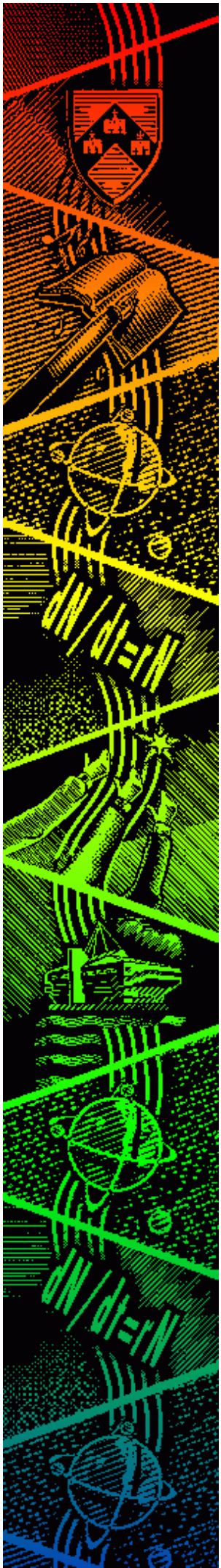

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Assessing the Real Exchange Rate Misalignments: Is Real Undervaluation of the Currency Likely and Can It Be Sustained?

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Abstract

There is a renewed debate on the role of exchange rate policies as industrial policy tools in both academic and policy circles. Policy practitioners usually examine real exchange rate (RER) misalignments to monitor the behavior of this key relative price and, if possible, exploit distortions in the traded and non-traded relative price to promote growth. Anecdotal evidence shows that some countries have pursued very active exchange rate policies to promote the export sector and enhance growth (e.g. China) by undervaluing their currencies. The main goal of this paper is to provide a systematic characterization of real exchange rate undervaluations. We first calculate fundamental RER misalignments based on the long run RER equation derived from the theoretical model developed by Kubota (2009). Then, we construct a dataset of real undervaluation episodes. Second, we present some basic evidence on the co-movement of RER undervaluation and (real and nominal) macroeconomic aggregates. We specifically assess the behavior of macro aggregates during undervaluations using an "event analysis" methodology. Finally, we evaluate whether (and if so, to what extent) economic policies can be used to either cause or sustain real undervaluations. In this context we empirically model the likelihood and magnitude of sustaining RER undervaluations by examining their link to policy instruments (e.g. exchange rate regimes, capital controls, among other policies) using Probit and Tobit models, respectively.

JEL Classification: F3, F41

Key Words: Misalignment, Undervaluation, Fundamentals and Open Macro Policy

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1. Introduction

The growing globalization of financial markets –as observed by rising cross-border trade of assets– has led to some important changes in the patterns of saving and investment across the world. Lane and Milesi-Ferretti (2007, 2008a) has extensively documented the fact that emerging market economies (in particular, emerging Asia and oil exporting countries) have become net suppliers of savings while the United States became an absorber of global savings. This *saving glut* in emerging markets and the excess consumption in the U.S. led to the so-called *global imbalances*. The recent debate on the resolution of these imbalances has brought attention towards the role of the real exchange rate (RER) as the relative price that would drive the international adjustment of countries. It has been argued that the depreciation of the US dollar may help improve the net foreign asset (NFA) position of the country through trade and financial effects (Lane and Milesi-Ferretti, 2005, 2006 2008b). The *trade effect* suggests that current account deficits will narrow (and, eventually, turn into a surplus) thanks to a required weakening of the US dollar. The *financial effect*, on the other hand, implies that the depreciation of the US dollar may lead to an improvement of the NFA position due to the fact that the US external liabilities are mostly denominated in US dollars whereas its external assets have a more varied currency composition. Therefore, the real exchange rate exerts an influence on both net capital flows and net capital gains on external holdings (Lane and Milesi-Ferretti, 2002, 2004, 2006 and 2007; Galstyan and Lane, 2008).

Emerging market economies have recently undertaken competitive devaluations so as to keep their currencies undervalued in recent terms and, hence, promote exports. Recent evidence shows that growth accelerations tend to be associated with higher investment, export surges and real exchange rate depreciation (Hausmann, Pritchett and Rodrik, 2005). Rodrik (2008) finds a somewhat positive co-movement between RER undervaluation and growth increases in China, India, South Korea, Taiwan, Uganda and Tanzania. He states that undervaluation facilitates growth among developing countries and stresses the role of the relative price of traded to non-traded goods as an instrument of industrial policy in the process of economic convergence. Theoretically, Rodrik (2008) argues that RER undervaluation acts as a second-best mechanism to alleviate distortions in developing countries (*e.g.* institutional weaknesses and incomplete contracts in the traded sector, and information and

coordination problems) and, hence, foster structural change and spur growth. Aizenman and Lee (2007), on the other hand, suggest that RER undervaluations may be used to internalize a learning-by-doing (LBD) externality in the traded sector if the LBD calls for subsidies to labor in tradables. This debate has led to a heated argument about the desirability of undervaluations and the likelihood of support them through economic policies. In this context, the main goal of this paper is to understand the causes and consequences of real exchange rate misalignments –and, more specifically, real undervaluation of the currency. What are the real consequences of undervaluations (on real output, investment, exports among others)? If undervaluations can generate positive effect on economic activity, can they be supported by economic policy actions?

Why is our study of real exchange rate misalignments so relevant? Real exchange rate misalignments help to signal distortions in relative prices. Measuring the misaligned currencies (in real terms) would permit us to assess and monitor the behavior or real exchange rate as well as examine the consequences of either overvaluation or undervaluation of the currency in real terms. It has been documented in the literature that a real overvaluation of the currency may have an adverse impact on economic performance –especially, if this associated to poor macroeconomic and inconsistent exchange rate policies (Dollar, 1992; Razin and Collins, 1999). A relatively stronger currency tends to raise the cost of imports (among them, intermediate inputs and capital goods) and has a detrimental effect on investment. Moreover the loss of competitiveness associated with the overvaluation could hamper the country's ability to adjust internationally and reallocate resources more efficiently across the different sectors of economic activity. However, the literature on the growth effects of RER undervaluation is not abundant. As we mentioned above, Hausmann et al. (2005) and Rodrik (2008) have suggested that RER undervaluation may trigger growth.[1] If it is true that real undervaluation of the currency leads to higher growth, the relevant policy question is what type of policy shocks may cause RER undervaluations and how persistent these are.

[1] Recent research on the "mercantilist" view of exchange rate policy suggests that the accumulation of international reserves by some countries such as China and Argentina are aimed at keeping the real exchange rate undervalued; therefore, promote growth through rising exports (Rodrik, 2008). Others suggest that accumulating reserves may soften the blow of adverse financial and real shocks –that is, demand for reserve hoarding is precautionary (Aizenman and Lee, 2007; Cheung et al. 2007).

To accomplish this task, we first need to define and characterize real undervaluations of the currency. In turn, this implies providing a measure of RER misalignments. To do this, we calculate the RER misalignment as deviations of the actual from the equilibrium RER. We model the equilibrium RER using the theoretical model in Kubota (2009) and we estimate the fundamental RER equation using the time series and panel econometric techniques applied in Kubota (2009).[2] This equilibrium level is derived from a theoretical model that guarantees intertemporal BOP equilibrium and equilibrium in the tradable and non-tradable goods market by solving for the current account dynamics and Harrod-Balassa-Samuelson (HBS) productivities.

In this paper we characterize undervaluation episodes by using the dataset on fundamental real exchange rate misalignments generated by Kubota (2009). After identifying episodes of large real undervaluations of the currency (*excess* depreciations beyond some pre-determined threshold), we examine the behavior of key real activity variables (e.g. real output, private consumption, investment and savings) and policy variables (say, capital controls and foreign exchange market intervention) using the *event analysis* approach. Then we use limited dependent variable techniques to explore: (a) the linkages between policy actions and the likelihood of sustaining undervaluations, and (b) the ability of economic policy to influence the magnitude of real undervaluations. As a result, we evaluate whether real exchange rate undervaluations could be sustained by economic policy tools using *Probit* and *Tobit* analysis. While the probabilistic model (*Probit*) helps to estimate to what extent the likelihood of achieving a real undervaluation of the currency is affected by policies, the *Tobit* model examines whether the size of undervaluations can be influenced by policies such as active intervention in the exchange market by the Central Bank (say, reserve hoarding), capital controls, labor and output market regulations, among other factors.

The main goal of our paper is to test whether economic policies and regulations undertaken by the authorities affect the likelihood of keeping the RER undervalued and/or determine the size of the undervaluation. This will allow us to test whether the

[2]In order to compute our theory-based measure of RER misalignment a long-run RER equation from a theoretical model that considers the equilibrium real exchange rate (ERER) as the relative price of tradable to non-tradable goods. The building blocks of the model will follow Balassa (1964) and Samuelson (1964) for equilibrium in the tradable and non-tradable goods market, and Mussa (1984) and Frenkel and Mussa (1985) for the inter-temporal BOP equilibrium.

"*mercantilist*" view of the exchange rate policy is empirically valid. To accomplish this task we gather an unbalanced panel dataset of 79 countries, of which 21 are industrial economies and 58 are developing countries, over the period 1971-2005 (*i.e.* at most 36 observations per country).

Our *event-analysis* confirms the conjecture that real GDP growth accelerates during and after the start of an undervaluation episode while analyzing the full sample of countries. In addition, export growth speeds up during the undervaluation episodes and it slows down in the aftermath. After the undervaluation ensues, *domestic demand* seems to also drive growth in GDP. The evidence shows that growth in private consumption and investment accelerates significantly. Finally, although the evidence during the undervaluation episode is not robust, the estimated coefficients indicate that fiscal austerity may pick up during the undervaluation episode.

Next, we undertake our *Probit* and *Tobit* analysis of the determinants of the incidence and magnitude of undervaluations. In short, our *Probit* analysis shows that pro-active economic policies may have an effect on the likelihood of sustaining the RER undervaluation while our *Tobit* model shows that the authorities may have a more limited ability to influence the magnitude of the RER undervaluation.

Our *Probit* analysis shows evidence that active exchange rate policies may influence the incidence of RER undervaluations. For instance, intervention in the foreign exchange market is effective to support small to medium RER undervaluation and its effect becomes non-negligible for larger degrees of undervaluation. The flexibility of exchange rate arrangements —proxied by either the coarse or fine classification of arrangements made by Reinhart and Rogoff (2004)— has a positive and significant coefficient regardless of the threshold of undervaluation. These findings imply that countries with more flexible exchange rate arrangements and larger intervention in the FOREX market are able to experience episodes of currency undervaluation. Analogous to the intervention result, an active fiscal policy seems to raise the likelihood of small to medium RER undervaluation, and it becomes ineffective when the RER undervaluation is larger (say, more than 20 percent).

The *Tobit* analysis shows that policymakers may have a more limited role in influencing the magnitude of the RER undervaluation. In contrast to our *Probit* results, flexible exchange arrangements and FOREX market intervention have a less robust link with the size of RER undervaluations. The exchange arrangement is

mostly not significant in all regressions, while FOREX intervention has a positive and significant effect only when controlling for the fiscal policy stance.

This paper consists of the following sections: Section 2 explains the data used in the empirical work. In Section 3 we not only define the undervaluation of episodes using binary variables whenever the misalignment goes beyond certain threshold but also we examine the behavior of selected macroeconomic indicators around sharp undervaluation episodes using *event analysis*. Section 4 describes the econometric methodology applied to evaluate the determinants of the incidence and size of real exchange rate misalignments (*Probit* and *Tobit* analysis, respectively) whereas Section 5 analyzes the results from our *Probit* and *Tobit* analysis. Section 6 finally concludes.

2. The Data

This section provides the description and sources of the data used in our empirical analysis. We follow Kubota (2009) to define and generate the data on real exchange rate misalignment, and RER misalignments are defined as deviations of the actual RER from its equilibrium level. First, we describe the data sources on the determinants of the real exchange rate as suggested by the model in Kubota (2009). Second, we describe the variables used for the event-analysis associated to sharp undervaluation episodes and for the econometric assessment of the incidence and size of real exchange rate undervaluations. We gather annual information for a sample of 79 countries over the period 1971-2005 and for a wide array of factors such as exchange rate regimes, capital controls, foreign exchange intervention, trade and financial openness, liability dollarization and central government balance.

2.1. The Determinants of the Equilibrium Real Exchange Rate

In order to define the dependent variable in the analysis of the likelihood and sustainability of RER undervaluations, we first need to define the *real exchange rate misalignment* as the deviation of the actual RER from its equilibrium value. Following Kubota (2009) we compute the equilibrium RER by first regressing the actual RER on the ratio of net foreign assets to GDP, productivity differentials and terms of trade. The actual RER is proxied by the real effective exchange rate (*REER*),

as defined by the domestic price index of country *i* vis-à-vis the price index of its main trading partners multiplied by the nominal exchange rate of country *i*,

$$q_{it} = \frac{P_{it}}{(e_{it}/e_{i0})\prod_{k=1}^{n}\left[\frac{P_{kt}^{*}}{e_{kt}} \Big/ \frac{P_{k0}^{*}}{e_{k0}}\right]^{\omega_k}}$$

where e_{it} is the nominal exchange rate of country *i* (*vis-à-vis* the US dollar) in period *t*, P_{it} is the consumer price index of country *i* in period *t*, d_{kt} is the nominal exchange rate of the *k*-th trading partner of country *k* in period *t* (in units of local currency *vis-à-vis* the US dollar), and P_{kt}^{0} is the wholesale price index of the *k*-th trading partners in period *t*. The *nominal exchange rate*, *e*, is proxied by the average price of the dollar in local currency (line *rf* of the International Monetary Fund's International Financial Statistics (IFS). Domestic and foreign prices, *P*, are proxied by the consumer price index of the country (line *64* of IFS). According to this definition, an increase in *q* implies a real appreciation of the domestic currency.

NFA data is drawn from Lane and Milesi-Ferretti (2001, 2007). This database comprises a set of foreign asset and liability stocks for a large group of industrial and developing countries spanning over the 1970-2005 period. The construction of the data is thoroughly documented in Lane and Milesi-Ferretti (2001, 2007), and the NFA position of country *i* in year *t* is defined as:

$$NFA_{it} = \left[FDIA_{it} - FDIL_{it}\right] + \left[EQYA_{it} - EQYL_{it}\right] + \left[RA_{it} + LA_{it} - LL_{it}\right]$$

where the letters *A* and *L* denote assets and liabilities, respectively. Thus, the net foreign asset position is the sum of net holdings of direct foreign investment, *FDIA-FDIL*, plus net holdings of portfolio equity assets, *EQYA-EQYL*, and the net position in non-equity related assets (*i.e.* "loan assets"). In turn, the net position in non-equity related assets consists of international reserves, *RA*, and the net loan position, *LA-LL*.

For *productivity differentials* we use labor productivity differentials weighted by trade patterns. Then, we develop the data on labor productivity of traded and non-traded sectors based on ISIC code classifications of the economic activity.[3] Output per capita is proxied by GDP per capita, and output per capita of the foreign country is a

[3] The sign of the coefficient of relative labor productivity at Home (relative to the Foreign) country will be positive (negative) if the surge in aggregate labor productivity is explain by shocks to tradables (non-tradables).

trade-weighted average of GDP per capita of the domestic country's trading partners. *TOT* is the ratio of export to import prices. Data are taken from IMF, the World Bank, OECD, and national central banks.

The equilibrium RER is obtained by multiplying the estimated coefficients of the long-run RER equation by the permanent values of the RER fundamentals. These permanent components are computed using the band-pass filter, and the RER misalignment is the difference between the actual and equilibrium levels of the RER. According to our definition of RER, positive (negative) deviations imply a real exchange rate over- (under-) valuation.

2.2 The Determinants of the Likelihood and Sustainability of Real Exchange Rate Undervaluations

After defining the real exchange rate misalignments, we examine the behavior of selected macroeconomic variables around sharp real undervaluation episodes. To conduct this event analysis we use a set of macroeconomic indicators that comprises the following variables: real GDP growth, growth in real exports, an indicator of fiscal discipline, saving rates, private consumption, real domestic investment, the CPI inflation rate, the nominal exchange rate, intervention in the foreign exchange market and capital controls. Then we examine the ability of economic policies to affect the probability and magnitude of RER undervaluations. We include policy variables such as exchange rate regimes, capital controls, foreign exchange market intervention, trade openness, liability dollarization and fiscal discipline.

Exchange Rate Regimes. We approximate the exchange rate regime *de facto* in place in the country by the database developed by Reinhart and Rogoff (2004) and updated by Ilzetzky, Reinhart and Rogoff (2009). These authors have developed a new system to classify historical exchange rate regimes. In contrast to previous classifications, their extensive database is not only uses of market-determined or parallel exchange rates but also develops a *natural* classification algorithm. Specifically, we use the fine classification of Reinhart-Rogoff that takes values between *1* and *15* where higher values indicate a higher level of flexibility in the exchange rate arrangements in place.

The data on *capital controls* used in this paper is a binary variable collected from the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. It takes the value of *1* in the years when restrictions on capital account transactions are

in place and *0* otherwise (Prasad, Rogoff, Wei and Kose, 2003). The typical problem of this type of data is that, although it captures the presence of controls, it fails to capture the intensity of the controls imposed.

As a result, countries with closed capital account may increase the stringency of those controls by imposing restrictions on current account transactions, multiple exchange rate practices or the surrender of export proceeds while countries with an open capital account may still restrict the flow of capital by imposing other restrictions on cross-border financial transactions (Chinn and Ito, 2007). To capture these aspects, we complement the measure mentioned above with the inverse of the Chinn-*Ito index of financial openness* which incorporates the different types of restrictions on cross-border financial transactions stated above. We multiply the Chinn-Ito index by -1 to capture the presence of different types of restrictions on cross-border financial transactions. Higher values of this new index would imply more strict restrictions on cross-border financial operations.

The data on intervention in the foreign exchange market is constructed following Levy-Yeyati and Sturzenegger (2007). We aim to show whether FOREX intervention has a lasting effect on the real exchange rate. Although it has traditionally been argued that nominal interventions are unlikely to have a real impact, we examine whether FOREX interventions help to sustain misalignments. According to Levy-Yeyati and Sturzenegger (2007) we construct a measure of intervention that is not affected by the growth-induced increases in money demand —which in turn may lead to either increases in domestic credit or in international reserves. To calculate such a measure, we construct first the ratio of reserves to broad money (*M2*) for country *c* in year *y* and month *m*, $R2_{c,y,m}$,

$$R2_{c,y,m} = \frac{FA_{c,y,m}}{M_{c,y,m}}$$

and, then, intervention in the FOREX market, *Int2*, is computed as the average of the monthly change in the ratio of reserves to broad money, *R2*,

$$Int2_{c,y} = \sum_{m=1}^{12} \left(R2_{c,y,m} - R2_{c,y,m-1} \right)$$

Note that *Int2* is positive whenever reserve accumulation exceeds the increase in monetary aggregates —thus, implying a strong degree of intervention in the foreign exchange market.

We also consider trade and financial openness as determinants of RER misalignments. *Trade openness* is proxied as the ratio of real value of exports and imports (that is, total trade) to real GDP, and the data is obtained from the World Bank's World Development Indicators (WDI). Measuring *financial openness* involves data on foreign assets and liabilities from Lane and Milesi-Ferretti (2001, 2007). We construct the ratio of foreign liabilities as a percentage of GDP (which include stocks of liabilities in portfolio equity, foreign direct investment, debt and financial derivatives) and, for robustness purposes, the ratio of foreign assets and liabilities to GDP. We also assess the role played by the composition of capital flows in affecting the ability of the government to sustain RER undervaluations. Hence, we decompose our measure of financial openness into equity- and loan-related foreign liabilities. While the former includes the foreign liability position in foreign direct investment and portfolio equity, the latter includes only the debt liability position (*i.e.* portfolio debt and other investments). The same calculation is performed for the ratio of foreign assets and liabilities to GDP.

Liability dollarization is measured as the ratio of foreign liabilities of the financial sector to money. The data is taken from the IMF's International Financial Statistics (*IFS*) —more specifically, lines 26C and 34 for foreign liabilities of the financial sector and broad money, respectively. Although this is not a direct measure of the extent to which a country's balance sheet present currency mismatches in assets and liabilities, there is a wide availability across countries and over time which is attractive for panel data analysis.

Our proxy for fiscal discipline is the *central government balance as percentage of GDP* and the data is obtained from WDI and the IMF's World Economic Outlook (WEO). Savings, on the other hand, is measured as the ratio of gross domestic savings to GDP in local currency units taken from WDI whereas *private consumption* is the ratio of household final consumption expenditures to GDP in local currency units from WDI. Finally, *export growth* is annual percentage growth rate of exports of goods and services, *gross domestic investment* is calculated as the ratio of gross capital formation to GDP in local currency units, and *inflation* is the percentage

change in consumer price index. All the variables mentioned above are constructed using data from the World Bank's WDI.

3. Characterizing Undervaluations Using Event-Analysis

In this section we introduce a more heuristic approach to characterize the behavior of macroeconomic variables during, before and after episodes of undervaluation. We present the averages across episodes of undervaluation as well as 2 years before and 2 years after for the following variables: real aggregates such as GDP, exports, saving, investments, fiscal balance and private consumption, as well as nominal and financial variables like inflation, nominal exchange rate, intervention in FOREX market and capital controls. We made these calculations for the sample of all countries and for developing countries. Then we conduct our event analysis by regressing the macroeconomic variables mentioned above on dummies characterizing the beginning of the undervaluation episode, the period before and after as well as controlling for country and time-specific effects.

3.1. Identification of Event-Analysis

We identify the different episodes of RER undervaluation and we report these results in Table 1. How do we construct these episodes? We first create a dummy variable that takes the value of *1* whenever the real exchange rate is undervalued and otherwise zero. We consider consecutive years of undervaluation in one episode if there is no significant recovery of more than half from the start of the undervaluation (i.e. the initial point of the event). We also consider the 2 years before the undervaluation episodes as the "*before*" scenario, and the 2 years post-undervaluation as the "*after*" scenario. If the undervaluation episode starts in the 2000s or near the end of our sample period and continues in 2005 (or, say, the undervaluation does not disappear in 2005), then we call it "*ongoing episode*". If the episodes seem to start before 1971 (the start of our estimation period), then we call it "*pre-occurring episode*". In Figures 'GDP' stands for GDP growth rate, 'Exp' is export growth, 'Fiscal' is the ratio of government balance to GDPs, 'Savings' is growth in savings, 'Priv Con' is growth in private consumption to GDP, 'Investment' is growth in investment, 'Inflation' is an inflation in CPI, 'NER' is a change in nominal exchange rate, 'Intervention' is 10 times of intervention variable, and 'Control' is 1/10 of

capital control variable while ‘Control’ variable for industrial countries is divided by 100 in order to be more representative.

All Completed Episodes of Undervaluation for ALL Countries

Figure 1.1 depicts the cross-episode average of the growth of real GDP and its demand components for the full sample of countries. We find that real GDP growth accelerates during and after the event of undervaluation. Export growth, on the other hand, increases during undervaluation episodes but it slows down in the aftermath. Growth in exports after the event is lower than that before the event. An analogous behavior is exhibited by savings (see Figure 1.1).

We do not find a significant difference in the fiscal balance before, during and after the undervaluation episodes. However, we find that after picking up during the undervaluation episode, growth in private consumption and investment accelerates significantly in the aftermath of the undervaluation episode. Therefore, it can be also observed that the economic growth seems to be mainly driven by higher growth in private consumption and investment.

Figure 1.2 depicts the behavior of variables associated with monetary policy such as inflation, the nominal exchange rate, intervention in the FOREX market and capital controls. During the undervaluation episode the domestic currency depreciates in real terms and it is supported by the Central bank buying foreign currency in the FOREX market (active exchange rate policy) while inflation goes up slightly during the undervaluation episodes and goes back to almost the same average level as ‘before’ the event. FOREX intervention is positive (buying foreign currency) before the undervaluation event and it becomes negative (selling foreign currency) during and after the event of undervaluation. Nominal exchange rates depreciate more ‘after’ the event with respect to ‘before’ and ‘during’ the event. Finally, capital controls seem to have declined more during the undervaluation episodes.

All Completed Episodes of Undervaluation for Developing Countries

Figure 2.1 reports the evolution of GDP and its components from the demand side for the sample of developing countries. When we analyze the completed episodes of undervaluation for developing countries, we find that growth in real GDP moves up during the event of undervaluation (see Figure 2.1). The growth rate of GDP accelerates even more after the undervaluation episode among developing countries

similar to the case of all countries. The behavior of GDP is correlated with the pick-up in private consumption in before, during and after the undervaluation episode while investment increases during the event and stays at almost unchanged. In contrast the figure shows that during undervaluations GDP grows slightly while the fiscal balance does not change.

In Figure 2.2 FOREX intervention is positive before the undervaluation episodes and negative during and after. It decreases because 'during' undervaluation due to moving from purchasing to selling foreign currency. We find that the monetary authority purchases foreign currencies and then nominal exchange rate depreciates; hence, depreciation is supported by consistent intervention of the monetary authority in the foreign exchange market (i.e. buying foreign currency) to induce the undervaluation episode. Nominal exchange rates depreciate even more after the event compared with 'before' and 'during' the event. Control variable does not change 'before', 'during' and 'after' the undervaluation episodes for developing countries. Inflation increases during the event of undervaluation and it decreases aftermath although it is still higher than previous inflation of the event.

All Completed Episodes of Undervaluation for Industrial Countries

Figure 3.1 shows that GDP drops during undervaluation for industrial countries. It also shows the V-shaped pattern that is usually the norm for event-analysis of currency crisis (instead of the inverted V-shape expected by the mercantilists). This result may need to distinguish between episodes of undervaluation triggered in the aftermath of currency crisis vis-à-vis episodes of the monetary authority trying to lean against the wind during episodes of significant capital flows to the country.

Export growth increases during the episodes and slows down in the aftermath (see Figure 3.1). We do not find a significant difference either before, during or after the undervaluation events in the fiscal balance. It can be also observed that growth picks up during the aftermath of the undervaluation episode and seems to be mainly driven by higher both private consumption and investment growth. We find that savings growth increases during the undervaluation episode and declines after the event; however, it is still relatively higher than its growth before the event. While private consumption increases during the episodes and even more after the episodes, growth in investment declines during the undervaluation episodes and increases in the aftermath of undervaluation episodes even more than before the episode starts. During

the undervaluation episode the domestic currency depreciates while inflation declines slightly with respect to the period pre-undervaluation. Although nominal exchange rates appreciate even more after the undervaluation episodes, inflation still decreases after the event. While capital controls are tightened at the start and during the undervaluation episode, FOREX intervention declines during the event.

3.2. Test Statistics for Event-Analysis Database

To test statistically whether macroeconomic variables exhibit different behavior before, during or after an undervaluation episode, we conduct the event analysis. We run regressions for these macroeconomic variables on dummies that capture the undervaluation episode as well as the windows before and after the event. We also control for country and time-specific effects in these regressions. More specifically, we regress the macroeconomic variables on the annual undervaluation event *before* 1, 2 and 3 years (T-1, T-2, and T-3), *during* (T) and *after* 1, 2 and 3 years (T+1, T+2, and T+3) using the sample of 79 countries for the period 1971-2005. We conduct the event analysis for the following variables: the growth rate of GDP, export growth rate, the ratio of fiscal balance to GDP, the ratio of savings to GDP, the ratio of private consumption to GDP, the ratio of investment to GDP, the CPI inflation, nominal exchange rates, FOREX market intervention and capital controls. Table 2 through 11 present these regressions that characterize the behavior of the variables mentioned above during undervaluation episodes. These regressions account for country and time effects and the regression analysis is conducted for "all episodes" and for "completed episodes."

Economic Growth. Table 2 shows growth regression of GDP growth on the window dummies and controlling for country effects (FE) and for country and time effects (TI). Overall the coefficient of time *T* (*0 year*) of the undervaluation episode is negative (positive) if growth is lower (higher) than in those years. If the coefficient estimates in period T-1, T-2, and T-3 are negative (positive) and even lower (higher) than that of time T, then growth was lower (higher) before the episode. The same can be applied to the aftermath of the undervaluation –say, in period T+1, T+2, and T+3.

We find that the coefficient for the year 0 dummy is negative but statistically insignificant which implies that the growth rate during the undervaluation is similar to the average growth outside the undervaluation window [T-3, …, T., …, T+3]. Growth

in the year before the undervaluation episode starts (T-1) is lower than when it triggers (T). We also find that growth starts slowing down after 3 years.

The behavior of growth around RER undervaluation episodes is similar to that of the full sample of countries: average growth during undervaluations is similar to the average of non-undervaluation years and higher than the periods before and after. Growth in the period of undervaluation is smaller than the average growth outside this event window. While controlling for fixed effects, the growth rate of GDP is smaller in the 2nd and 3rd years after the undervaluation than that registered in year 0.

Export Growth. Table 3 shows the regression of export growth on the undervaluation "*window dummies*" and controlling for *FE* and *TI*. As explained above in the case of the growth regressions, if the coefficient of time *T* (*0 year*) of the undervaluation episode is negative (positive) if export growth is lower (higher) than in those years. If the coefficient estimates in period T-1, T-2, T-3, T+1, T+2 and T+3 are negative (positive) and even lower (higher) than that of time T, then export growth was lower (higher) before the episode.

According to our findings the coefficient for the year 0 dummy is positive but statistically not significant for all episodes –except for the sample of industrial countries in the post-Bretton Woods period. The results for the latter case indicate that export growth rate during the undervaluation is higher than the average growth outside the undervaluation window [T-3, …, T., …, T+3]. For the sample of completed episodes, our results show that growth in period T-3 is lower than that of period T for all countries and developing countries. The rest of the coefficients are mostly negative and statistically insignificant.

The behavior of export growth around RER undervaluation episodes among developing countries is similar to that of the full sample of countries for the completed episodes: average growth during undervaluation is similar to the average of non-undervaluation years and higher than the periods before and after. However, the full sample results obtained when analyzing *ALL* episodes yields opposite results to those obtained when examining only completed episodes. Export growth in the period of undervaluation for the completed episodes is smaller than the average growth outside this event window while that of all episodes is larger than its average growth outside the event window. While controlling for fixed effects, the growth rate of

export is smaller in the 1st and 2nd years after the undervaluation than that registered in year 0.

Fiscal Balance. The regression of fiscal discipline on the undervaluation dummies and the 7-year window is presented in Table 4. We also include in our regressions FE as well as TI. When we observe the regression results for the full sample of countries and the sample of developing countries (either all or only completed episodes), we fail to find a significant coefficient. This implies that the budget balance of the Central Government (as % of GDP) does not show a pattern of behavior different from the average observed outside the undervaluation window [T-3, …, T., …, T+3].

The fiscal balance among industrial countries is slightly higher (1.2 percentage points of GDP) in year 0 relative to the average in periods outside the "*event window*." We also show that before the undervaluation, the coefficient is positive and significant but smaller than that of year 0. Finally, the coefficient in the aftermath of the undervaluation is not significant in most cases –except for year T+2 when controlling for fixed effects only. As a result, fiscal balances are larger before and during the undervaluation and fiscal discipline becomes more lax in the aftermath.

The saving rate. In Table 5, we find that the coefficient of year 0 dummy (time *T* of the undervaluation episode) is positive and statistically significant for the full sample and developing countries, thus implying that the saving rate during the undervaluation is different and higher than that of GDP outside the undervaluation window [T-3, …, T., …, T+3]. The savings rate at the start of the undervaluation episode (T) reaches its peak throughout the event and gradually slows down in the aftermath of the undervaluation episode.

While examining the completed episodes for our sample of industrial countries, the coefficient for the year 0 dummy is negative and statistically significant –which implies that the saving rate during the undervaluation is lower than the average ratio of savings to GDP outside the *event-window* [T-3, …, T., …, T+3]. The coefficients before the undervaluation period are negative and large in absolute value that that of year 0. Hence, the fiscal balance improves in the run up to the undervaluation period. Afterwards, the coefficients are mostly positive and not statistically significant.

Private Consumption. Table 6 presents the evidence for the ratio of private consumption to GDP. Throughout the window most coefficients are negative and significant for either the full sample of countries or that of developing countries. Hence, the private consumption rate is weaker during the undervaluation event window than the average rate of private consumption outside of that window. Second, rate in consumption reaches bottom in year 0, whereas it is faster either before or after the start of the undervaluation. These results hold for both the full sample of countries and that of developing countries. Qualitatively similar but statistically weaker results are found for both samples when examining only completed episodes.

Domestic Investment. The regressions for the ratio of gross capital formation to GDP are presented in Table 7. In most cases, the level of investment at the start of the undervaluation (year *0*) is either lower or similar (that is, not statistically significant) than the average level outside the event window. Rate in real investment in the second and third year before the undervaluation takes place is higher than in the year of undervaluation. We note that in the aftermath of the undervaluation, rate in investment is higher in year 2 for the full sample of countries and in year 1 for developing countries.

CPI Inflation. We show the regression results for the annual rate of inflation on the event window dummies, country effects and time effects in Table 8. While controlling for country and time effects (*TI* columns), inflation in year *0* for the full sample of countries as well as for developing countries seems to be lower than the average outside the event window. Otherwise, we find that the regression coefficients are not statistically significant. Paradoxically, we find that inflation declines at the start of the undervaluation period.

Nominal Exchange Rate. Table 9 presents the evolution of the nominal exchange rate in the undervaluation window. If we analyze "ALL" event-window coefficients for the full sample of countries and the sample of developing countries, we observe that all coefficients are significant. This implies that the nominal exchange rate, on average, weakens in windows of undervaluation episodes. A closer look at the coefficients indicates that nominal exchange rates depreciates in the run-up to the undervaluation and reaches its peak in period *T* (year *0*). Afterwards, it appreciates

slightly relative to period *T*. In contrast, the coefficient for the year *0* dummy shows negative significance for industrial countries after 1974. Nominal exchange rates in the period of undervaluation are smaller than the average growth outside this event window.

Intervention. Table 10 shows the regression of intervention (*Int2*) on the event window dummies. If we focus on *all* episodes of undervaluation, we fail to find a significant coefficient in most of the variables for the full sample of countries and for that of developing countries –except in period *T+1*. We find that intervention in the period after the undervaluation decreases relative to period T.

Capital Openness. The regressions of the index of capital account openness (Chinn and Ito, 2007) on event window dummy coefficients are presented in Table 11. We find that the coefficient for the year *0* dummy is negative and statistically insignificant except the coefficient for all episode in industrial countries shows positive insignificance which implies that the capital openness during the undervaluation is most likely different from the average capital openness outside the undervaluation window [T-3, …, T., …, T+3]. The behavior of capital openness around RER undervaluation episodes is similar to that of the full sample of countries: average growth during undervaluation is similar to the average of non-undervaluation.

4. Econometric Methodology

This section describes the econometric techniques we use to examine whether policymakers are able to sustain real exchange rate misalignments –and, more specifically, undervaluations, through policy actions. As a result, we empirically model the likelihood of sustaining a RER undervaluation as well as the magnitude of this undervaluation using limited dependent variable and censored variable techniques. In particular, we examine the impact of active economic policies on the likelihood (or incidence) of real exchange rate undervaluations using the *Probit* analysis while the *Tobit analysis* is used to assess the effects of economic policy on the size or magnitude of RER undervaluations.

4.1. The *Probit* Model

The *Probit* model is a model of binary choice where the dependent variable takes the value of one whenever there is a sharp real undervaluation of the currency and zero otherwise. Suppose that X is a binary variable that can only take two possible outcomes, zero (*0*) and one (*1*). We also have a vector z of variables that is assumed to have an effect on the outcome X. Hence, we assume that our probabilistic model (*Probit*) takes the following form:

$$\Pr ob(X = 1) = F(z, \beta)$$
$$\Pr ob(X = 0) = 1 - F(z, \beta)$$

Our regression model is such that:

$$x = E[x \mid z] + (x - E[x \mid z])$$
$$= \beta' z + \varepsilon$$

where $E[x \mid z] = F(z, \beta)$ and $Var[\varepsilon \mid z] = \beta' z(1 - E[x \mid z])$.

This assumption requires that:

$$\lim_{\beta' z \to +\infty} \Pr ob(X = 1) = 1 \text{ and } \lim_{\beta' z \to -\infty} \Pr ob(X = 1) = 0$$

$$\Pr ob(X = 1) = \int_{-\infty}^{\beta' z} \phi(t) dt$$
$$= \Phi(\beta' z)$$
$$L(X \mid \beta) = \prod_{x=1} \Phi(\beta' z) + \prod_{x=1} [1 - \Phi(\beta' z)]$$

Assuming a standard normal distribution, the logistic distribution implies that:

$$\Pr ob(X = 1) = \frac{e^{\beta' z}}{1 + e^{\beta' z}}$$
$$= \Omega(\beta' z)$$

The dependent variable takes the value of *1* whenever the actual RER depreciates more than equilibrium (or appreciates less than equilibrium) beyond a threshold, and *0* otherwise. We test whether policy variables have an influence on the likelihood of achieving an undervalued real exchange rate. The negative coefficient in the dependent variable shows the smaller a lag in the misalignment values the higher

tendency to undervalue the RER. Our dependent variable X is a dichotomic variable which reflects whether or not we observe a certain phenomenon.

$$\Pr ob(X = 1), \text{ if } (q - q^*) < k < 0$$
$$\Pr ob(X = 0), \text{ otherwise}$$

This means that X reflects the incidence/likelihood of episodes, where the RER is below, is equilibrium level beyond a certain threshold *k*. The response, as we see, is binary which is a choice between 2 possible outcomes is. We model this response as a linear regression problem and the probability of achieving an undervalued RER beyond some threshold *k* such as 5, 10, 20 and 25 percent. We regress the binary outcome on potential explanatory variables such as intervention, exchange rate arrangements, openness, monetary and fiscal variables. The expected value of achieving undervaluation in the model (given a set of explanatory variables z) is:

$$E[x \mid z] = 1 * \Pr ob\{(q - q^*) < k\} + 0 * \Pr ob\{Otherwise\}$$
$$= 1 * \Pr ob\{(q - q^*) < k\}$$
$$= \Pr ob[X = 1 \mid z]$$
$$= \text{linear function of z}$$

Our Probit analysis therefore evaluates the impact of active macroeconomic policies on the probabilities of RER undervaluation with using our event-analysis database.

4.2. The *Tobit* Model

The Tobit model is a type of *censored regression* model where the latent variable cannot always be observed while the explanatory variables are always observed. The Tobit model has the following general specification:

$$x_i^* = \beta' z_i + \varepsilon_i$$
$$x_i = 0 \text{ if } x_i^* \le 0$$
$$x_i = x_i^* \text{ if } x_i^* > 0$$

The latent variable, $E[x_i^*]$ is $\beta' z_i$. The estimation of this model is similar to one of truncated regression. The log-likelihood for the censored regression model is:

$$\log L = -\sum_{x_i>0}\frac{1}{2}\left[\log(2\pi)+\log\sigma^2+\frac{\left(x_i-\beta' z_i\right)^2}{\sigma^2}\right]+\sum_{x_i=0}\log\left[1-\Phi\left(\frac{\beta' z_i}{\sigma}\right)\right]$$

In our model the dependent variable is the extent of RER undervaluation when it takes place otherwise *0* when the RER is in equilibrium or overvalued.

The dependent variable is the absolute value of the undervaluation beyond a certain threshold, and *0* otherwise. We test whether policy variables have an influence on the extent of real undervaluation of the local currency. The negative coefficient in the dependent variable means that the smaller a lag in the misalignment the larger magnitude of undervaluation in the local currency. This model is used when the response is continuous but possibly censored with the dependent variables assuming discrete values. Although these values are unknown, we can still identify whether those values are greater than some threshold values. We want to investigate whether the RER undervaluations greater than some thresholds such as 5, 10, 20 and 25 percent. Hence, our dependent variable is as:

$$X = \mid q - q^* \mid \text{ if } \left(q - q^*\right) < k < 0$$

$$X = 0\text{, otherwise}$$

This implies that X reflects the magnitude of the deviation of RER below its equilibrium level beyond a certain threshold k. We measure the size of the undervaluation when it is greater than a threshold k and explain whether our explanatory variables affect the size of the undervaluation beyond a certain threshold. In short, our Tobit analysis examines the effects of macroeconomic policies on the magnitude of RER undervaluations.

5. Empirical Assessment

In this section we present and discuss our results on the linkages between economic policies and the likelihood (of sustaining) and magnitude of RER under-valuations.

5.1. Policy Analysis of RER Undervaluations: *Probit* and *Tobit* Models

We examine the linkages between policy actions, the likelihood of sustaining under-valuations and the extent to which policy can affect the magnitude of the

undervaluation —these relationships are evaluated using *Probit* and *Tobit* models, respectively. Some researchers argue that some countries (*e.g.* China and Argentina) use active exchange rate policies to undervalue their currency in real terms so that they can foster growth in their economic activity. Our purpose is to test whether it is likely that economic authorities can sustain under-valuations and whether they could affect the size of this undervaluation through the use of active exchange rate policies (say, strong intervention in the foreign exchange market by the monetary authority), and the use of capital controls, strategies of outward orientation and fiscal discipline among other factors.

5.2. What Determines the Success in Occurring Undervaluations?

In the following section we discuss the results on the effects of policy determinants on the likelihood of occurring real exchange rate undervaluations beyond some determined threshold, and the influence of the authorities on the magnitude of the real exchange rate undervaluation.

The *incidence of RER undervaluation, I,* is captured by a dummy variable that takes the value of one when the RER deviation from its computed long-run equilibrium is such that:

$$I(q-\bar{q}) = \begin{cases} 1, & if\ q-\bar{q} < \kappa < 0 \\ 0, & otherwise \end{cases}$$

where we define the occurrence of RER undervaluation for different values of the threshold κ —more specifically, κ = 5%, 10%, 20% and 25%.

Also, we define the variable *magnitude of undervaluation, S,* is captured by a dummy variable that the value of one when the RER deviation from its computed long-run equilibrium is as:

$$S(q-\bar{q}) = \begin{cases} |q-\bar{q}|, & if\ q-\bar{q} < \kappa < 0 \\ 0, & otherwise \end{cases}$$

5.2.1 Can Pro-Active Policies Determine the Likelihood of Occurring RER Undervaluations? *A Probit Analysis*

We model the likelihood of real exchange rate under-valuations occurring using *Probit* models and test whether pro-active economic policies may affect that

probability. The set of policies comprises active exchange rate policies (as proxied by the exchange rate regime in place and the degree of integration in the foreign exchange market), outward-oriented policies in goods and asset markets (say, trade and financial openness) and the composition of capital flows, reducing currency mismatches (as measured by the degree of liability dollarization), and fiscal discipline (as measured by the central government surplus).

The empirical assessment explores the link between economic policies and country characteristics on RER undervaluation. Our purpose is to show whether governments can sustain the real undervaluation of the currency through policy actions. Therefore, we evaluate the impact of economic policies on the incidence and magnitude of RER undervaluation.

Baseline Results

Table 12 shows the baseline regression analysis for our *Probit* model where the dependent variable takes the value of *1* whenever there is an episode of RER undervaluation beyond 5%. The lagged misalignment is statistically significant in our *Probit* regressions. Hence, real exchange rate misalignments in period *t-1* would affect the likelihood of undervaluation in the current period (*t*), thus enabling the initial RER misalignment to play a role. For instance, the negative coefficient of the lagged misalignment found in regression [1] in Table 12 shows that a drastic devaluation that might lead to an undervalued local currency in real terms if there is an initial disequilibrium occurs with a probability of 27.3%.

Regarding financial openness, it is found that foreign liabilities (*FL*) and total foreign assets and liabilities (*FAL*) are all insignificant. The lack of significance of the outcome measures of financial openness may be attributed to the fact that we do not take into account the composition of capital flows.[4] The policy measure of financial closedness —as measured by a measure of capital controls derived from the Chinn-Ito index— enters with a significant coefficient but the sign is not robust. Closed capital accounts have a negative sign when we control for fiscal policy and a positive one when we do not control for that variable. If we include fiscal policy in our regression, trade openness reduces the likelihood of undervaluation by about 9.5 percent, while excluding fiscal policy raises the effect of openness by 8.3 percent.

[4] We analyze whether the composition of capital flows matters in Table 13.

Fiscal discipline, as measured by the Central Government budget balance (as % of GDP) enters with a negative sign. This implies that countries with healthier fiscal positions are less likely to undervalue their currencies.

Interestingly, the exchange rate regime (as proxied by the *fine* classification of Reinhart and Rogoff, 2004) and intervention in the foreign exchange market enter with a positive sign in our regressions. This implies that countries with more flexible exchange rate arrangements and more frequent intervention in the FOREX market are able to generate an undervaluation of the currency. Liability dollarization is only significant without fiscal policy; hence, dollarization matters on a probability to undervalue the exchange rate while central government does not process its policy.

Composition effects in Financial Openness

Table 13, on the other hand, presents the results for the *composition effects of financial openness*. That is, we test whether the structure of external liabilities plays a role in determining the likelihood of real undervaluations. Before we discuss these results we should point out that our *policy measure of financial openness* (the index of capital controls) enters the regressions with an insignificant coefficient. As we mentioned above, we conjecture that the failure to find a significant impact from *outcome measures* of financial openness such as the total foreign assets and liabilities may be due to fact that different types of capital flows may have opposite effects on the likelihood of occurring RER undervaluations. For instance, Calderón and Kubota (2009) show that the composition of capital flows is important when analyzing the factors that help mitigate the impact of shocks on real exchange rate volatility. In fact, they found that shocks to the RER would be mitigated by the accumulation of equity-related foreign liabilities, whereas they would be amplified by loan-related foreign liabilities.

This distinction between different types of flows and integration to capital markets may be important due to the different persistence of these flows and its differential impact on RER and its deviations from equilibrium. Hence, we decompose foreign liabilities into equity- and loan-related liabilities. Note that the coefficient of equity-related liabilities is robustly negative across specifications while that of loan-related liabilities is positive and significant. This shows that the structure of external liabilities plays a role in explaining the probability of real exchange rate undervaluations taking place.

Finally, we should point out the following interesting results in Table 13 (when controlling for the structure of external liabilities): Countries with more flexible exchange rate arrangements (proxied either by the coarse or fine classification of exchange rate regimes) are more prone to generate an undervaluation of the currency. So do countries that intervene in the foreign exchange rate market.

Real Vulnerabilities

Table 14 tests whether vulnerabilities on the real side, and more specifically vulnerabilities in the outward orientation of the country, might prevent the country from sustaining undervaluations. We include measures of output concentration and export concentration. In fact, we include the Herfindahl index of output based on the 1-digit ISIC of economic activity and the Herfindahl index of export values using the COMTRADE database. In addition, to test whether the effect of openness depend upon the diversification of economic activity in the country, we interacted our trade openness ratio with both measures of concentration. The results reported in Table 14 show that we fail to find a significant effect from trade openness and concentration. These results suggest that the trade patterns of specialization do not matter in determining the probability of RER undervaluation.

Sensitivity Analysis

Tables 15 through 17 replicates the results reported in Tables 12 through 14 for different thresholds of RER undervaluation. In the first two columns of these Tables we report the baseline results for a RER undervaluation greater than 5%. Then, we present the results where the dependent variable is the occurrence of a RER undervaluation taking place as defined by higher thresholds –say, 10, 20 and 25 percent.

We find that in contrast to the results found with undervaluations beyond 5%, capital controls have a positive and significant effect for undervaluations greater than 10, 20 or 25%. This implies that capital controls may be successfully used to sustain larger undervaluations. Since higher values indicate high intensity of capital controls, the positive coefficient estimate implies that capital controls may help to maintain the real exchange rate undervalued —say, by either avoiding further appreciation that what the equilibrium appreciation dictates or by leading to further depreciation (beyond the equilibrium level).

The trade openness variable (*open*) fails to yield a significant coefficient estimate and so do the outcome measures of financial policy. Fiscal discipline, on the other hand, shows a negative and significant sign only when we consider thresholds of undervaluation of 5 and 10%. This implies that fiscal discipline reduces the likelihood of being able to sustain undervaluations. If the threshold is 20 or 25 percent, the fiscal variable becomes insignificant. This shows that fiscal policy is effective while the probability of the RER undervaluation is still closer to its equilibrium and fiscal policy likely becomes ineffective while the threshold gets more than 20 percent.

Finally, the ability to sustain undervaluations granted by flexible exchange rate regimes and FOREX market intervention is robust for different thresholds of RER undervaluation (see Table 15). Higher values of the indicator of intervention in the foreign exchange market (*Int2*) help signal a more active policy to keep the currency undervalued. The regressions in Tables 15 through 17 show that with the 5 percent threshold the RER is more likely to undervalue in countries pursuing a more active intervention in the foreign exchange rate market. As the value of the threshold increases, the coefficients become insignificant. This means that the RER is less likely to be undervalued when pursuing a more active intervention when the RER gets too far from its equilibrium.

Table 16 investigates the effects of the structural of external liabilities on the likelihood of generating and/or sustaining RER undervaluations. Consistent with the results found in Table 13, equity-related liabilities enter with a negative sign whereas loan-related liabilities have a positive coefficient. Countries with a large accumulation of loan-related liabilities are more prone to sustain RER undervaluations.

Central government balance as a fiscal variable is a positive significant if the threshold is either 5 or 10 percent in Table 15~17. Table 17 includes the real vulnerabilities –as proxied by concentration in economic activity and in the export sector. Again, we fail to find a significant coefficient for those variables.

5.2.2 Can Active Policies Affect the Magnitude RER Undervaluations? *A Tobit* Analysis

Baseline Results

Table 18 presents our Tobit analysis of RER undervaluations. The dependent variable measures the size of the undervaluation (in absolute value) whenever the actual rate weakens relative to the equilibrium real exchange rate by more than 5%.

The baseline results show a negative and significant coefficient for the lagged level of RER misalignment. This implies that the degree of RER misalignment in the previous period would affect the extent of undervaluation in the current period. For instance, regression [1] in Table 18 implies that if the RER misalignment index deteriorates by 50% (ln(1/2)=-0.69) in period *t-1*, the probability of affecting the level of RER undervaluation in period *t* by 15% (=-0.229 x -0.69).

Interestingly, either policy or outcome measures of financial openness fail to explain the magnitude of RER undervaluation. An analogous result is found for trade openness. Liability dollarization did not seem to matter either. In contrast, the central government budget balance has a negative and significant coefficient. This shows that fiscal policy may play a role in determining the extent of undervaluation in the exchange rate market. It also shows that fiscal discipline may reduce the size of the undervaluation.

Finally, the coefficient estimate of intervention in the FOREX market is not robust. When controlling for fiscal balance we find a statistically insignificant coefficient whereas it becomes positive and significant when we do not control for the fiscal position. On the other hand, the exchange arrangement is mostly not significant in all regressions but column [3] of Table 18.

Composition Effects in Financial Openness

Table 19 attempsts to disentangle the effects of financial openness and investigates whether the structural of foreign liabilities helps determine the size of RER undervaluations. Analogously to the Probit analysis, we find that equity-related liabilities have negative and significant coefficient while loan-related liabilities have positive and significant coefficient in almost all specifications reported in Table 19.

Again, fiscal policy has a negative and significant coefficient, whereas intervention in the foreign exchange market is significant only when we exclude the fiscal position of our analysis. The coefficient is positive though, supporting the idea that active policies in the FOREX market may also influence the size of the undervaluation. Finally, we find that the exchange rate regime indicator –either measured by the coarse or find classification- has a positive and significant coefficient estimate in most regressions. Hence, countries with more flexible arrangements are able to sustain and also affect the magnitude of the RER undervaluation.

Real Vulnerabilities

Table 20 includes measures of output and export concentration as well as their interactions with trade openness. We only find a positive coefficient for the Herfindahl index of export values (our measure of export concentration) om regression [2] of Table 20. The other coefficients of trade openness, trade and output structure as well as their interactions are insignificant. Output concentration patterns do not matter in influencing the size of undervaluation; however, export patterns might be influential on the extent of undervaluation. This means that the extent of undervaluation is more likely to increase in countries with less-diversified export structures (that is, higher concentration in exports).

Sensitivity Analysis

In a similar fashion to that of the Probit analysis, we report the Tobit analysis for different definitions of the dependent variables. Here, we change the threshold of the RER undervaluation –not only we report the initial results of 5% threshold but also run regressions with higher thresholds (such as 10, 20 and 25%). The results are reported in Tables 21 through 23.

We find a robust negative coefficient for the (lagged level of the) RER misalignment. This implies that the lower the index of RER misalignments, the higher the level of undervaluation beyond any threshold specified in Table 21 through 23 (say, 5, 10, 20 and 25 percent). Capital controls seem to have a negligible relationship with the magnitude of RER undervaluations. This evidence is consistent with Glick and Hutchinson (2005) and IMF (2007) where capital controls do not seem to sustain the level of the RER or reduce its volatility.

Fiscal discipline —as measured by the central government (CG) budget balance as a ratio to GDP— has a negative and significant coefficient (see Table 21 through 23). This shows that fiscal policy matters in influencing the size of the RER undervaluation. Fiscal surpluses may contribute to fund active intervention in the foreign exchange rate market and may allow the authorities to keep the RER undervalued. However, the coefficient of CG balance becomes not significant when trying to sustain larger RER undervaluations (beyond 20%) in Table 22.

Intervention in the foreign exchange market has a positive coefficient estimate but not significant in most cases –except for regression [1] of Table 23. On the other hand, the flexibility of the exchange rate regime has, in most cases, a positive

relationship with the magnitude of the RER undervaluation in our *Tobit* model. It has a positive relationship in some (but not in most) regressions. In short, the evidence does not allow us to conclude that pro-active exchange rate policies in the foreign exchange markets may help influence the degree of undervaluations.

Table 22 shows the differential impact on the magnitude of undervaluation of the equity-related and loan-related financial openness. In most cases throughout Table 22, accumulating equity-related liabilities may reduce the degree of undervaluation whereas higher loan-related liabilities would have the opposite effect. Finally, Table 23 reports the output and export concentration coefficient estimates in our Tobit model. Interestingly we find a robust positive and significant coefficient for export concentration regardless of the level of the threshold undervaluation in our Tobit analysis. Hence, larger undervaluations are more likely to occur in countries with less diversified export revenues.

6. Conclusions

Misalignments of real exchange rate is a useful tool to analyze macroeconomic performance because misaligned currencies (in real terms) generate distortions in relative prices and are assumed to have an effect on real economic activity. One strand of the literature has extensively documented the negative association between RER overvaluation and development (*e.g.* Dollar, 1992). The other recent evidence shows that RER undervaluation is present in episodes of growth accelerations (Hausmann et al. 2005). Given the evidence on the growth effects of undervaluation, the main goal of this paper is to examine whether RER undervaluations can be achieved and maintained through active macroeconomic policies.

In order to accomplish this task we first need to compute real exchange rate misalignments after we define an equilibrium level of the RER. The latter is based on a theoretical model where the equilibrium RER is obtained by achieving inter-temporal BOP equilibrium and equilibrium in the tradable and non-tradable goods market (Kubota, 2009). According to this model, the main determinants of the equilibrium RER are net foreign assets, TOT and relative labor productivity (*i.e.* HBS effect). This theoretical model will give us the framework to conceptually measure the equilibrium RER and, hence, RER misalignments.

In this paper, after defining RER misalignment, we characterize RER undervaluation episodes by creating a binary variables that takes the value of 1 when the actual RER has depreciated more (or appreciated less) than its equilibrium level. We determine threshold levels beyond which we characterize those time periods as periods of undervaluation. Then, we analyze the behavior of macroeconomic variables around these periods of undervaluation using the event analysis approach.

After the event analysis, we examine the relationship between policy instruments (exchange rate regimes, capital controls, foreign exchange rate market intervention, fiscal balance, openness, among others) and the incidence and magnitude of RER undervaluations using *Probit* and *Tobit* models.

We conduct an *event-analysis* for undervaluation episodes for the full sample countries. In this analysis we find that real GDP growth accelerates during and after the event of undervaluation. Export growth, on the other hand, speeds up during the undervaluation episodes and it slows down in the aftermath. What drives higher growth in the aftermath of undervaluation episodes? The evidence shows that growth in private consumption and investment accelerates significantly in the aftermath of the undervaluation episode. Finally, although we do not find a significant difference in the fiscal balance before, during and after the undervaluation episodes, the coefficients indicate that fiscal austerity may pick up during the undervaluation episode,

Regarding the behavior of the nominal exchange rate, we find that the domestic currency depreciates in real terms and is supported by Central Bank purchases of foreign currency in the FOREX market during the undervaluation episode. In the aftermath of the undervaluation, nominal exchange rates depreciate more than before or during the event. FOREX intervention is positive (*i.e.* buying foreign currency) before the undervaluation event and it becomes negative (selling foreign currency) during and after the event of undervaluation. However, inflation goes up slightly during undervaluation episodes and it goes back to almost the same average level as 'before' the event. Finally, capital controls seem to have declined more during the undervaluation episodes.

Our limited dependent variable analysis (*Probit* and *Tobit* modeling) attempts to evaluate the ability of policy variables to influence over the incidence and magnitude of RER undervaluation. The *Probit* analysis shows that pro-active economic policies may affect the probability of sustaining a RER undervaluation. Intervention in the

foreign exchange market is effective in supporting small to medium RER undervaluation and its effect becomes non-negligible for larger degrees of undervaluation. The flexibility of exchange rate arrangements —proxied by either the coarse or fine classification of exchange rate arrangements made by Reinhart and Rogoff (2004)— has a positive and significant coefficient regardless of the threshold of undervaluation. This implies that countries with more flexible exchange rate arrangements and more frequent intervention in the FOREX market are able to generate an undervaluation of the currency. Fiscal policy is also effective while the probability of the size of RER undervaluation is small to medium whereas it becomes ineffective when the RER undervaluation is larger (say, more than 20 percent). Interestingly, our results suggest that fiscal discipline shows a negative sign which implies that countries with healthier fiscal positions are less likely to undervalue their currencies. Finally, financial openness proxied by aggregate external liabilities (*FL*) or external assets and liabilities (*FAL*) fails to have a significant effect. This could be attributed to the fact that it may be important to account for the composition effect of capital flows. In this context, we find a robustly negative coefficient for equity-related liabilities and a positive and significant coefficient for loan-related liabilities. This shows that the structure of external liabilities plays a role in explaining the probability of real exchange rate undervaluations taking place: while equity-related flows tend to reduce the ability of countries to sustain undervaluations, loan-related flows tend to sustain it. Finally, the coefficient of liability dollarization is not robust.

The *Tobit* analysis, on the other hand, shows evidence that the authorities may have a more limited ability to influence the magnitude of the RER undervaluation. In contrast to our *Probit* results, flexible exchange arrangements and FOREX market intervention have a less robust link with the size of RER undervaluations. The exchange arrangement is mostly not significant in all regressions, while FOREX intervention has a positive and significant effect only when controlling for the fiscal position. Fiscal policy is again effective only in small to medium undervaluations (below 20%). The central government budget balance has a negative and significant coefficient. This shows that the fiscal policy may play a role in determining the extent of undervaluation in the exchange rate market. It shows though that fiscal discipline may reduce the size of the undervaluation.

Consistent with the Probit results, we find that both policy and outcome measures of financial openness fail to explain the magnitude of RER undervaluation. However,

we find that composition effects in financial openness may affect the magnitude of the RER undervaluation. More specifically, equity-related liabilities have negative and significant coefficient while loan-related liabilities have positive and significant coefficient in almost all specifications. Once more, liability dollarization did not seem to matter either. Finally, export concentration —as measured by the Hirschman-Herfindahl index of export revenues— shows a positive and significant coefficient. This means that export pattern matters on the magnitude of RER undervaluation. The results on the ability of exchange rate flexibility to affect the magnitude of the undervaluation are mixed.

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Table 1: Counts for the event of undervaluations (Notes: * indecates the ecent of drops)

79 Countries

1	ARG	Argentina	4	41	JOR	Jordan	1
2	AUS	Australia	2 *	42	JPN	Japan	0
3	AUT	Austria	0	43	KEN	Kenya	1
4	BEL	Belgium	3	44	KOR	Korea, Rep.	3
5	BFA	Burkina Faso	1	45	LKA	Sri Lanka	4
6	BGD	Bangladesh	1 *	46	MAR	Morocco	1 *
7	BOL	Bolivia	3	47	MDG	Madagascar	1 *
8	BRA	Brazil	2	48	MEX	Mexico	5
9	BWA	Botswana	0 *	49	MYS	Malaysia	2 *
10	CAN	Canada	2	50	NER	Niger	4
11	CHE	Switzerland	2	51	NGA	Nigeria	1 *
12	CHL	Chile	3	52	NIC	Nicaragua	1
13	CHN	China	2 *	53	NLD	Netherlands	1
14	CIV	Cote d'Ivoire	3	54	NOR	Norway	1
15	COG	Congo, Rep.	3 *	55	NZL	New Zealand	3
16	COL	Colombia	3	56	PAK	Pakistan	1
17	CRI	Costa Rica	2	57	PAN	Panama	3
18	DNK	Denmark	2	58	PER	Peru	2
19	DOM	Dominican Republic	2	59	PHL	Philippines	1
20	DEU	Germany	3	60	PNG	Papua New Guinea	3
21	DZA	Algeria	2	61	PRT	Portugal	4
22	ECU	Ecuador	2	62	PRY	Paraguay	6
23	EGY	Egypt, Arab Rep.	3	63	SEN	Senegal	2 *
24	ESP	Spain	3	64	SGP	Singapore	3
25	FIN	Finland	2	65	SLV	El Salvador	3
26	FRA	France	1	66	SWE	Sweden	3
27	GBR	United Kingdom	3	67	SYR	Syrian Arab Republic	3
28	GHA	Ghana	3 *	68	TGO	Togo	3
29	GRC	Greece	0	69	THA	Thailand	3
30	GTM	Guatemala	2	70	TTO	Trinidad and Tobago	3
31	HND	Honduras	3	71	TUN	Tunisia	4
32	HTI	Haiti	5	72	TUR	Turkey	1
33	IDN	Indonesia	3 *	73	URY	Uruguay	3
34	IND	India	3	74	USA	United States	0 *
35	IRL	Ireland	4 *	75	VEN	Venezuela, RB	2
36	IRN	Iran, Islamic Rep.	1	76	ZAF	South Africa	2
37	ISL	Iceland	5	77	ZAR	Congo, Dem. Rep.	1
38	ISR	Israel	5	78	ZMB	Zambia	3
39	ITA	Italy	1 *	79	ZWE	Zimbabwe	3
40	JAM	Jamaica	6				

Figure 1.1: Completed Episodes for All Countries

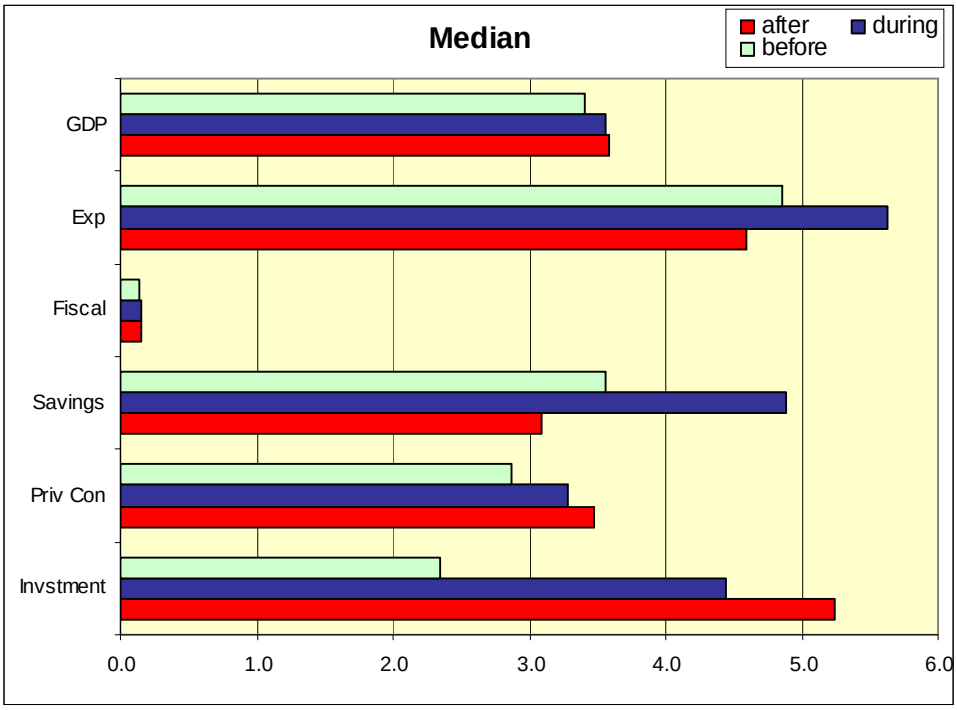

Figure 1.2: Completed Episodes for All Countries

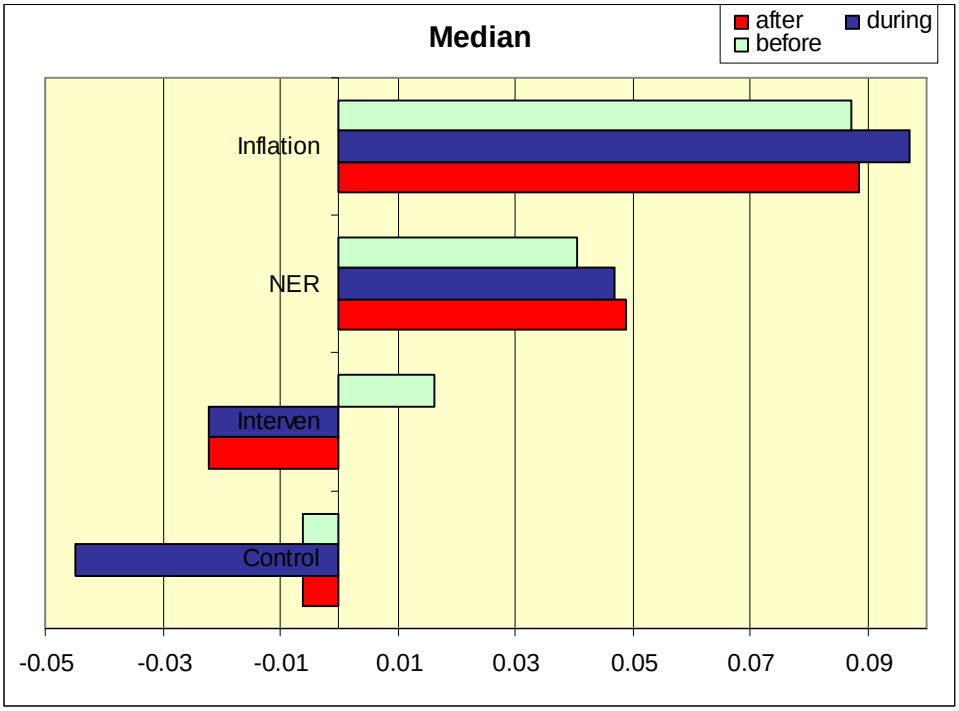

Figure 2.1: Completed Episodes for Developing Countries

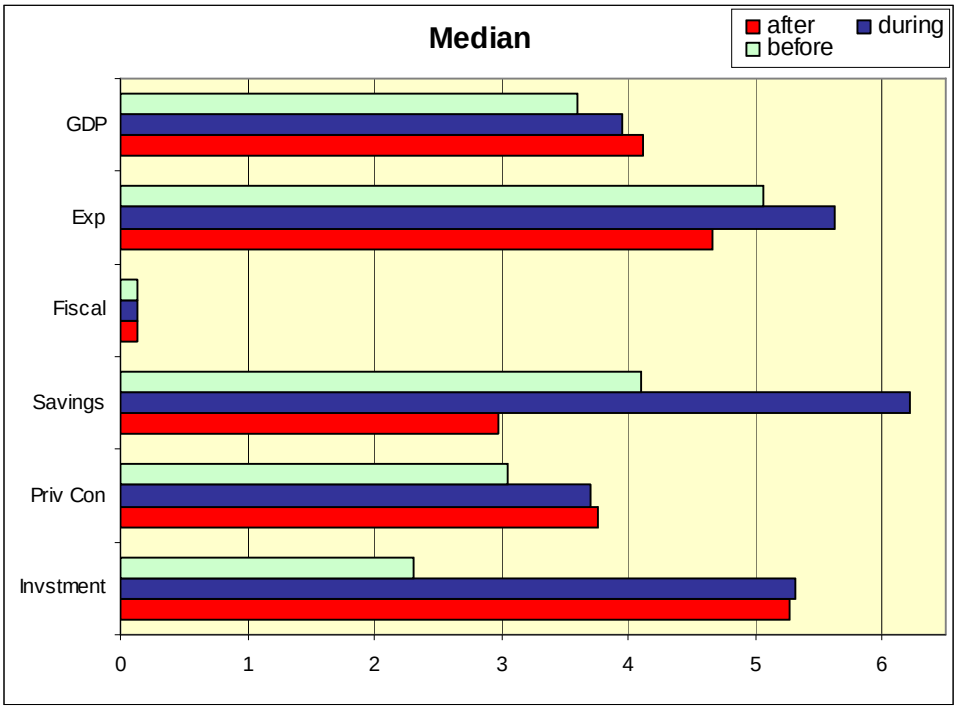

Figure 2.2: Completed Episodes for Developing Countries

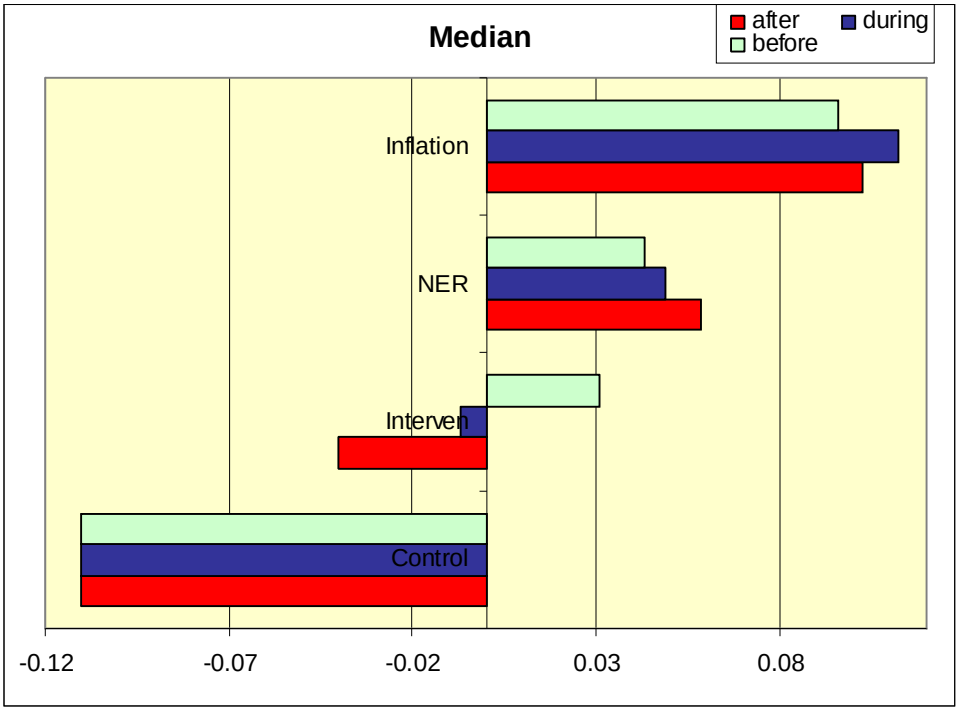

Figure 3.1: Completed Episodes for Industrial Countries

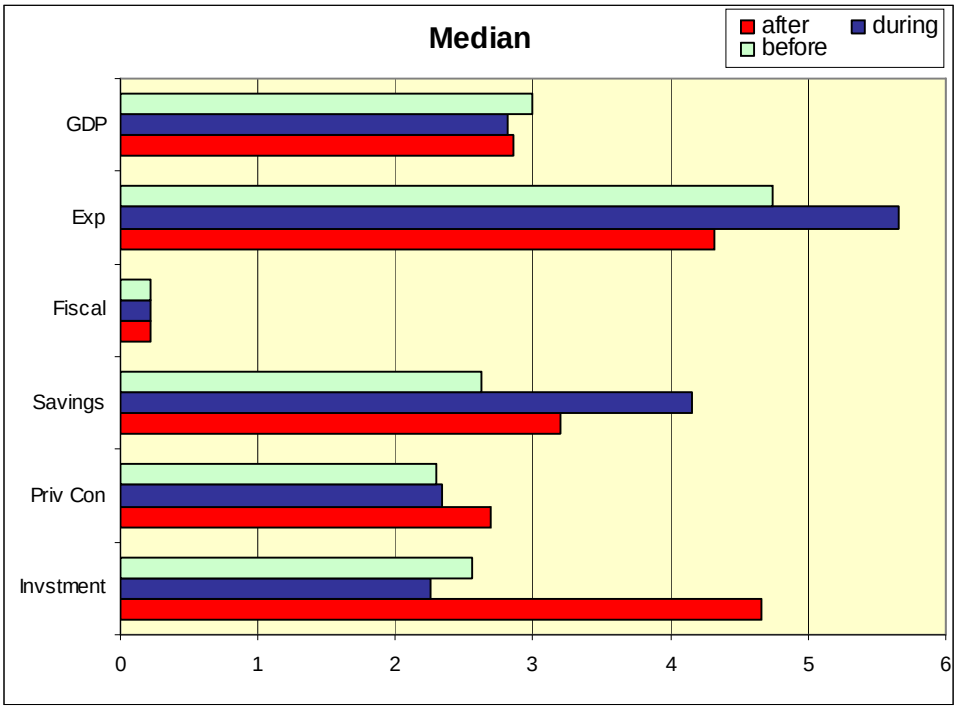

Figure 3.2: Completed Episodes for Industrial Countries

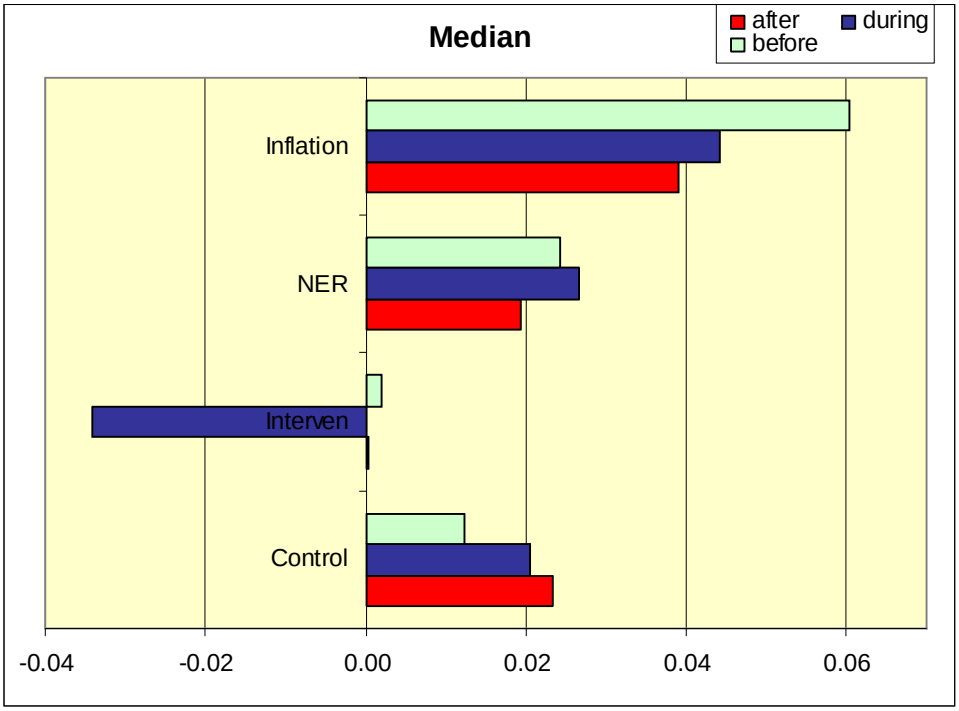

Table 2

Behavior of GDP Growth during Undervaluation Episodes: Simple Regression Analysis

Dependent Variable: Economic Growth (GDP Growth Rates)

Sample of 79 countries, 1971-2005 (annual observations)

Methodology: Least squares (fixed effects and accounting for country- and time-specifiic effects)

	All Countries		Developing Countries		Industrial Countries	
	FE	TI	FE	TI	FE	TI
	[1]	[2]	[3]	[4]	[5]	[6]
All Episodes						
3 years	0.057	0.001	0.127	0.063	-0.169	-0.366
(before)	(-0.37)	(-0.37)	(-0.47)	(-0.47)	(-0.44)	(-0.39)
2 years	0.030	0.006	-0.062	-0.017	0.367	-0.225
(before)	(-0.33)	(-0.33)	(-0.42)	(-0.42)	(-0.39)	(-0.35)
1 year	-0.679 **	-0.707 **	-0.745 *	-0.771 *	-0.437	-0.502
(before)	(0.03)	(0.33)	(-0.42)	(-0.42)	(-0.39)	(-0.35)
0 year	-0.201	-0.138	-0.061	-0.046	-0.687 **	-0.649 **
(current)	(-0.24)	(-0.23)	(-0.30)	(-0.29)	(0.27)	(0.24)
1 year	-0.050	0.043	-0.007	0.090	-0.227	0.433
(after)	(-0.34)	(-0.33)	(-0.44)	(-0.43)	(-0.39)	(-0.34)
2 years	-0.479	-0.144	-0.350	0.046	-0.948 **	-0.347
(after)	(-0.34)	(-0.33)	(-0.43)	(-0.43)	(0.38)	(-0.34)
3 years	-1.072 **	-0.677 *	-1.077 **	-0.612	-1.130 **	-0.497
(after)	(0.37)	(-0.37)	(0.48)	(-0.47)	(0.43)	(-0.38)
Completed Episodes						
3 years	-0.036	-0.047	0.003	0.019	-0.159	-0.231
(before)	(-0.37)	(-0.36)	(-0.46)	(-0.46)	(-0.43)	(-0.39)
2 years	-0.064	-0.037	-0.195	-0.057	0.421	-0.060
(before)	(-0.32)	(-0.32)	(-0.41)	(-0.41)	(-0.38)	(-0.34)
1 year	-0.765 **	-0.725 **	-0.885 **	-0.793 **	-0.313	-0.321
(before)	(0.32)	(0.31)	(0.41)	(0.40)	(-0.37)	(-0.33)
0 year	-0.418 *	-0.174	-0.339	-0.062	-0.710 **	-0.478 **
(current)	(-0.22)	(-0.23)	(-0.28)	(-0.30)	(0.25)	(0.22)
1 year	0.000	0.228	-0.005	0.305	-0.029	0.550 *
(after)	(-0.34)	(-0.34)	(-0.44)	(-0.44)	(-0.40)	(-0.35)
2 years	-0.364	0.079	-0.275	0.320	-0.751 *	-0.278
(after)	(-0.34)	(-0.34)	(-0.43)	(-0.43)	(-0.40)	(-0.35)
3 years	-1.276 **	-0.710 *	-1.288 **	-0.610	-1.317 **	-0.468
(after)	(0.38)	(-0.38)	(0.48)	(-0.48)	(0.45)	(-0.40)
Observations	2637	2637	1925	1925	712	712

Table 3
Behavior of Export Growth during Undervaluation Episodes: Simple Regression Analysis
Dependent Variable: Export Growth (Export Growth Rates)
Sample of 79 countries, 1971-2005 (annual observations)
Methodology: Least squares (fixed effects and accounting for country- and time-specifiic effects)

	All Countries		Developing Countries		Industrial Countries		Industrial Countries (After 1973)	
	FE	TI	FE	TI	FE	TI	FE	TI
	[1]	[2]	[3]	[4]	[5]	[6]	[5]	[6]
All Episodes								
3 years	-2.273 **	-2.279 **	-2.696 **	-2.482 *	-0.854	-0.994	-0.357	-0.332
(before)	(1.05)	(1.04)	(1.37)	(-1.37)	(-1.07)	(-0.96)	(-1.07)	(-0.96)
2 years	-0.091	0.150	-0.415	0.177	0.991	-0.408	1.348	0.025
(before)	(-0.94)	(-0.92)	(-1.23)	(-1.22)	(-0.95)	(-0.84)	(-0.95)	(-0.85)
1 year	-0.488	-0.450	-0.565	-0.764	-0.221	0.073	-0.072	0.356
(before)	(-0.93)	(-0.92)	(-1.22)	(-1.22)	(-0.95)	(-0.84)	(-0.96)	(-0.85)
0 year	0.687	0.543	0.693	0.492	0.692	0.828	1.183 *	1.292 **
(current)	(-0.66)	(-0.65)	(-0.86)	(-0.86)	(-0.66)	(-0.58)	(-0.69)	(0.60)
1 year	-0.114	0.194	0.063	0.444	-0.756	0.360	-0.404	0.354
(after)	(-0.96)	(-0.95)	(-1.27)	(-1.26)	(-0.94)	(-0.83)	(-0.93)	(-0.82)
2 years	-0.646	-0.154	-0.519	0.148	-1.113	-0.104	-0.737	-0.102
(after)	(-0.94)	(-0.94)	(-1.25)	(-1.25)	(-0.93)	(-0.82)	(-0.91)	(-0.81)
3 years	-0.314	0.356	-0.251	0.549	-0.428	0.433	-0.018	0.472
(after)	(-1.06)	(-1.05)	(-1.40)	(-1.39)	(-1.06)	(-0.94)	(-1.04)	(-0.92)
Completed Episodes								
3 years	-2.647 **	-2.541 **	-3.139 **	-2.763 **	-1.165	-1.163	-0.609	-0.565
(before)	(1.03)	(1.02)	(1.34)	(1.35)	(-1.04)	(-0.94)	(-1.05)	(-0.95)
2 years	-0.498	-0.131	-0.912	-0.134	0.687	-0.561	1.106	-0.166
(before)	(-0.91)	(-0.90)	(-1.19)	(-1.20)	(-0.92)	(-0.82)	(-0.93)	(-0.84)
1 year	-1.018	-0.881	-1.221	-1.218	-0.509	-0.202	-0.297	0.013
(before)	(-0.89)	(-0.89)	(-1.18)	(-1.18)	(-0.91)	(-0.81)	(-0.92)	(-0.83)
0 year	-0.274	-0.294	-0.511	-0.419	0.363	0.402	1.083 *	0.695
(current)	(-0.61)	(-0.64)	(-0.80)	(-0.87)	(-0.60)	(-0.55)	(-0.61)	(-0.55)
1 year	-0.974	-0.846	-1.101	-0.691	-0.858	-0.253	-0.506	-0.432
(after)	(-0.96)	(-0.95)	(-1.26)	(-1.27)	(-0.97)	(-0.86)	(-0.95)	(-0.84)
2 years	-1.270	-0.831	-1.514	-0.704	-0.710	-0.505	-0.334	-0.665
(after)	(-0.96)	(-0.95)	(-1.26)	(-1.27)	(-0.97)	(-0.86)	(-0.95)	(-0.84)
3 years	-0.951	-0.196	-0.897	-0.009	-1.104	0.057	-0.682	-0.059
(after)	(-1.08)	(-1.07)	(-1.41)	(-1.41)	(-1.13)	(-1.00)	(-1.10)	(-0.97)
Observations	2471	2471	1764	1764	707	707	665	665

Table 4

Behavior of Fiscal Balance during Undervaluation Episodes: Simple Regression Analysis

Dependent Variable: Fiscal Balance (a ratio of fiscal balance to GDP)

Sample of 79 countries, 1971-2005 (annual observations)

Methodology: Least squares (fixed effects and accounting for country- and time-specifiic effects)

	All Countries		Developing Countries		Industrial Countries	
	FE	TI	FE	TI	FE	TI
	[1]	[2]	[3]	[4]	[5]	[6]
All Episodes						
3 years	0.003	0.002	0.002	0.000	0.008 **	0.007 **
(before)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(0.00)	(0.00)
2 years	0.001	0.000	-0.001	-0.002	0.007 **	0.007 **
(before)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(0.00)	(0.00)
1 year	0.002	0.001	-0.001	-0.001	0.009 **	0.009 **
(before)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(0.00)	(0.00)
0 year	0.003	0.003	0.000	0.000	0.012 **	0.012 **
(current)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(0.00)	(0.00)
1 year	0.000	0.000	-0.002	-0.002	0.004	0.003
(after)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
2 years	0.001	0.000	-0.001	-0.002	0.006 **	0.004
(after)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
3 years	0.002	0.001	0.001	0.000	0.006	0.002
(after)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
Completed Episodes						
3 years	0.003	0.000	0.002	-0.001	0.005 *	0.002
(before)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
2 years	0.000	-0.002	-0.001	-0.003	0.003	0.002
(before)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
1 year	0.001	-0.001	0.000	-0.002	0.005 *	0.003
(before)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
0 year	0.003	-0.001	0.002	-0.003	0.007 **	0.003
(current)	(0.00)	(-0.00)	(-0.00)	(-0.00)	(0.00)	(-0.00)
1 year	0.000	-0.002	0.000	-0.002	0.001	-0.001
(after)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
2 years	0.001	-0.001	0.000	-0.002	0.003	0.000
(after)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
3 years	0.002	0.000	0.002	-0.001	0.003	-0.001
(after)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
Observations	2294	2294	1587	1587	707	707

Table 5

Behavior of Savings during Undervaluation Episodes: Simple Regression Analysis

Dependent Variable: Savings (a ratio of savings to GDP)

Sample of 79 countries, 1971-2005 (annual observations)

Methodology: Least squares (fixed effects and accounting for country- and time-specifiic effects)

	All Countries		Developing Countries		Industrial Countries	
	FE	TI	FE	TI	FE	TI
	[1]	[2]	[3]	[4]	[5]	[6]
All Episodes						
3 years	0.017 *	0.021 **	0.028 **	0.030 **	-0.018 **	-0.010
(before)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(-0.01)
2 years	0.012	0.015 *	0.020 **	0.022 **	-0.017 **	-0.013 **
(before)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
1 year	0.012	0.016 **	0.021 **	0.024 **	-0.019 **	-0.012 **
(before)	(-0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(-0.01)
0 year	0.024 **	0.026 **	0.031 **	0.032 **	-0.001	0.000
(current)	(0.01)	(0.01)	(0.01)	(0.01)	(-0.00)	(-0.00)
1 year	0.016 **	0.017 **	0.019 *	0.020 **	0.006	0.009
(after)	(0.01)	(0.01)	(-0.01)	(0.01)	(-0.01)	(-0.01)
2 years	0.010	0.013 *	0.011	0.015	0.008	0.009
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
3 years	0.001	0.004	-0.002	0.003	0.008	0.009
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
Completed Episodes						
3 years	0.009	0.017 **	0.018 *	0.026 **	-0.021 **	-0.012 *
(before)	(-0.01)	(-0.01)	(-0.01)	(0.01)	(0.01)	(-0.01)
2 years	0.003	0.010	0.009	0.018 **	-0.020 **	-0.014 **
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(0.01)	(0.01)
1 year	0.002	0.010	0.009	0.018 **	-0.023 **	-0.014 **
(before)	(-0.01)	(-0.01)	(-0.01)	(0.01)	(0.01)	(0.01)
0 year	0.009 *	0.021 **	0.014 **	0.030 **	-0.012 **	-0.008 **
(current)	(-0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(-0.00)
1 year	0.008	0.014 *	0.011	0.019 *	0.001	0.004
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
2 years	0.004	0.011	0.005	0.016 *	0.003	0.004
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
3 years	-0.003	0.004	-0.005	0.006	0.003	0.004
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
Observations	1636	1636	1228	1228	408	408

Table 6

Behavior of Private Consumption during Undervaluation Episodes: Simple Regression Analysis

Dependent Variable: Private Consumption (a ratio of private consumption to GDP)

Sample of 79 countries, 1971-2005 (annual observations)

Methodology: Least squares (fixed effects and accounting for country- and time-specifiic effects)

	All Countries		Developing Countries		Industrial Countries	
	FE	TI	FE	TI	FE	TI
	[1]	[2]	[3]	[4]	[5]	[6]
All Episodes						
3 years	-0.011 *	-0.013 *	-0.014 *	-0.016 *	0.002	0.001
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
2 years	-0.011 *	-0.012 **	-0.014 *	-0.014 *	0.000	0.000
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
1 year	-0.016 **	-0.016 **	-0.018 **	-0.017 **	-0.004	-0.004
(before)	(0.01)	(0.01)	(0.01)	(0.01)	(-0.01)	(-0.01)
0 year	-0.020 **	-0.018 **	-0.019 **	-0.018 **	-0.021 **	-0.016 **
(current)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
1 year	-0.017 **	-0.017 **	-0.018 **	-0.020 **	-0.011 *	-0.008
(after)	(0.01)	(0.01)	(0.01)	(0.01)	(-0.01)	(-0.01)
2 years	-0.014 **	-0.013 **	-0.015 *	-0.016 **	-0.011 *	-0.008
(after)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(-0.01)
3 years	-0.015 **	-0.014 **	-0.016 *	-0.016 *	-0.009	-0.007
(after)	(0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
Completed Episodes						
3 years	-0.006	-0.010	-0.009	-0.014 *	0.008	0.004
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
2 years	-0.007	-0.009	-0.009	-0.013 *	0.006	0.004
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
1 year	-0.010 *	-0.012 **	-0.013 *	-0.015 **	0.003	0.000
(before)	(-0.01)	(0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
0 year	-0.013 **	-0.015 **	-0.013 **	-0.017 **	-0.012 **	-0.008 **
(current)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
1 year	-0.013 **	-0.015 **	-0.015 *	-0.020 **	-0.008	-0.002
(after)	(0.01)	(0.01)	(-0.01)	(0.01)	(-0.01)	(-0.01)
2 years	-0.011 *	-0.012 *	-0.012	-0.016 **	-0.007	-0.001
(after)	(-0.01)	(-0.01)	(-0.01)	(0.01)	(-0.01)	(-0.01)
3 years	-0.013 *	-0.013 *	-0.015 *	-0.017 *	-0.006	-0.001
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
Observations	2125	2125	1717	1717	408	408

Table 7

Behavior of Investment during Undervaluation Episodes: Simple Regression Analysis

Dependent Variable: Investment (a ratio of investment to GDP)

Sample of 79 countries, 1971-2005 (annual observations)

Methodology: Least squares (fixed effects and accounting for country- and time-specifiic effects)

	All Countries		Developing Countries		Industrial Countries	
	FE	TI	FE	TI	FE	TI
	[1]	[2]	[3]	[4]	[5]	[6]
All Episodes						
3 years	0.009	0.012 **	0.013 *	0.018 **	-0.011 *	-0.008
(before)	(-0.01)	(0.01)	(-0.01)	(0.01)	(-0.01)	(-0.01)
2 years	0.009 *	0.011 **	0.012 **	0.015 **	-0.008 *	-0.005
(before)	(-0.01)	(0.01)	(-0.01)	(0.01)	(-0.01)	(-0.01)
1 year	0.005	0.007	0.007	0.011 *	-0.008	-0.003
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
0 year	0.002	0.005	0.006	0.007 *	-0.014 **	-0.010 **
(current)	(-0.00)	(-0.00)	(-0.01)	(-0.00)	(0.00)	(0.00)
1 year	0.009	0.008 *	0.012 *	0.010 *	0.000	0.005
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
2 years	0.009 *	0.008 *	0.010	0.009	0.003	0.007
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
3 years	0.007	0.007	0.007	0.007	0.006	0.008
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
Completed Episodes						
3 years	0.005	0.009	0.008	0.014 **	-0.006	-0.003
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
2 years	0.005	0.008 *	0.007	0.011 *	-0.003	-0.001
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
1 year	0.000	0.003	0.001	0.006	-0.004	0.000
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
0 year	-0.008 **	-0.003	-0.007 *	-0.002	-0.010 **	-0.005
(current)	(0.00)	(-0.00)	(-0.00)	(-0.00)	(0.00)	(-0.00)
1 year	0.002	0.003	0.003	0.005	-0.004	0.003
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
2 years	0.004	0.005	0.005	0.006	0.000	0.006
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
3 years	0.002	0.004	0.001	0.003	0.006	0.010 *
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
Observations	2152	2152	1744	1744	408	408

Table 8

Behavior of Inflation during Undervaluation Episodes: Simple Regression Analysis

Dependent Variable: Inflation (Consumer Price Index percent per annum)

Sample of 79 countries, 1971-2005 (annual observations)

Methodology: Least squares (fixed effects and accounting for country- and time-specifiic effects)

	All Countries		Developing Countries		Industrial Countries	
	FE	TI	FE	TI	FE	TI
	[1]	[2]	[3]	[4]	[5]	[6]
All Episodes						
3 years	-63.000	-77.713	-82.002	-97.329	0.371	-1.283
(before)	(-57.66)	(-58.22)	(-76.78)	(-77.69)	(-1.33)	(-0.99)
2 years	-60.263	-67.688	-79.419	-92.942	-0.145	-0.899
(before)	(-51.54)	(-51.94)	(-68.44)	(-69.03)	(-1.20)	(-0.89)
1 year	-21.000	-25.545	-28.984	-35.063	0.173	-0.670
(before)	(-51.45)	(-51.80)	(-68.27)	(-68.78)	(-1.20)	(-0.88)
0 year	-50.472	-66.210 *	-65.838	-88.145 *	-1.711 **	-0.891
(current)	(-36.43)	(-36.69)	(-48.67)	(-49.06)	(0.83)	(-0.60)
1 year	-53.281	-53.391	-71.560	-69.479	1.121	0.374
(after)	(-52.85)	(-53.30)	(-70.71)	(-71.42)	(-1.20)	(-0.88)
2 years	-68.544	-70.197	-91.693	-98.483	1.706	1.421 *
(after)	(-52.18)	(-52.79)	(-69.78)	(-70.70)	(-1.19)	(-0.87)
3 years	-44.770	-49.383	-58.102	-71.936	0.474	0.342
(after)	(-57.42)	(-58.00)	(-77.20)	(-77.98)	(-1.29)	(-0.95)
Completed Episodes						
3 years	-43.370	-64.826	-57.570	-84.932	1.650	-1.029
(before)	(-56.32)	(-57.34)	(-75.10)	(-76.67)	(-1.31)	(-0.97)
2 years	-39.110	-53.066	-53.041	-78.456	1.133	-0.681
(before)	(-49.83)	(-50.68)	(-66.23)	(-67.50)	(-1.17)	(-0.87)
1 year	3.053	-9.137	0.676	-19.077	1.321	-0.449
(before)	(-49.26)	(-50.04)	(-65.53)	(-66.65)	(-1.16)	(-0.85)
0 year	-8.357	-47.583	-12.308	-71.603	-0.236	-0.596
(current)	(-33.79)	(-36.61)	(-45.13)	(-49.72)	(-0.78)	(-0.58)
1 year	-31.405	-45.054	-42.921	-62.579	0.256	0.494
(after)	(-53.15)	(-54.11)	(-70.73)	(-72.50)	(-1.24)	(-0.91)
2 years	-50.683	-65.001	-66.990	-94.466	0.841	1.511 *
(after)	(-52.96)	(-53.96)	(-70.40)	(-72.16)	(-1.25)	(-0.91)
3 years	-25.786	-41.559	-32.273	-62.699	0.023	0.774
(after)	(-58.55)	(-59.45)	(-77.96)	(-79.38)	(-1.37)	(-1.00)
Observations	2540	2540	1849	1849	691	691

Table 9
Behavior of Nominal Exchange Rates during Undervaluation Episodes: Simple Regression Analysis
Dependent Variable: Nominal Exchange Rates
Sample of 79 countries, 1971-2005 (annual observations)
Methodology: Least squares (fixed effects and accounting for country- and time-specifiic effects)

	All Countries		Developing Countries		Industrial Countries		Industrial Countries (After 1974)	
	FE	TI	FE	TI	FE	TI	FE	TI
	[1]	[2]	[3]	[4]	[5]	[6]	[5]	[6]
All Episodes								
3 years	240.493 **	348.120 **	305.180 **	418.839 **	-10.738	-10.296	-13.334	-9.882
(before)	(119.34)	(117.60)	(155.02)	(152.56)	(-17.71)	(-18.28)	(-16.17)	(-16.68)
2 years	260.189 **	347.191 **	343.183 **	437.743 **	-20.199	-18.291	-26.168 *	-24.522 *
(before)	(106.62)	(104.88)	(138.44)	(135.91)	(-15.76)	(-16.18)	(-14.71)	(-15.18)
1 year	296.487 **	370.060 **	390.291 **	464.646 **	-29.439 *	-24.561 *	-35.399 **	-30.896 **
(before)	(106.62)	(104.81)	(138.06)	(135.35)	(-15.91)	(-16.30)	(14.87)	(15.31)
0 year	308.507 **	340.913 **	399.896 **	436.258 **	-20.344 *	-21.486 *	-22.149 **	-19.874 *
(current)	(75.21)	(73.96)	(97.57)	(91.72)	(-11.13)	(-11.18)	(10.89)	(-10.95)
1 year	263.500 **	270.414 **	353.274 **	363.605 **	-24.181 *	-18.285	-34.957 **	-26.796 *
(after)	(109.11)	(107.48)	(142.63)	(140.19)	(-15.73)	(-16.14)	(14.92)	(-15.25)
2 years	239.245 **	220.996 **	321.129 **	305.438 **	-14.211	-10.796	-21.671 *	-11.170
(after)	(107.57)	(106.31)	(140.80)	(138.75)	(-15.45)	(-15.89)	(-13.90)	(-14.19)
3 years	292.446 **	236.061 **	376.282 **	310.878 **	4.816	2.159	-2.147	2.223
(after)	(119.51)	(117.84)	(156.29)	(153.61)	(-17.31)	(-17.72)	(-15.48)	(-15.76)
Completed Episodes								
3 years	115.122	304.678 **	146.264	380.808 **	-0.212	0.510	-9.713	-4.793
(before)	(-117.03)	(115.92)	(-152.22)	(150.50)	(-17.38)	(-18.00)	(-15.85)	(-16.43)
2 years	128.325	296.808 **	173.575	390.975 **	-10.567	-8.334	-22.216 *	-19.421
(before)	(-103.54)	(102.46)	(-134.60)	(132.94)	(-15.34)	(-15.83)	(-14.38)	(-14.93)
1 year	145.928	305.441 **	198.684	403.386 **	-19.023	-14.548	-31.975 **	-26.118 *
(before)	(-102.60)	(101.45)	(-133.17)	(131.27)	(-15.30)	(-15.77)	(14.42)	(-14.96)
0 year	46.650	279.965 **	63.942	399.262 **	0.162	-6.186	-17.802 *	-15.559 *
(current)	(-70.18)	(73.82)	(-91.33)	(97.13)	(-10.32)	(-10.68)	(-10.04)	(-10.22)
1 year	131.300	199.273 *	179.128	296.612 **	-14.903	-17.546	-31.379 **	-26.361 *
(after)	(-110.14)	(-109.27)	(-143.14)	(142.16)	(-16.33)	(-16.83)	(14.75)	(-15.08)
2 years	126.487	156.986	170.618	244.580 *	-5.018	-9.551	-18.747	-14.160
(after)	(-109.51)	(-108.75)	(-142.47)	(-141.50)	(-16.18)	(-16.68)	(-14.48)	(-14.76)
3 years	190.798 *	181.212	239.074 *	257.102 *	18.295	8.186	4.456	3.758
(after)	(-122.29)	(-121.00)	(-158.40)	(-156.35)	(-18.48)	(-19.01)	(-16.46)	(-16.79)
Observations	2568	2568	1929	1929	639	639	576	576

Table 10

Behavior of Intervention during Undervaluation Episodes: Simple Regression Analysis

Dependent Variable: Intervention

Sample of 79 countries, 1971-2005 (annual observations)

Methodology: Least squares (fixed effects and accounting for country- and time-specifiic effects)

	All Countries		Developing Countries		Industrial Countries	
	FE	TI	FE	TI	FE	TI
	[1]	[2]	[3]	[4]	[5]	[6]
All Episodes						
3 years	0.007	0.006	0.006	0.004	0.019 *	0.019
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
2 years	-0.001	0.000	-0.001	0.000	-0.003	-0.008
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
1 year	-0.002	-0.002	-0.003	-0.002	0.002	0.008
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
0 year	0.002	0.003	0.001	0.003	0.000	-0.001
(current)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
1 year	-0.016 *	-0.014	-0.020 *	-0.018 *	0.007	0.007
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
2 years	-0.004	0.000	-0.003	0.000	-0.008	-0.008
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
3 years	-0.001	0.003	-0.005	-0.001	0.027 **	0.021 *
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(0.01)	(-0.01)
Completed Episodes						
3 years	0.006	0.007	0.005	0.005	0.018 *	0.020 *
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
2 years	-0.002	0.001	-0.002	0.001	0.000	-0.005
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
1 year	-0.002	0.000	-0.004	-0.001	0.005	0.012
(before)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
0 year	0.000	0.005	-0.001	0.006	0.003	0.003
(current)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
1 year	-0.017 *	-0.013	-0.023 **	-0.018 *	0.015	0.014
(after)	(-0.01)	(-0.01)	(0.01)	(-0.01)	(-0.01)	(-0.01)
2 years	-0.006	-0.002	-0.006	-0.001	-0.007	-0.008
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
3 years	-0.003	0.003	-0.007	0.000	0.023 *	0.018
(after)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)	(-0.01)
Observations	1979	1979	1695	1695	284	284

Table 11

Behavior of Control (Capital Openness) during Undervaluation Episodes: Simple Regression Analysis

Dependent Variable: Control (Capital Openness)

Sample of 79 countries, 1971-2005 (annual observations)

Methodology: Least squares (fixed effects and accounting for country- and time-specifiic effects)

	All Countries		Developing Countries		Industrial Countries	
	FE	TI	FE	TI	FE	TI
	[1]	[2]	[3]	[4]	[5]	[6]
All Episodes						
3 years	-0.206 **	-0.050	-0.137	-0.018	-0.452 **	-0.109
(before)	(0.09)	(-0.08)	(-0.10)	(-0.10)	(0.22)	(-0.15)
2 years	-0.157 *	-0.034	-0.112	-0.019	-0.312 *	-0.001
(before)	(-0.08)	(-0.07)	(-0.09)	(-0.09)	(-0.19)	(-0.13)
1 year	-0.207 **	-0.096	-0.174 *	-0.096	-0.308 *	0.001
(before)	(0.08)	(-0.07)	(-0.09)	(-0.08)	(-0.19)	(-0.13)
0 year	-0.110 *	-0.104 **	-0.166 **	-0.143 **	0.093	0.108
(current)	(-0.06)	(0.05)	(0.07)	(0.06)	(-0.13)	(-0.09)
1 year	-0.087	-0.106	-0.092	-0.110	-0.028	0.064
(after)	(-0.09)	(-0.08)	(-0.10)	(-0.09)	(-0.19)	(-0.13)
2 years	-0.057	-0.106	-0.058	-0.094	-0.011	0.025
(after)	(-0.09)	(-0.07)	(-0.09)	(-0.09)	(-0.19)	(-0.13)
3 years	-0.036	-0.123	-0.036	-0.092	-0.028	-0.087
(after)	(-0.09)	(-0.08)	(-0.10)	(-0.10)	(-0.21)	(-0.14)
Completed Episodes						
3 years	-0.289 **	-0.053	-0.201 **	-0.001	-0.600 **	-0.145
(before)	(0.09)	(-0.08)	(0.10)	(-0.09)	(0.21)	(-0.15)
2 years	-0.239 **	-0.033	-0.178 **	0.001	-0.459 **	-0.018
(before)	(0.08)	(-0.07)	(0.09)	(-0.08)	(0.19)	(-0.13)
1 year	-0.295 **	-0.096	-0.246 **	-0.072	-0.465 **	-0.046
(before)	(0.08)	(-0.07)	(0.09)	(-0.08)	(0.18)	(-0.13)
0 year	-0.342 **	-0.141 **	-0.376 **	-0.131 **	-0.215 *	-0.044
(current)	(0.05)	(0.05)	(0.06)	(0.06)	(-0.12)	(-0.09)
1 year	-0.147 *	-0.132 *	-0.152 *	-0.098	-0.080	-0.132
(after)	(-0.09)	(-0.08)	(-0.09)	(-0.09)	(-0.19)	(-0.13)
2 years	-0.112	-0.139 *	-0.117	-0.092	-0.050	-0.171
(after)	(-0.09)	(-0.08)	(-0.09)	(-0.09)	(-0.19)	(-0.13)
3 years	-0.075	-0.138 *	-0.092	-0.085	-0.021	-0.246 *
(after)	(-0.09)	(-0.08)	(-0.10)	(-0.10)	(-0.22)	(-0.15)
Observations	2570	2570	1867	1867	703	703

Table 12
Probit Estimation: Baseline Regression Analysis
Sample of 79 countries, 1971-2005 (Annual)

	Undervaluation > 5%			
Variables	[1]	[2]	[3]	[4]
Dummy Variable				
RER misalignment /1	-0.273 **	-0.242 **	-0.273 **	-0.242 **
as a ratio (one lag)	(0.04)	(0.03)	(0.04)	(0.03)
Financial Openness (FO)				
Chinn-Ito measure of capital controls /2	-0.093 **	0.083 **	-0.095 **	0.082 **
(one lag)	(0.05)	(0.04)	(0.05)	(0.04)
Total Foreign Liabilities	1.93E-03	7.25E-04	..	..
as % of GDP	(0.00)	(0.00)		
Total Foreign Assets and Liabilities	..	..	6.60E-04	1.17E-04
as % of GDP			(0.00)	(0.00)
Trade Openness (TO)				
Trade openness	-1.97E-03	6.90E-04	-1.66E-03	7.79E-04
as % of GDP (one lag)	(0.00)	(0.00)	(0.00)	(0.00)
Liability Dollarization				
Ratio of Foreign Liabilities to Money	1.78E-04	2.87E-04 *	2.34E-04	3.31E-04 *
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy				
Central Governmnet Balance	-3.86E-05 **	..	-3.88E-05 **	..
as % of GDP	(0.00)		(0.00)	
Exchange Rate Regime				
Fine classification /3	0.047 **	0.035 **	0.049 **	0.037 **
(Reinhart and Rogoff fine classification)	(0.02)	(0.01)	(0.02)	(0.01)
Levy-Yeyati and Sturzenegger	1.079 **	0.785 **	1.084 **	0.797 **
(Levy-Yeyati and Sturzenegger definition)	(0.52)	(0.37)	(0.52)	(0.37)
Observations	1081	1480	1081	1480
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000

1/ It takes 1 if undervaluation is greater than 5%.
2/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
3/ The fine classification codes from 1 to 15. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)

Table 13
Probit Estimation: Regression Analysis, The Role of the Structure of External Assets and Liabilities
Sample of 79 countries, 1971-2005 (Annual)

	Undervaluation > 5%			
Variables	[1]	[2]	[3]	[4]
Dummy Variable				
RER misalignment /1	-0.271 **	-0.273 **	-0.235 **	-0.236 **
as a ratio (one lag)	(0.04)	(0.04)	(0.03)	(0.03)
Financial Openness (FO)				
Chinn-Ito measure of capital controls /2	0.033	0.028	0.031	0.028
(one lag)	(0.05)	(0.05)	(0.04)	(0.04)
Equity-related Liabilities	-0.012 **	-0.012 **	-0.013 **	-0.013 **
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Loan-related Liabilities	0.006 **	0.005 **	0.004 **	0.004 **
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Trade Openness (TO)				
Trade openness	-4.07E-05	6.51E-05	2.37E-03	2.57E-03
as % of GDP (one lag)	(0.00)	(0.00)	(0.00)	(0.00)
Liability Dollarization				
Ratio of Foreign Liabilities to Money	-8.43E-05	-6.91E-05	5.05E-05	5.75E-05
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy				
Central Governmnet Balance	-3.73E-05 **	-3.66E-05 **	..	..
as % of GDP	(0.00)	(0.00)		
Exchange Rate Regime				
Fine classification /3	0.046 **	..	0.033 **	..
(Reinhart and Rogoff fine classification)	(0.02)		(0.01)	
Course classification /4	..	0.149 **	..	0.107 **
(Reinhart and Rogoff fine classification)		(0.05)		(0.04)
Levy-Yeyati and Sturzenegger	1.051 **	1.094 **	0.840 **	0.853 **
(Levy-Yeyati and Sturzenegger definition)	(0.53)	(0.53)	(0.37)	(0.37)
Observations	1081	1081	1476	1476
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000

1 It takes 1 if undervaluation is greater than 5%.
2/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
3/ The fine classification codes from 1 to 15. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)
4/ The fine classification codes from 1 to 6. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)

Table 14
Probit Estimation: Regression Analysis, Real Vulnerabilities
Sample of 79 countries, 1971-2005 (Annual)

	Undervaluation > 5%			
Variables	[1]	[2]	[3]	[4]
Dummy Variable				
RER misalignment /1	-0.269 **	-0.251 **	-0.270 **	-0.251 **
as a ratio (one lag)	(0.04)	(0.04)	(0.04)	(0.04)
Financial Openness (FO)				
Chinn-Ito measure of capital controls /2	0.043	0.039	0.042	0.039
(one lag)	(0.05)	(0.05)	(0.05)	(0.05)
Equity-related Liabilities	-0.008 **	-0.008 **	-0.008 **	-0.009 **
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Loan-related Liabilities	0.004 **	0.004 **	0.004 **	0.004 **
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Trade Openness (TO)				
Trade openness	-8.73E-04	-5.33E-04	-7.28E-04	3.26E-03
as % of GDP (one lag)	(0.00)	(0.00)	(0.01)	(0.00)
Output Concentration /3	0.101	..	0.128	..
as Herfindahl Index ratio	(1.99)		(2.52)	
Export Concentration /4	..	0.048	..	0.699
as Herfindahl Index ratio		(0.42)		(0.75)
Output Concentration	..	..	-1.19E-03	..
as openness times output concentration			(0.03)	
Export Concentration	..	..	..	-0.010
as openness times export concentration				(0.01)
Liability Dollarization				
Ratio of Foreign Liabilities to Money	-2.75E-04	-2.58E-04	-2.83E-04	-2.26E-04
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy				
Central Governmnet Balance	-3.69E-05 **	-3.64E-05 **	-3.69E-05 **	-3.64E-05 **
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Exchange Rate Regime				
Fine classification /5	0.048 **	0.047 **	0.048 **	0.045 **
(Reinhart and Rogoff fine classification)	(0.02)	(0.02)	(0.02)	(0.02)
Levy-Yeyati and Sturzenegger	0.993 *	1.186 **	0.999 *	1.200 **
(Levy-Yeyati and Sturzenegger definition)	(0.53)	(0.58)	(0.53)	(0.58)
Observations	1049	955	1046	952
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000

1 It takes 1 if undervaluation is greater than 5%.
2/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
3/ is a measure of the size of firms in relationship to the industry and an indicator of the amount of competition among them. The output concentration ratio gives more weight to larger firm.
4/ Herfindahl Index of Merchandise Export Revenue Concentration
5/ The fine classification codes from 1 to 15. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)
6/ The fine classification codes from 1 to 6. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)

Table 15
Probit Estimation: Baseline Sensitivity Analysis
Sample of 79 countries, 1971-2005 (Annual)

	Undervaluation > 5%		Undervaluation > 10%		Undervaluation > 20%		Undervaluation > 25%	
Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Dummy Variable								
RER misalignment /1	-0.273 **	-0.273 **	-0.260 **	-0.260 **	-0.231 **	-0.231 **	-0.216 **	-0.216 **
as a ratio (one lag)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Financial Openness (FO)								
Chinn-Ito measure of capital controls /2	-0.093 **	-0.095 **	0.100 **	0.101 **	0.103 *	0.105 **	0.116 **	0.122 **
(one lag)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)
Total Foreign Liabilities	0.002	..	0.002	..	0.002	..	0.003 **	..
as % of GDP	(0.00)		(0.00)		(0.00)		(0.00)	
Total Foreign Assets and Liabilities	..	6.60E-04	..	5.55E-04	..	6.93E-04	..	1.24E-03
as % of GDP		(0.00)		(0.00)		(0.00)		(0.00)
Trade Openness (TO)								
Trade openness	-1.97E-03	-1.66E-03	-3.17E-03	-2.81E-03	-1.68E-03	-1.34E-03	-1.93E-03	-1.47E-03
as % of GDP (one lag)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Liability Dollarization								
Ratio of Foreign Liabilities to Money	1.78E-04	2.34E-04	2.08E-04	2.86E-04	2.46E-04	3.09E-04	1.71E-04	2.43E-04
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy								
Central Governmnet Balance	-3.86E-05 **	-3.88E-05 **	-3.10E-05 *	-3.11E-05 *	-2.34E-05	-2.31E-05	-1.98E-05	-1.93E-05
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exchange Rate Regime								
Fine classification /3	0.047 **	0.049 **	0.042 **	0.045 **	0.051 **	0.054 **	0.049 **	0.052 **
(Reinhart and Rogoff fine classification)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Levy-Yeyati and Sturzenegger	1.079 **	1.084 **	1.161 **	1.169 **	0.841	0.849 *	0.537	0.550
(Levy-Yeyati and Sturzenegger definition)	(0.52)	(0.52)	(0.53)	(0.53)	(0.57)	(0.57)	(0.58)	(0.58)
Observations	1081	1081	1081	1081	1081	1081	1081	1081
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

1 It takes 1 if undervaluation is greater than 5%, 10%, 20% and 25%, respectively.
2/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
3/ The fine classification codes from 1 to 15. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)

Table 16
Probit Estimation: Sensitivity Analysis, The Role of the Structure of External Assets and Liabilities
Sample of 79 countries, 1971-2005 (Annual)

	Undervaluation > 5%		Undervaluation > 10%		Undervaluation > 20%		Undervaluation > 25%	
Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Dummy Variable								
RER misalignment /1	-0.271 **	-0.273 **	-0.260 **	-0.263 **	-0.228 **	-0.230 **	-0.211 **	-0.212 **
as a ratio (one lag)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Financial Openness (FO)								
Chinn-Ito measure of capital controls /2	0.033	0.028	0.030	0.029	0.037	0.034	0.041	0.034
(one lag)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
Equity-related Liabilities	-0.012 **	-0.012 **	-0.010 **	-0.010 **	-0.013 **	-0.012 **	-0.014 **	-0.013 **
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Loan-related Liabilities	0.006 **	0.005 **	0.005 **	0.004 **	0.006 **	0.005 **	0.007 **	0.007 **
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Trade Openness (TO)								
Trade openness	-4.07E-05	6.51E-05	-1.70E-03	-1.68E-03	5.01E-04	6.02E-04	6.71E-04	7.90E-04
as % of GDP (one lag)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Liability Dollarization								
Ratio of Foreign Liabilities to Money	-8.43E-05	-6.91E-05	-2.91E-04	-2.69E-04	5.61E-06	1.71E-05	-1.02E-04	-8.90E-05
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy								
Central Governmnet Balance	-3.73E-05 **	-3.66E-05 **	-2.91E-05 *	-2.91E-05 *	-2.25E-05	-2.21E-05	-1.96E-05	-1.88E-05
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exchange Rate Regime								
Fine classification /3	0.046 **	..	0.045 **	..	0.050 **	..	0.047 **	..
(Reinhart and Rogoff fine classification)	(0.02)		(0.02)		(0.02)		(0.02)	
Course classification /4	..	0.149 **	..	0.131 **	..	0.156 **	..	0.162 **
(Reinhart and Rogoff fine classification)		(0.05)		(0.05)		(0.05)		(0.06)
Levy-Yeyati and Sturzenegger	1.051 **	1.094 **	1.039 *	1.081 **	0.779	0.818	0.451	0.485
(Levy-Yeyati and Sturzenegger definition)	(0.53)	(0.53)	(0.54)	(0.54)	(0.58)	(0.58)	(0.60)	(0.60)
Observations	1081	1081	1081	1081	1081	1081	1081	1081
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

1 It takes 1 if undervaluation is greater than 5%, 10%, 20% and 25%, respectively.
2/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
3/ The fine classification codes from 1 to 15. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)
4/ The fine classification codes from 1 to 6. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)

Table 17
Probit Estimation: Sensitivity Analysis, Real Vulnerabilities
Dependent Variable: Incidence of undervaluation (binary variable that takes the value of 1 whenever undervaluation exceeds a certain threshold)
Sample of 79 countries, 1971-2005 (Annual)

	Undervaluation > 5%		Undervaluation > 10%		Undervaluation > 20%		Undervaluation > 25%	
Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Dummy Variable								
RER misalignment	-0.269 **	-0.251 **	-0.255 **	-0.237 **	-0.227 **	-0.210 **	-0.212 **	-0.195 **
as a ratio (one lag)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Capital Controls								
Chinn-Ito measure of capital controls /1	0.043	0.039	0.045	0.031	0.044	0.041	0.047	0.054
(one lag)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)
Equity-related Liabilities	-0.008 **	-0.008 **	-0.010 **	-0.010 **	-0.013 **	-0.012 **	-0.013 **	-0.012 **
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Loan-related Liabilities	0.004 **	0.004 **	0.004 **	0.005 **	0.006 **	0.005 **	0.007 **	0.006 **
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Trade Openness (TO)								
Trade openness	-8.73E-04	-5.33E-04	-1.15E-03	-1.90E-03	5.15E-04	9.54E-04	3.20E-04	1.24E-03
as % of GDP (one lag)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Output Concentration /2	0.101	..	0.634	..	-0.068	..	-0.587	..
Hirschman-Herfindahl index	(1.99)		(2.17)		(2.38)		(2.61)	
Export Concentration /3	..	0.048	..	0.021	..	0.313	..	0.391
Hirschman-Herfindahl index		(0.42)		(0.44)		(0.47)		(0.52)
Liability Dollarization								
Ratio of Foreign Liabilities to Money	-2.75E-04	-2.58E-04	-2.66E-04	-3.14E-04	4.72E-06	5.11E-05	-9.93E-05	1.26E-05
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy								
Central Government Balance	-3.69E-05 **	-3.64E-05 **	-2.94E-05 *	-2.85E-05 *	-2.33E-05	-2.17E-05	-1.99E-05	-1.79E-05
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exchange Rate Policies								
Exchange Rate Flexibility 4/	0.048 **	0.047 **	0.045 **	0.044 **	0.045 **	0.051 **	0.042 **	0.047 **
(Reinhart and Rogoff fine classification)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Intervention in the Foreign Exchange Market 5/	0.993 *	1.186 **	1.036 *	1.149 *	0.788	0.620	0.443	0.098
(Levy-Yeyati and Sturzenegger definition)	(0.53)	(0.58)	(0.54)	(0.59)	(0.58)	(0.63)	(0.60)	(0.66)
Observations	1049	955	1049	955	1049	955	1049	955
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

1/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
2/ We compute the Hirschman-Herfindahl index of output concentation based on the 1-digit ISIC classification of economic activity.
3/ We compute the Hirschman-Herfindahl index of export concentation based on the 2-digit SITC classification of export revenues.
4/ Our proxy of exchange rate flexbility follows the "fine" classification coded from 1 to 15 by Reinhart and Rogoff. Higher values of this variable indicate a more flexible exchange rate arrangement (Reinhart and Rogoff, 2004)
5/ Annual average change in the ratio of reserves to broad money. Positive values of this variable imply a "strong" degree of intervention, because for intervention to be positive reserve accumulation must exceed the incresae in monetary aggregates (Levy-Yeyati and Sturzenegger, 2007)

Table 18
Tobit Estimation: Baseline Regression Analysis
Sample of 79 countries, 1971-2005 (Annual)

	Undervaluation > 5%			
Variables	[1]	[2]	[3]	[4]
Dummy Variable				
RER misalignment /1	-0.229 **	-0.373 **	-0.230 **	-0.373 **
as a ratio (one lag)	(0.03)	(0.02)	(0.03)	(0.02)
Financial Openness (FO)				
Chinn-Ito measure of capital controls /2	0.051	0.056	0.048	0.057
(one lag)	(0.05)	(0.04)	(0.05)	(0.04)
Total Foreign Liabilities	1.67E-03	5.16E-04	..	..
as % of GDP	(0.00)	(0.00)		
Total Foreign Assets and Liabilities	..	..	5.39E-04	1.54E-04
as % of GDP			(0.00)	(0.00)
Trade Openness (TO)				
Trade openness	-1.26E-03	7.33E-04	-1.05E-03	7.61E-04
as % of GDP (one lag)	(0.00)	(0.00)	(0.00)	(0.00)
Liability Dollarization				
Ratio of Foreign Liabilities to Money	5.29E-05	1.56E-04	1.06E-04	1.75E-04
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy				
Central Governmnet Balance	-2.69E-05 **	..	-2.62E-05 *	..
as % of GDP	(0.00)		(0.00)	
Exchange Rate Regime				
Fine classification /3	0.021	0.017	0.025 *	0.018
(Reinhart and Rogoff fine classification)	(0.02)	(0.01)	(0.02)	(0.01)
Levy-Yeyati and Sturzenegger	0.188	0.777 **	0.198	0.783 **
(Levy-Yeyati and Sturzenegger definition)	(0.51)	(0.40)	(0.52)	(0.40)
Observations	1081	1480	1081	1480
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000

1/ It takes 1 if undervaluation is greater than 5%.
2/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
3/ The fine classification codes from 1 to 15. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)

Table 19
Tobit Estimation: Regression Analysis, The Role of the Structure of External Assets and Liabilities
Sample of 79 countries, 1971-2005 (Annual)

	Undervaluation > 5%			
Variables	[1]	[2]	[3]	[4]
Dummy Variable				
RER misalignment /1	-0.233 **	-0.231 **	-0.372 **	-0.372 **
as a ratio (one lag)	(0.03)	(0.03)	(0.02)	(0.02)
Financial Openness (FO)				
Chinn-Ito measure of capital controls /2	0.004	-0.006	0.026	0.016
(one lag)	(0.05)	(0.05)	(0.05)	(0.05)
Equity-related Liabilities	-0.006 **	-0.005 *	-0.008 *	-0.007 *
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Loan-related Liabilities	0.003 **	0.002 *	0.002 *	0.002
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Trade Openness (TO)				
Trade openness	-2.24E-04	3.66E-04	0.002	0.002
as % of GDP (one lag)	(0.00)	(0.00)	(0.00)	(0.00)
Liability Dollarization				
Ratio of Foreign Liabilities to Money	-2.21E-04	-1.65E-04	2.66E-05	5.85E-05
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy				
Central Governmnet Balance	-2.56E-05 *	-2.39E-05 *	..	..
as % of GDP	(0.00)	(0.00)		
Exchange Rate Regime				
Fine classification /3	0.025 *	..	0.015	..
(Reinhart and Rogoff fine classification)	(0.02)		(0.01)	
Course classification /4	..	0.121 **	..	0.080 *
(Reinhart and Rogoff fine classification)		(0.05)		(0.04)
Levy-Yeyati and Sturzenegger	0.110	0.138	0.800 **	0.811 **
(Levy-Yeyati and Sturzenegger definition)	(0.52)	(0.52)	(0.40)	(0.40)
Observations	1081	1081	1476	1476
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000

1 It takes 1 if undervaluation is greater than 5%.
2/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
3/ The fine classification codes from 1 to 15. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)
4/ The fine classification codes from 1 to 6. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)

Table 20
Tobit Estimation: Regression Analysis, Real Vulnerabilities
Sample of 79 countries, 1971-2005 (Annual)

Variables	Undervaluation > 5% [1]	[2]	[3]	[4]
Dummy Variable				
RER misalignment /1	-0.230 **	-0.226 **	-0.231 **	-0.228 **
as a ratio (one lag)	(0.03)	(0.03)	(0.03)	(0.03)
Financial Openness (FO)				
Chinn-Ito measure of capital controls /2	0.004	-0.003	0.001	0.003
(one lag)	(0.05)	(0.05)	(0.05)	(0.05)
Equity-related Liabilities	-0.008 **	-0.006	-0.008 *	-0.005 *
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Loan-related Liabilities	0.004 **	0.003 *	0.004 **	0.002
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Trade Openness (TO)				
Trade openness	5.50E-04	-7.24E-04	-1.25E-03	-4.22E-04
as % of GDP (one lag)	(0.00)	(0.00)	(0.01)	(0.00)
Output Concentration /3	1.767	..	1.213	..
as Herfindahl Index ratio	(2.07)		(2.52)	
Export Concentration /4	..	1.042 **	..	0.983
as Herfindahl Index ratio		(0.42)		(0.76)
Output Concentration	..	..	0.010	..
as openness times output concentration			(0.04)	
Export Concentration	..	..	..	-2.80E-04
as openness times export concentration				(0.01)
Liability Dollarization				
Ratio of Foreign Liabilities to Money	-2.75E-04	-4.82E-05	-8.89E-05	-1.31E-04
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy				
Central Governmnet Balance	-3.69E-05 **	-2.74E-05 *	-2.74E-05 **	-2.34E-05 *
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)
Exchange Rate Regime				
Fine classification /5	0.048 **	0.020	0.020	0.022
(Reinhart and Rogoff fine classification)	(0.02)	(0.02)	(0.02)	(0.02)
Levy-Yeyati and Sturzenegger	0.993 *	0.125	0.132	0.129
(Levy-Yeyati and Sturzenegger definition)	(0.53)	(0.60)	(0.53)	(0.61)
Observations	1049	955	1046	952
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000

1 It takes 1 if undervaluation is greater than 5%.
2/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
3/ is a measure of the size of firms in relationship to the industry and an indicator of the amount of competition among them. The output concentration ratio gives more weight to larger firm.
4/ Herfindahl Index of Merchandise Export Revenue Concentration
5/ The fine classification codes from 1 to 15. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)
6/ The fine classification codes from 1 to 6. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)

Table 21
Tobit Estimation: Baseline Sensitivity Analysis
Sample of 79 countries, 1971-2005 (Annual)

	Undervaluation > 5%		Undervaluation > 10%		Undervaluation > 20%		Undervaluation > 25%	
Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Dummy Variable								
RER misalignment /1	-0.229 **	-0.230 **	-0.235 **	-0.236 **	-0.247 **	-0.247 **	-0.249 **	-0.250 **
as a ratio (one lag)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Financial Openness (FO)								
Chinn-Ito measure of capital controls /2	0.051	0.048	0.048	0.049	0.060	0.056	0.056	0.065
(one lag)	(0.05)	(0.05)	(0.05)	(0.05)	(0.07)	(0.06)	(0.07)	(0.07)
Total Foreign Liabilities	1.67E-03	..	1.71E-03	..	1.78E-03	..	2.96E-03	..
as % of GDP	(0.00)		(0.00)		(0.00)		(0.00)	
Total Foreign Assets and Liabilities	..	5.39E-04	..	3.91E-04	..	4.15E-04	..	9.68E-04
as % of GDP		(0.00)		(0.00)		(0.00)		(0.00)
Trade Openness (TO)								
Trade openness	-1.26E-03	-1.05E-03	-2.20E-03	-1.70E-03	-1.37E-03	-1.02E-03	-1.58E-03	-9.48E-04
as % of GDP (one lag)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Liability Dollarization								
Ratio of Foreign Liabilities to Money	5.29E-05	1.06E-04	8.46E-05	1.64E-04	1.44E-04	2.24E-04	6.78E-05	1.60E-04
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy								
Central Governmnet Balance	-2.69E-05 **	-2.62E-05 *	-2.63E-05 *	-2.53E-05 *	-3.04E-05 *	-2.89E-05 *	-3.10E-05 *	-2.99E-05
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exchange Rate Regime								
Fine classification /3	0.021	0.025 *	0.023	0.027 *	0.039 *	0.042 *	0.040 *	0.043 *
(Reinhart and Rogoff fine classification)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Levy-Yeyati and Sturzenegger	0.188	0.198	0.305	0.340	0.183	0.207	-0.075	-0.035
(Levy-Yeyati and Sturzenegger definition)	(0.51)	(0.52)	(0.58)	(0.58)	(0.74)	(0.74)	(0.82)	(0.82)
Observations	1081	1081	1081	1081	1081	1081	1081	1081
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

1 It takes 1 if undervaluation is greater than 5%, 10%, 20% and 25%, respectively.
2/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
3/ The fine classification codes from 1 to 15. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)

Table 22
Tobit Estimation: Sensitivity Analysis, The Role of the Structure of External Assets and Liabilities
Sample of 79 countries, 1971-2005 (Annual)

	Undervaluation > 5%		Undervaluation > 10%		Undervaluation > 20%		Undervaluation > 25%	
Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Dummy Variable								
RER misalignment /1	-0.233 **	-0.231 **	-0.239 **	-0.237 **	-0.251 **	-0.248 **	-0.249 **	-0.247 **
as a ratio (one lag)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)
Financial Openness (FO)								
Chinn-Ito measure of capital controls /2	0.004	-0.006	0.001	-0.014	-0.009	-0.021	-0.006	-0.018
(one lag)	(0.05)	(0.05)	(0.05)	(0.05)	(0.07)	(0.07)	(0.07)	(0.07)
Equity-related Liabilities	-0.006 **	-0.005 *	-0.008 **	-0.008 **	-0.010 **	-0.010 **	-0.011 *	-0.011 *
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Loan-related Liabilities	0.003 **	0.002 *	0.003 **	0.003 *	0.004 **	0.003 *	0.006 **	0.006 **
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Trade Openness (TO)								
Trade openness	-2.24E-04	3.66E-04	-1.06E-03	-2.62E-04	4.24E-04	9.57E-04	7.75E-04	1.41E-03
as % of GDP (one lag)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Liability Dollarization								
Ratio of Foreign Liabilities to Money	-2.21E-04	-1.65E-04	-2.50E-04	-1.90E-04	-2.67E-04	-2.00E-04	-1.25E-04	-1.28E-04
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy								
Central Governmnet Balance	-2.56E-05 *	-2.39E-05 *	-2.47E-05 *	-2.34E-05 *	-2.65E-05	-2.51E-05	-3.00E-05	-2.75E-05
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exchange Rate Regime								
Fine classification /3	0.025 *	..	0.027	..	0.045 **	..	0.040 *	..
(Reinhart and Rogoff fine classification)	(0.02)		(0.02)		(0.02)		(0.03)	
Course classification /4	..	0.121 **	..	0.116 **	..	0.179 **	..	0.187 **
(Reinhart and Rogoff fine classification)		(0.05)		(0.05)		(0.07)		(0.08)
Levy-Yeyati and Sturzenegger	0.110	0.138	0.216	0.237	0.034	0.083	-0.184	-0.156
(Levy-Yeyati and Sturzenegger definition)	(0.52)	(0.52)	(0.58)	(0.58)	(0.74)	(0.74)	(0.83)	(0.82)
Observations	1081	1081	1081	1081	1081	1081	1081	1081
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

1 It takes 1 if undervaluation is greater than 5%, 10%, 20% and 25%, respectively.
2/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
3/ The fine classification codes from 1 to 15. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)
4/ The fine classification codes from 1 to 6. The higher number describes more floating regimes. (Reinhart and Rogoff, 2004)

Table 23
Tobit Estimation: Sensitivity Analysis, Real Vulnerabilities
Dependent Variable: Incidence of undervaluation (binary variable that takes the value of 1 whenever undervaluation exceeds a certain threshold)
Sample of 79 countries, 1971-2005 (Annual)

	Undervaluation > 5%		Undervaluation > 10%		Undervaluation > 20%		Undervaluation > 25%	
Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Dummy Variable								
RER misalignment	-0.230 **	-0.226 **	-0.235 **	-0.231 **	-0.249 **	-0.245 **	-0.252 **	-0.247 **
as a ratio (one lag)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Capital Controls								
Chinn-Ito measure of capital controls /1	0.004	-0.003	0.012	-0.011	0.019	-0.006	-0.006	-0.006
(one lag)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)	(0.08)	(0.08)
Equity-related Liabilities	-0.008 **	-0.006	-0.010 **	-0.008 *	-0.011 *	-0.008	-0.012 *	-0.009
as % of GDP	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Loan-related Liabilities	0.004 **	0.003 *	0.004 **	0.004 *	0.004 *	0.003	0.006 **	0.004
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Trade Openness (TO)								
Trade openness	5.50E-04	-7.24E-04	1.48E-04	-1.51E-03	-1.67E-04	2.23E-04	4.20E-04	8.00E-04
as % of GDP (one lag)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Output Concentration /2	1.767	..	1.672	..	0.533	..	-0.092	..
Hirschman-Herfindahl index	(2.07)		(2.25)		(3.06)		(2.98)	
Export Concentration /3	..	1.042 **	..	1.062 **	..	1.371 **	..	1.530 **
Hirschman-Herfindahl index		(0.42)		(0.46)		(0.54)		(0.60)
Liability Dollarization								
Ratio of Foreign Liabilities to Money	-2.75E-04	-4.82E-05	-7.91E-05	-7.12E-05	-8.32E-05	3.88E-05	-1.20E-04	8.03E-07
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal Policy								
Central Government Balance	-3.69E-05 **	-2.74E-05 *	-2.74E-05 *	-2.63E-05 *	-3.08E-05 *	-2.68E-05	-3.01E-05	-2.68E-05
as % of GDP	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exchange Rate Policies								
Exchange Rate Flexibility /4	0.048 **	0.020	0.019	0.019	0.033	0.040 *	0.035	0.039
(Reinhart and Rogoff fine classification)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Intervention in the Foreign Exchange Market /5	0.993 *	0.125	0.229	0.184	0.093	-0.248	-0.189	-0.755
(Levy-Yeyati and Sturzenegger definition)	(0.53)	(0.60)	(0.59)	(0.68)	(0.75)	(0.85)	(0.83)	(0.95)
Observations	1049	955	1049	955	1049	955	1049	955
Prob > chi2 (Wald chi2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

1/ This capital closeness is calculated by multiplying -1 by kaopen in Chinn-Ito Index.
2/ We compute the Hirschman-Herfindahl index of output concentation based on the 1-digit ISIC classification of economic activity.
3/ We compute the Hirschman-Herfindahl index of export concentation based on the 2-digit SITC classification of export revenues.
4/ Our proxy of exchange rate flexbility follows the "fine" classification coded from 1 to 15 by Reinhart and Rogoff. Higher values of this variable indicate a more flexible exchange rate arrangement (Reinhart and Rogoff, 2004)
5/ Annual average change in the ratio of reserves to broad money. Positive values of this variable imply a "strong" degree of intervention, because for intervention to be positive reserve accumulation must exceed the incresae in monetary aggregates (Levy-Yeyati and Sturzenegger, 2007)