconomic variables are capable of predicting that a devaluation will occur.

Using windows around the devaluation announcement, we find that the amount of the devaluation and whether a country is a developing nation significantly impact the stock market's returns. However, other macroeconomic factors also help explain equity markets' reactions to a devaluation. Specifically, stock markets decline more around a devaluation if inflation was high, if the real exchange rate has depreciated over the prior years, or if the capital account has declined. These findings have useful implications for central bankers as well as for international investors.

In related literature, Wilson, Saunders, and Caprio (2000) study the stock market reaction around the 1994 Mexican peso devaluation. Their findings suggest that investors did not anticipate the devaluation of the peso, and that the decline in the stock market was much more significant in dollar terms than in peso terms. Glen (2002) studies the stock market response to currency devaluation for a sample of 24 emerging markets using monthly returns and finds significant negative returns in the months before, but not after, the devaluation.

Section II discusses our data and events. The empirical methodology is explained in Section III. Section IV provides an overview of the abnormal returns for equity markets around a currency devaluation. Section V presents a regression analysis of abnormal returns during currency devaluations using a number of macroeconomic variables primarily drawn from the existing literature, and Section VI concludes.

II. Data and Events

In efficient markets, prices react to new information as soon as the information is released. Therefore, to examine the effect of currency devaluations on country market index returns, we collect the earliest announcement dates of these devaluations from *Lexis-Nexis* and *Factiva*. We search this database from 1979-2004 for all announcements of currency devaluations by countries for which we have stock market data, and recorded the date and magnitude of the devaluation as well as if the country switched from a fixed exchange rate system to a floating exchange rate system. This data collection gives us a sample of 146 announcements of currency devaluations for 41 countries, although only for 85 of these announcements from 27 countries do we have sufficient data for our event study analysis. Out of these 85 observations, 39 are from developing countries.

An example of such an announcement is, “The devaluation of the Belgian franc decided after Sunday's finance ministerial wrangling the Brussels marks a watershed not just for Belgium but for the whole of Europe. The 8.5 per cent devaluation against other members of the European Monetary System -- announced along with a 3 per cent lowering of the Danish Krone --is Belgium's first formal devaluation since 1949. The 8.5 per cent devaluation against other members of the European Monetary System -- announced along with a 3 per cent lowering of the

Danish Krone is Belgium's first formal devaluation since 1949." (Financial Times, Feb 23, 1982). Similarly, "Russia devalues ruble after months of turmoil- After weeks of financial turmoil, Russia sharply devalued the ruble today -- a move that is expected to cause hardship for Russian consumers. The Central Bank said it would permit the value of the ruble to fall about 34 percent -- from about 6.3 to the dollar to 9.5 to the dollar. The price for dollars on the street immediately jumped as high as 9.5 rubles." (Financial Times, Aug 17, 1998).

We use the daily returns on the MSCI country index denominated in US dollars for our event study analysis. These are value weighted indices and MSCI targets a 60 percent market capitalization in the construction of these indices. Since the country indices come from the same sources and are computed using the same methodology, they are directly comparable. We begin our sample in December 31, 1979 since that is the earliest date when the MSCI country index series are available on a daily basis. The world market index used is also the MSCI world market index.

We obtain macroeconomic data from IMF's *International Financial Statistics.* Guided by prior research (Krugman, 1979; Flood and Garber, 1984; Obstfeld, 1994; Kaminsky and Reinhart, 1999; and Patro, Wald and Wu, 2002), the variables we collect include Reserves, GDP, Real Exchange Rate, Price Index, National Debt, Interest and FDI. The exchange rate is defined as the foreign currency price per U.S. dollar so that an increase in the real exchange rate indicates a real depreciation of the foreign currency relative to the dollar. We transform these variables as needed in our analysis by taking growth rates or ratios to GDP or Reserves. Further, we also collect data on the country credit ratings as reported in the March and September issues of *Institutional Investor*.

III. Methodology

We use the traditional market model to estimate abnormal returns. However, since we are using country stock market index returns, the market is the return on the world market index. The return on the world market portfolio has been identified as the most important source of variations in international equity index returns (e.g., Ferson and Harvey, 1993). To estimate risk-adjusted abnormal returns, returns on the MSCI country indices are regressed on the returns of the MSCI world market index for a 255 trading days period before the event from t=-510 to t=-256, where the day of the announcement is t=0.[2] The market model is estimated as follows:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \quad (1)$$

where, $R_{i,t}$ is the daily return on a country's MSCI equity index and $R_{m,t}$ is the return on the MSCI world market index.[3] Using the parameters estimated from the market model, $(\hat{\alpha}_i, \hat{\beta}_i)$, the abnormal returns for each day during the observation period are calculated as follows:

$$AR_{i,t} = (R_{i,t} - \hat{\alpha}_i - \hat{\beta}_i R_{m,t}) \quad (2)$$

These abnormal returns are averaged for each event day across countries (where t=0 is the announcement day). Next, the *Cumulative Abnormal Returns* (CARs) are computed by summing the average abnormal returns for the window of interest.

These CARs are then tested to see if they are statistically significantly different from zero. The *t*-statistic for the hypothesis that CAR is zero is computed in several ways. First, the

[2] We skip a relatively long time period before the devaluation because there may be leakage of information, and the markets may be declining in anticipation of the event. When we read through the related news announcements, we sometimes found significant discussion of a possible devaluation months before the event. We examine a window relatively far from the devaluation event in order to avoid bias, although this may add some noise to the estimated betas.

[3] Note that the world market index is an index of developed countries'; however, using the all country index, which includes both developed and emerging market indices, gives us similar results since the capitalization weighted indices are dominated by the developed markets. Of course since the countries we examine did not have a floating exchange rate system, we cannot include a currency risk factor.

standard Patell (1976) test is used. This test is also referred to as the standardized abnormal returns test and is based on assuming cross-sectional independence. The test statistic follows a standard normal distribution and is reported as the '*Z-stat'* when we report our event study results.

Brown and Warner (1980) argue that if the securities in the sample experience the event during the same calendar month, there is a 'clustering' of events which can distort the size of the tests, resulting in too frequent rejection of the null hypothesis. Therefore, they propose a 'crude dependence adjustment' to account for this cross-sectional dependency. Unlike the Patell (1976) test which is based on the standardized abnormal returns which allows for unequal variances across securities when computing the standardized abnormal returns, this test uses the standard deviation of average abnormal returns for calculating the *t*-statistic for testing hypothesis about the CAR. We report this statistic as the '*t-stat*' in our tables. Additionally, we compute the 'generalized *Z-stat'*, which is a test of the hypothesis that the fraction of positive returns is the same during the event window and the estimation period. This non-parametric test complements our above two parametric tests and provides a robustness check for the significance of our test results.

In order to further verify our results, we also estimate mean-adjusted abnormal returns. The methodology used is as follows. Let $R_{i,t}$ be country i's index return at time t, and let $\overline{R}_i$ be the time-series mean return for the estimation period. For the mean-adjusted returns technique, the abnormal returns, $AR_{i,t}$, are calculate as $AR_{i,t} = R_{i,t} - \overline{R}_i$. The procedures used to test the significance of the mean-adjusted CARs are the same as those for the market adjusted CARs. We use a one factor model since for most of the sample, the countries we examine have fixed or pegged exchange rates. However, for some of the sample, the exchange rates may vary slightly

under a pegged regime or there may be other factors affecting the country equity returns. Using mean-adjusted returns partially addresses this issue and also provides robustness check for our results using market adjusted abnormal returns.

IV. Abnormal Returns around Devaluations

Our first objective in this paper is to examine how financial markets, in particularly equity markets, respond to announcements of devaluations by central banks. By examining the announcement effects before the event, we are able to study if markets anticipate devaluations. Our second objective is to explain the abnormal returns around devaluations using a country's macroeconomic variables.

As discussed in the previous section, we estimate abnormal returns for country equity index returns using both the market model and the mean-adjusted returns model. Our estimation period is from t=-510 to t=-256, where the day of the announcement is t=0. We use the estimated parameters for this period to compute our abnormal returns for various windows of interest. The abnormal returns are summed over these windows and tested if they are significantly different from zero.

The empirical results for the cumulative abnormal returns (CARs) for country equity indices around currency devaluations are presented in Table I. These CARs are based on 85 devaluation events from 27 countries. In panel A, we report the results from market model CARs and in panel B we report the mean-adjusted CARs. Panel C reports the raw returns for ease of comparison. We report the CARs for widows before, during, and after devaluations.

The findings show that there are significant negative abnormal returns around currency devaluations. Since the results from the market model and the mean-adjusted model are similar,

our discussion is focused on the market model results reported in panel A. The announcement CARs for days (-1,0) is -2.32 percent, which is significant at all conventional levels with a Brown and Warner (1980) *t*-stat of -7.807. In fact, the day (-1,0) CARs are significantly negative at the 5 percent level using all three statistical tests (Patell, 1976; Brown and Warner, 1980; and the non-parametric sign test). Similarly, the day (-1,+1) CARs, -3.11 percent, are significantly different from zero at the 5 percent level using the first two tests and at the 10 percent level using the third test. These results indicate that stock markets on average react negatively to currency devaluations. However, the CARs (-1,0) have a standard deviation of 7.21 percent and ranges from -42.85 percent for the February 2001 devaluation of the Turkish lira to 9.24 percent for the August 1998 devaluation of the Russia ruble. Therefore, the stock market reaction varies greatly across countries and in the next section we explore potential determinants of this variation.

Also interesting is that CARs are significantly negative for many days before the announcement, suggesting that currency devaluations are often undertaken when the stock markets are declining. For example, the CAR for (-90, -1) is -9.14 percent. Alternatively, it may be that stock markets often anticipate a devaluation and the negative CARs before the announcement reflect that expectation. Again, this result varies considerably across countries. While Mexico had a -26.30 percent CAR for (-90, -1) during the December 1994 peso devaluation, Italy had a 26.98 percent CAR for the same window during the August 1985 lira devaluation. We explore what explains the stock market returns for the longer window around devaluation in the next section.

The results for the average CARs are presented graphically in Figure 1. The patterns of the CARs confirm the negative impact of devaluations on country index returns and the negative abnormal returns before the devaluation. Our -3.11 percent of CARs for days (-1,+1) compares

well with the -2.87 percent return reported by Wilson *et al.* (2000) for the Mexican currency crisis. The CARs also indicate that the decline during the announcement of devaluations eventually reverses around one year after the event. For example, the CAR for (+255, +510) is 4.85 percent. This reversal may reflect an improvement in the country's export sector following the devaluations. For developing countries, this may also reflect remedial efforts by central banks and international institutions. In contrast, Wilson et al. (2000) find that the Mexican stock market did not anticipate the devaluation and the stock returns during the pre-devaluation window are, although negative, not significant. Our findings of a negative impact of devaluations during and before announcements are similar to those of Glen (2002), although we have a larger data set consisting of both developed and developing countries, and our analysis is based on abnormal daily returns instead of raw monthly returns.

As mentioned earlier, the market reactions to announcements of devaluations vary across countries. In the next section, we examine which macroeconomic variables explain the cross-sectional variations in CARs across countries.

V. Devaluations and Macroeconomic Variables

Economic theory suggests that a devaluation is typically associated with growth in exports, a decline in imports, and a depreciation in the real exchange rate (see, for instance, Kaminsky and Reinhart, 1999; and Kaminsky, 2006). Table II Panel A reports summary statistics of the key macroeconomic variables that we use to explain the impacts of currency devaluation on equity market response. In Table II Panel B, we examine the raw correlations between the cumulative abnormal returns around the devaluation announcement, the amount of the announced devaluation, and several macroeconomic variables. We measure these economic

variables around the devaluation, from four quarters before to four quarters after the announcement. As expected, we find that a larger devaluation is associated with a larger decline in imports, a larger increase in exports, and a depreciation in the real exchange rate. Thus the basic economics of devaluations functions as expected.

We next turn to explaining the impact of the devaluation on the local stock market using an event window methodology. As our macroeconomic variables exhibit heteroskedasticity in these specifications, we use a feasible generalized least squares estimator, where the independent variables significantly related to the variance are included in a heteroskedasticity correction. We model the variance of the error term as $\sigma^2 = \exp(Z'\gamma)$, where Z is a vector of independent variables and γ is the corresponding vector of parameters.

Panel A's of Tables III through VI consider regressions on cumulative abnormal returns from -1 to +1 days around the announcement of the devaluation. Because in most cases the devaluation appears to be at least partly anticipated, and because some of the devaluations' impacts appear to have a long-term impact, we also examine the cumulative abnormal returns from -30 to +30 days around the announcement in Panel B's of Tables III through VI.

One difficulty with this type of analysis is that not every macroeconomic variable is available for every country. At each point, we present the regressions with the largest possible number of observations, and discuss possible selection bias along the way.

Regression 1A in Table III Panel A presents results using the amount of the devaluation as the only explanatory variable. If the value of the stocks does not change in local currency terms, the expected coefficient would be -1, whereas if the value of the stocks does not change in dollar terms, the expected value would be 0. Regression 1A, and most of our other results for this

cumulative abnormal return suggests that the truth is some place between these extremes, with a coefficient of -0.427 which is significantly different from both 0 and -1 at the 5 percent level.

In Regression 2A, we add a dummy variable equal to one if the devaluation announcement was also accompanied by an announcement that the currency would move to a floating rate regime, a dummy variable equal to one if the announcement included a widening of exchange rate bands, and a dummy variable equal to one if the devaluing country is a developing nation. Neither the float nor the widen dummy are significant at conventional significance levels; however, developing countries appear to have a significantly larger drop in their stock markets than developed countries upon the announcement of a devaluation.

Panel B of Table III presents similar regressions for the 30 days before to 30 days after the devaluation announcement. Regression 1B again shows a coefficient between zero and minus one on the amount of devaluation, although closer to minus one than in the case above, suggesting that more of the devaluation impacts the stock market in the longer time period. When other dummy variables are included in Regressions 2B, again the dummy for developing countries is negative and significant, although in this case the coefficient on the amount of the devaluation is no longer significant.

We next analyze the impact of three macroeconomic variables often associated with government policies that may be inconsistent with a fixed exchange rate regime. Specifically, based on models by Krugman (1979), Flood and Garber (1984), and Obstfeld (1994), and the empirical findings of Kaminsky and Reinhart (1999), variables such as the growth rate of reserves, the growth rate of the real foreign exchange rate (a positive growth represents a real depreciation of the foreign currency relative to the dollar), and the inflation rate may be associated with a devaluation. If government policies are inconsistent with the fixed exchange

rate regime, this would manifest itself in a significant decline in reserves, and in increases in inflation and the real exchange rate (a real depreciation of the foreign currency).

Regressions 3A and 4A in Table IV Panel A show the impact of reserves, either measured via growth in the four quarters prior to the devaluation or as reserves as a fraction of GDP in the quarter prior to the devaluation, on equity returns. Neither of these measures of reserves appears to be significantly associated with changes in the equity markets around a devaluation for the shorter time period around the announcement date. For the longer 60-day window considered in Regressions 3B and 4B in Table IV Panel B, higher reserve growth is associated with more negative stock market returns. This is a rather unexpected result, as higher growth in reserves may suggest a policy that is consistent with fixed exchange rates, and therefore a smaller decline in equity markets.

Regression 5A in Panel A of Table IV considers the impact of real foreign exchange growth in the four quarters prior to the devaluation on cumulative abnormal returns. Larger growth in real exchange rates appears to be significantly negatively related to equity returns around a devaluation, suggesting a more severe economic impact of devaluation in countries with larger foreign exchange depreciation. Real foreign exchange rate growth is similarly related to stock returns in the 60-day window in Regression 5B of Table IV Panel B. Thus, for countries which had larger past real depreciations, a currency devaluation event implies a greater real decline in equity prices.

Regression 6A in Panel A of Table IV includes inflation in the prior quarter as an additional explanatory variable, but inflation does not appear to be significantly related to equity returns immediately around the devaluation. Regression 7A includes these four variables together, but finds that for the short window, none of them is significant for the smaller sample

when considered in the same regression. On the other hand, for a 60-day window in Regression 6B prior quarter inflation has a significant negative relationship with equity returns. These results continue in Regression 7B, where all the coefficients that were significant in other regressions continue to be significant, and where the adjusted R^2 climbs to a relatively high 51 percent.

A number of authors, such as Krugman (1998), Corsetti *et al*. (1999) and Kane (2000), consider a moral hazard explanation as a possible cause for sudden devaluations. These authors suggest that large debt investments may be implicitly guaranteed either by local authorities or by the IMF and may therefore be associated with overinvestment.

A separate hypothesis originally associated with Diamond and Dybvig (1983) suggests that if there is a sufficiently large mismatch in duration between assets and liabilities, a self-fulfilling run on liquidity may occur. In this case, investors lose confidence in the ability of the local institutions to pay back their debts, and a sudden run on liquidity occurs causing a shortage of funds and a real contraction. Both this hypothesis and the moral hazard hypothesis above suggest that measures of debt in the economy are crucial to the severity of a devaluation. For instance, Furman and Stiglitz (1998) and Rodrik and Velasco (1999) use short-term debt flows as a fraction of reserves to explain the severity of the crisis.

In Table V, we consider three measures of a country's debt and how they relate to the equity decline around a devaluation. Specifically, we consider the ratio of short-term debt to the international reserves, the ratio of interest paid on debt to reserves, and the ratio of short-term to long-term debt, all measured in the quarter prior to the announcement. The first two variables may be effective measures of the stock of debt, whereas the third may serve as a proxy to measure the mismatch between short-term and long-term assets. As these data come from the World Bank, and as this data is only available for developing countries, our analysis is conducted

only for developing countries and thus we do not include the developing dummy variable in these regressions. However, as inflation was significant in Table IV Panel B, we include it as an additional control variable.

The results in Panel A of Table V suggest that only the interest to reserves ratio variable is individually significant at the 5 percent level, but with an unexpected positive sign. When all the debt-related variables are considered simultaneously, none of them are significant. Panel B of Table V considers the relationship of these variables to equity returns in the longer window. We find that only short-term debt as a fraction of reserves is significant, again with an unexpected positive sign.

Tables VI considers a variety of measures of capital flows, including changes in the capital account as a fraction of GDP, changes in the deficit as a fraction of GDP, the log of country credit rating, and foreign direct investments (FDI) as a fraction of reserves. We include the amount of the devaluation, a dummy for developing countries, the real foreign exchange rate growth, and the inflation rate as control variables in these regressions. Regressions 12A and 12B consider changes in the capital account as a fraction of GDP and find that for both the short and long windows, this variable is significantly related to changes in the value of equity around currency devaluations. Consistent with expectations (Kaminsly and Reinhart, 1999), a larger decrease in the capital account is associated with a larger decrease in the value of equity around a devaluation.

Similarly, Regressions 13A and 13B consider changes in the deficit as a fraction of GDP as an alternative explanatory variable. Consistent with the capital account results, a larger increase in the deficit is associated with a greater decline in equity values around a devaluation, although this result is only statistically significant for the shorter window. We also examine the

level of the deficit as a fraction of GDP as an alternative variable, but find that it is not significant for either abnormal return window. The results are not reported in the table to economic on space.

We consider the country credit rating from the March or September prior to the devaluation as an alternative measure of how the country's borrowing position impacts the economy during a devaluation. However, we find that credit rating (or the log of credit rating) does not significantly impact equity returns around a devaluation regardless of the window used.

Lastly, we consider the impact of foreign direct investment as a fraction of total reserves on equity returns around a devaluation. A number of authors (e.g., Corsetti *et al*., 1999; Furman and Stiglitz, 1998; Radelet and Sachs, 1998; and Rodrick and Velasco, 1999) suggest that both debt and equity flows can potentially cause financial fragility; in this case, larger foreign direct investment may be associated with more negative equity returns around a devaluation. Alternatively, Bekaert and Harvey (2003), Henry (2003), and others suggest that financial liberalization and the associated equity flows are not associated with increased volatility. Regressions 15A and 15B suggest that higher equity flows are not associated with a larger decline in equity markets around a devaluation; in fact, foreign direct investment has a positive coefficient in both regressions, and this coefficient is significant for the 60-day window.

Jorion (1990), Patro *et al*. (2002), and others suggest that exchange rate exposure may vary with imports and exports. Thus, larger exports may imply a larger positive impact on equity returns around a devaluation, while larger imports may imply a larger negative impact around a devaluation. However, neither imports as a fraction of GDP nor exports as a fraction of GDP is significant when added to the abnormal returns regressions. Either other factors are more

important during a devaluation, or the power of our test is insufficient to capture these effects. These results are not reported in the table to save space.

VI. Conclusions

In this paper we study local stock market reaction to currency devaluations by a country's central bank. Our analysis indicates that devaluations are often anticipated by the local stock markets, and that there are significant negative abnormal returns even one year prior to the announcement of the devaluation. This negative trend persists for up to 30 days following the announcement. However, one year after the devaluations, the average abnormal returns are significantly positive, indicating a reversal in trend.

Guided by the theoretical literature on devaluations, we conduct a cross-sectional analysis of the relationship between the local stock market's abnormal returns around currency devaluations and the country's key macroeconomic indicators. We find that countries which have experienced real exchange rate depreciation, which have higher inflation, or which have suffered a drop in their capital accounts, have a larger decline in equity prices when a currency devaluation is announced. These findings have useful implications for central bankers as well as for international investors.

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Table I: Cumulative Abnormal Returns (CARs) around Currency Devaluations

This table reports the cumulative abnormal returns (CARs) for various event windows and their associated test statistics. The "*Z-stat*" is the standard Patell (1976) test statistic, the "*t-stat"* is the time series standard deviation test as in Brown and Warner (1980), and the "*generalized sign Z-stat*" is a nonparametric test of the hypothesis that the fraction of positive returns is the same during the event window and the estimation period. All three test statistics asymptotically follow the standard normal distribution whose 10, 5, and 1 percent critical values are, respectively, 1.64, 1.96, and 2.58, using a 2-tail test. The symbols *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively, using a 2-tail test.

Panel A: Market Model-adjusted CARs

Days	N	CAR (in percent)	Positive: Negative	*Z-stat*	*t-stat*	*Generalized Sign Z-stat*
(-255,-1)	85	-17.50	35:50	-4.692***	-5.207***	-1.481
(-90,-1)	85	-9.14	34:51	-4.572***	-4.578***	-1.698*
(-30,-1)	85	-4.21	40:45	-2.805***	-3.652***	-0.397
(-30,+30)	85	-9.48	39:46	-5.699***	-5.768***	-0.614
(-30,+90)	85	-7.82	47:38	-4.315***	-3.379***	1.122
(-30,+255)	85	-13.76	45:40	-4.893***	-3.867***	0.688
(-1,0)	85	-2.32	31:54	-8.592***	-7.807***	-2.349**
(-1,+1)	85	-3.11	34:51	-9.033***	-8.542***	-1.698*
(-1,+30)	85	-5.73	36:49	-5.761***	-4.812***	-1.264
(-1,+90)	85	-4.07	43:42	-3.714***	-2.017**	0.254
(-1,+255)	85	-10.01	44:41	-4.424***	-2.967***	0.471
(+1,+30)	85	-3.41	36:49	-3.718***	-2.954***	-1.264
(+1,+90)	85	-1.75	47:38	-2.465**	-0.875	1.122
(+1,+255)	85	-7.68	44:41	-3.669***	-2.287**	0.471
(-255,+255)	85	-27.05	43:42	-6.296***	-5.686***	0.254
(+255,+510)	84	4.85	50:34	3.989***	1.439	1.891*

Panel B: Mean-adjusted CARs

Days	N	CAR (in percent)	Positive: Negative	*Z-stat*	*t-stat*	*Generalized Sign Z-stat*
(-255,-1)	85	-15.60	39:46	-3.911***	-4.169***	-0.654
(-90,-1)	85	-8.17	38:47	-3.899***	-3.675***	-0.871
(-30,-1)	85	-3.63	41:44	-2.264**	-2.829***	-0.220
(-30,+30)	85	-8.62	42:43	-4.870***	-4.707***	-0.003
(-30,+90)	85	-5.85	48:37	-3.153***	-2.268***	1.299
(-30,+255)	85	-10.85	47:38	-3.718***	-2.738***	1.082
(-1,0)	85	-2.28	31:54	-7.984***	-6.881***	-2.389**
(-1,+1)	85	-3.01	34:51	-8.033***	-7.426***	-1.739*
(-1,+30)	85	-5.46	37:48	-5.110***	-4.117***	-1.088
(-1,+90)	85	-2.69	50:35	-2.673***	-1.197	1.733*
(-1,+255)	85	-7.70	49:36	-3.358***	-2.048**	1.516
(+1,+30)	85	-3.18	42:43	-3.203***	-2.476**	-0.003
(+1,+90)	85	-0.41	49:36	-1.503	-0.184	1.516
(+1,+255)	85	-5.41	48:37	-2.654***	-1.447	1.299
(-255,+255)	85	-22.82	42:43	-4.997***	-4.308***	-0.003
(+255,+510)	84	5.41	53:31	3.853***	1.442	2.505**

Panel C: Raw Returns

Days	N	Mean Raw return (in percent)	Positive: Negative	*Z-stat*	*t-stat*	*Generalized Sign Z-stat*
(-255,-1)	85	4.68	42:43	1.792*	1.248	0.593
(-90,-1)	85	-0.98	43:42	-0.491	-0.438	0.810
(-30,-1)	85	-1.25	46:39	-0.302	-0.971	1.463
(-30,+30)	85	-3.76	43:42	-2.081**	-2.054**	0.810
(-30,+90)	85	3.78	48:37	0.769	1.463	1.898*
(-30,+255)	85	11.97	54:31	2.362**	3.017***	3.203***
(-1,0)	85	-2.12	28:53	-7.494***	-6.400***	-2.453**
(-1,+1)	85	-2.78	31:50	-7.433***	-6.845***	-1.801*
(-1,+30)	85	-2.91	41:43	-3.099***	-2.195**	0.375
(-1,+90)	85	4.63	53:32	0.741	2.056**	2.986***
(-1,+255)	85	12.82	55:30	2.407**	3.408***	3.421***
(+1,+30)	85	-0.79	46:38	-1.253	-0.615	1.463
(+1,+90)	85	6.75	56:29	1.875*	3.033***	3.638***
(+1,+255)	85	14.94	57:28	3.090***	3.989***	3.856***
(-255,+255)	85	17.89	49:36	3.105***	3.374***	2.116**
(+255,+510)	84	25.36	68:16	9.628***	6.756***	6.387***

Table II: Summary Statistics and Cross-correlations of CARs and Explanatory Variables

This table reports the summary statistics and the cross-correlations of cumulative abnormal returns and key explanatory variables to be used in the cross-section regressions in subsequent Tables. The macroeconomic growth variables are defined as the growth rates from four quarters before the devaluation to four quarters after the devaluation. A positive growth of the real exchange rate means a real depreciation of the foreign currency relative to the dollar. "Devaluation Amount" is expressed as a positive number for a devaluation, thus 0.10 for a 10 percent devaluation.

Panel A: Summary Statistics of Variables

Variable	Mean	Standard Deviation	Number of Observations
CAR(-1,+1)	-0.031	0.086	85
CAR(-255,+255)	-0.270	1.715	85
CAR(-30, +30)	-0.095	0.315	85
Devaluation Amount	0.077	0.107	85
Float	0.094	0.294	85
Widen	0.047	0.213	85
Developing	0.459	0.501	85
Reserve Growth$_{t-5,t-1}$	-0.051	0.253	83
Reserves$_{t-1}$/GDP$_{t-1}$	0.300	0.404	81
Real Exch. Growth	0.103	0.811	78
Inflation$_{t-1}$	0.051	0.191	83
Debt$_{t-1}$/Reserves$_{t-1}$	2.139	1.507	28
Interest$_{t-1}$/Reserves$_{t-1}$	0.665	0.471	28
Short/Long Debt$_{t-1}$	0.229	0.133	28
(Cap.Ac$_{t-1}$-Cap.Ac$_{t-5}$)/GDP$_{t-1}$	-0.000	0.005	45
(Deficit$_{t-1}$-Deficit$_{t-5}$)/GDP$_{t-1}$	-0.040	0.225	60
Credit Rating	61.911	23.185	82
FDI$_{t-1}$/Reserves$_{t-1}$	-0.035	0.046	66

Panel B: Correlations of Variables around the Devaluation

	CAR (-1,+1)	CAR (-255, +255)	CAR (-30, +30)	Deval Amount	Export Growth	Import Growth	GDP Growth	Reserve Growth	M1 Growth	Real Exch. Growth
CAR (-1,+1)	1.00									
CAR (-255,+255)	0.32	1.00								
CAR (-30, +30)	0.51	0.74	1.00							
Deval. Amount	-0.46	-0.06	0.28	1.00						
Export Growth	0.09	0.31	0.15	0.20	1.00					
Import Growth	0.06	-0.06	0.07	-0.28	0.49	1.00				
GDP Growth	0.01	-0.04	-0.01	0.01	0.28	0.57	1.00			
Reserve Growth	-0.09	-0.04	-0.07	-0.13	0.16	0.20	0.35	1.00		
M1 Growth	-0.09	0.50	0.15	0.62	0.25	-0.16	0.40	0.12	1.00	
Real Exch. Growth	-0.12	-0.45	-0.28	-0.06	-0.09	0.24	0.28	0.09	-0.41	1.00

Table III: Cross-sectional Variation of CARs

This table reports GLS regressions of CARs on various cross-sectional characteristics. "Float" is a dummy variable equal to one if the devaluation coincided with a move to a floating exchange rate regime. "Widen" is a dummy variable equal to one if the devaluation coincided with a move to widen a pegged exchange rate. "Developing" is a dummy variable equal to one if the country is a developing nation. Numbers inside parentheses are *t*-ratios in absolute values. The symbols *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively, using a 2-tail test. Panel A reports results for the short window CARs(-1,1) while Panel B those for the long window CARs(-30,30).

Panel A: Regression of CARs (-1, +1)

Variable	Regression 1A	Regression 2A
Constant	-0.002 (0.320)	0.006 (0.999)
Devaluation Amount	-0.427*** (4.614)	-0.290*** (3.039)
Float		-0.003 (0.064)
Widen		-0.003 (0.147)
Developing		-0.033*** (2.648)
Number of Observations	85	85
Adjusted R^2	0.204	0.203

Panel B: Regression of CARs (-30, +30)

Variable	Regression 1B	Regression 2B
Constant	-0.031 (1.103)	0.011 (0.500)
Devaluation Amount	-0.872** (2.423)	0.056 (0.162)
Float		0.107 (0.942)
Widen		0.263 (1.244)
Developing		-0.274*** (3.223)
Number of Observations	85	85
Adjusted R^2	0.067	0.176

Table IV: Devaluation and Macroeconomic Variables

This table reports GLS regressions of CARs on growth rate of reserve over the past four quarters before the devaluation, reserve over GDP ratio, growth rate of real exchange rate (a positive growth means a real depreciation) over the past four quarters, and inflation of the past quarter. Numbers inside parentheses are *t*-ratios in absolute values. The symbols *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively, using a 2-tail test. Panel A reports results for the short window CARs(-1,1) while Panel B those for the long window CARs(-30,30).

Panel A: Regression of CARs (-1, +1)

Variable	Regression 3A	Regression 4A	Regression 5A	Regression 6A	Regression 7A
Constant	0.008	0.006	0.007	0.006	0.011
	(1.316)	(0.787)	(1.037)	(0.928)	(1.032)
Devaluation Amount	-0.377***	-0.314***	-0.337***	-0.310***	-0.489***
	(5.405)	(3.623)	(3.905)	(3.639)	(4.540)
Developing	-0.029***	-0.027	-0.026	-0.035*	-0.028
	(2.764)	(1.406)	(1.397)	(1.950)	(1.500)
Reserve Growth$_{t-5,t-1}$	-0.010				-0.016
	(0.608)				(0.542)
Reserves/GDP		-0.003			0.001
		(0.231)			(0.046)
Real FX Growth$_{t-5,t-1}$			-0.028**		-0.011
			(2.204)		(0.962)
Inflation$_{t-1}$				0.073	0.051
				(0.780)	(0.514)
Number of Observations	83	81	78	83	75
Adjusted R^2	0.176	0.174	0.225	0.194	0.266

Panel B: Regression of CARs (-30, +30)

Variable	Regression 3B	Regression 4B	Regression 5B	Regression 6B	Regression 7B
Constant	0.002	0.035	0.027	0.034	0.053*
	(0.096)	(1.318)	(1.032)	(1.319)	(1.850)
Devaluation Amount	-0.644**	-0.488	-0.470	-0.291	-0.992***
	(2.066)	(1.506)	(1.179)	(0.906)	(4.229)
Developing	-0.151**	-0.184***	-0.186***	-0.184***	-0.114**
	(2.314)	(2.819)	(2.953)	(3.398)	(2.342)
Reserve Growth$_{t-5,t-1}$	-0.217**				-0.202***
	(2.571)				(3.034)
Reserves/GDP		-0.048			-0.057
		(1.064)			(1.085)
Real FX Growth$_{t-5,t-1}$			-0.104**		-0.095***
			(2.244)		(3.807)
Inflation$_{t-1}$				-0.643***	-0.660***
				(8.612)	(10.791)
Number of Observations	83	81	78	83	75
Adjusted R^2	0.203	0.183	0.337	0.297	0.511

Table V: Devaluation and National Debt

This table reports GLS regressions of CARs on several measures of national debt. Since data on debt are available only for developing countries, the regressions in this table include only developing countries. Numbers inside parentheses are *t*-ratios in absolute values. The symbols *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively, using a 2-tail test. Panel A reports results for the short window CARs(-1,1) while Panel B those for the long window CARs(-30,30).

Panel A: Regression of CARs (-1, +1)

Variable	Regression 8A	Regression 9A	Regression 10A	Regression 11A
Constant	-0.072***	-0.083***	-0.054**	-0.062*
	(4.007)	(4.948)	(2.055)	(1.737)
Devaluation Amount	-0.019	-0.005	0.173	-0.048
	(0.154)	(0.029)	(1.536)	(0.182)
$Inflation_{t-1}$	-0.146***	-0.110*	-0.147	-0.079
	(5.337)	(1.838)	(1.524)	(0.842)
Short-Term $Debt_{t-1}/Reserves_{t-1}$	0.014			-0.019
	(1.585)			(0.653)
$Interest_{t-1}/Reserves_{t-1}$		0.049***		0.073
		(4.017)		(0.987)
Short/Long $Debt_{t-1}$			0.000	0.031
			(0.001)	(0.293)
Number of Observations	28	28	28	28
Adjusted R^2	-0.032	-0.014	-0.052	-0.171

Panel B: Regression of CARs (-30, +30)

Variable	Regression 8B	Regression 9B	Regression 10B	Regression 11B
Constant	-0.277***	-0.212***	-0.120	-0.409*
	(2.897)	(2.756)	(0.877)	(1.820)
Devaluation Amount	-0.100	-0.004	0.560	0.315
	(0.177)	(0.007)	(1.148)	(0.796)
$Inflation_{t-1}$	-0.777	-0.689***	-0.637***	-0.894**
	(1.518)	(8.534)	(5.656)	(2.304)
Short-Term $Debt_{t-1}/Reserves_{t-1}$	0.089**			0.203***
	(2.035)			(2.880)
$Interest_{t-1}/Reserves_{t-1}$		0.116		-0.299
		(0.891)		(1.086)
Short/Long $Debt_{t-1}$			-0.542	-0.023
			(1.458)	(0.045)
Number of Observations	28	28	28	28
Adjusted R^2	0.096	-0.002	-0.017	0.016

Table VI: Devaluation and Capital Flow

This table reports GLS regressions of CARs on several measures of capital flow. Numbers inside parentheses are *t*-ratios in absolute values. The symbols *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively, using a 2-tail test. Panel A reports results for the short window CARs(-1,1) while Panel B those for the long window CARs(-30,30).

Panel A: Regression of CARs (-1, +1)

Variable	Regression 12A	Regression 13A	Regression 14A	Regression 15A
Constant	0.005	0.002	0.034	0.012
	(0.717)	(0.317)	(0.802)	(1.532)
Devaluation Amount	-0.426***	-0.009	-0.463***	-0.367***
	(3.508)	(0.078)	(4.606)	(3.725)
Developing	-0.041*	-0.026	-0.033	-0.039**
	(1.823)	(1.445)	(1.363)	(2.148)
Real FX Growth$_{t-5,t-1}$	-0.009	-0.010	-0.028***	-0.017
	(1.044)	(0.749)	(3.204)	(1.441)
Inflation$_{t-1}$	0.114*	0.024	0.126*	-0.023
	(1.805)	(1.262)	(1.768)	(0.299)
(Cap.Ac$_{t-1}$-Cap.Ac$_{t-5}$)/GDP$_{t-1}$	3.159***			
	(4.878)			
(Deficit$_{t-1}$-Deficit$_{t-5}$)/GDP$_{t-1}$		-0.027*		
		(1.745)		
Log Credit Rating			-0.000	
			(0.728)	
FDI$_{t-1}$/Reserves$_{t-1}$				0.103
				(1.381)
Number of Observations	44	54	74	65
Adjusted R^2	0.317	-0.011	0.398	0.216

Panel B: Regression of CARs(-30, +30)

Variable	Regression 12B	Regression 13B	Regression 14B	Regression 15B
Constant	-0.005	0.034	0.336	0.085***
	(0.185)	(1.131)	(1.647)	(3.035)
Devaluation Amount	-0.689	-0.225	-0.332	-0.444
	(1.342)	(0.590)	(0.845)	(1.292)
Developing	-0.165	-0.256***	-0.272***	-0.227***
	(1.344)	(3.764)	(2.732)	(3.214)
Real FX Growth$_{t-5,t-1}$	-0.039	-0.020	-0.084	-0.071
	(0.812)	(1.320)	(1.431)	(1.328)
Inflation$_{t-1}$	-0.562***	-0.652***	-0.739***	-0.631***
	(4.252)	(8.936)	(8.729)	(8.222)
(Cap.Ac$_{t-1}$-Cap.Ac$_{t-5}$)/GDP$_{t-1}$	13.385***			
	(2.760)			
(Deficit$_{t-1}$-Deficit$_{t-5}$)/GDP$_{t-1}$		-0.063		
		(1.376)		
Log Credit Rating			-0.004	
			(1.512)	
FDI$_{t-1}$/Reserves$_{t-1}$				0.979*
				(1.850)
Number of Observations	44	54	74	65
Adjusted R^2	0.580	0.513	0.428	0.545

Figure 1: Cumulative Abnormal Returns (CARs) around Currency Devaluations