Managing Real Exchange Rate for economic development: empirical evidences from developing countries

Lúcio Otávio Seixas Barbosa[1]
Frederico G. Jayme Junior[2]
Fabrício J. Missio[3]

Abstract: This paper analyses macroeconomic policies capable of influencing the long-run real exchange rate (RER). In this vein, it identifies economic policy tools that can devalue RER, covering a theoretical issue neglected by the economic literature, which argues that competitive exchange rate enhances growth. After discussing the "Trilemma", we identify those variables that could affect RER without constraining monetary policy or exchange rate regime choice. In what follows, we model the probability of achieving an undervalued (small or large) RER for a sample of 14 developing countries from 1980 to 2010 (30 years) by applying econometric techniques for discrete choice and censored data. Afterwards, we compare the results for Latin-American nations with Asian ones. They suggest that competitive exchange rate requires different approaches depending on the region. Moreover, Latin American countries need to take on additional policies so that interventions in the Foreign Exchange Market become effective.

Key words: competitive exchange rate, exchange rate management, exchange rate policy.

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[1]Planning Department of Minas Gerais (SEPLAG-MG)
[2]Professor at Federal University of Minas Gerais (CEDEPLAR/UFMG)
[3] Professor at Federal University of Minas Gerais (CEDEPLAR/UFMG).

1 - Introduction

Recenty many papers have been dealing with economic growth strategies based on competitive (devaluated) exchange rates[1]. From a theoretical point of view, there are different channels through which exchange rate policies enhance economic growth, as boosting effective aggregate demand and improving functional or inter-sectoral income distribution (BHADURI e MARGLIN, 1990; ARAUJO, 2012; MISSIO and JAYME JR., 2012; among others). Empirically, there is robust evidence that competitive exchange rate prompts economic growth (DOLLAR, 1992; RAZIN and COLLINS, 1997; ACEMOGLU et al, 2002; GALA 2007b; RODRIK, 2008; MISSIO et al, 2015, among others).

Nevertheless, though such an approach endorses exchange rate devaluation, it does not mention how to accomplish it. In other words, few papers disclose economic strategies to devaluate real exchange rate (RER). Yet, under free capital mobility, is it possible to adopt exchange rate policies to keep a competitive exchange rate?

In this vein, this paper evaluates the means by which exchange rate policy can affect RER. It aims at identifying those variables that cause exchange rate devaluation. Indeed, this is the novelty of it. On one hand, we present an alternative approach so as to identify such variables. On the other hand, we follow a different empirical approach.

We employ discrete and censured econometric models, which allow assessing whether exchange rate policies are effective to devaluate RER. Since the dependent variable is binary (RER is devalued or not) or censured (overvalued periods are reported as zero), these approach are more appropriate and give better results. Moreover, we test such models in a panel data context, which are more appealing than Kubota (2011) approach.

We analyze the results comparing two country groups: Latin-American countries and Asian ones. By doing so, we seek to understand the relative success at managing the exchange rate of the latter group, while the former failed. In sequence, we present those measures that would allow Latin-American countries to take a similar route to Asian ones.

The paper has three sections, besides this introduction and the concluding remarks. Section 2 discusses exchange rate policies from a theoretical perspective. Section 3 presents how to measure them. Section 4, besides providing the empirical methodology, shows the analysis of the results.

2 – Exchange Rate Policies: theoretical approach

According to the policy "Trilemma" framework, the monetary authority can achieve only two out of three policies goals, which are (1) financial integration, (2) exchange rate stability and (3) monetary autonomy. Exchange rate stability improves predictability of external trade agreements and lessens foreign direct investment risks; free capital mobility would improve global savings allocation[2]; and monetary policy autonomy allows Central Banks (CBs) to focus on price stability and economic growth.

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[1] Macroeconomic fundamentals drive the real exchange rate under a conventional approach (see Isard, 2007). Following it, there is no role for exchange rate policy, once it does not affect the real economy. In contrast, under a non-conventional approach short-run and nominal variables, as well as long run and real variables, influence the real exchange rate (see Kaltenbrunner, 2015).

[2] Kregel (2004) and Palma (2012) argue that growth strategies based on external finance are harmful for developing countries, since they increase financial fragility (Minskyan approach) and exposes countries to massive liquidity of financial markets (according to Kindleberger).

Thus, when policymakers choose to keep exchange rate stability and free capital mobility, they step down CB autonomy. Assuming that government bonds issued by countries are perfect substitutes, a fixed exchange rate regime demands that both rates are equals, in line with Uncovered Interest Parity (UIP).

Although the policy "Trilemma" framework may be useful for small open economies, its results must be assessed cautiously[3]. In fact, the great majority of countries are not restrained by binary choices. They are able to choose the level of financial integration with standing capital controls, and to manage their exchange rate under a manage float regime, while keeping a monetary policy relatively independent. Therefore, countries seek for ways of matching these policies (Bresser-Pereira, 2012).

In addition, such a framework relies on UIP validity, which has questionable empirical results (Isard, 2007), and on the controversial assumption of desirable free capital mobility, which exposes developing countries (DCs) to sudden-stops of capital flows capable of undermining domestic economy. Hence, countries usually do not work in the three points of the triangle but somewhere inside it.

Lately, we have seen financial markets becoming even more integrated internationally, which forces countries to choose down giving up either exchange rate stability or monetary independence. This does not mean that they cannot have both simultaneously. Theoretically, there is nothing that prevents a country from pursuing a manage float exchange rate regime in which half of every fluctuation in demand for its currency is accommodated by intervention and the other half can be reflected in the exchange rate[4] (Frankel, 1999).

Nevertheless, CB cannot always intervene in the foreign exchange market. For instance, under an uprising demand for foreign exchange rate, it relies on its currencies reserves. Furthermore, CB intervention results usually are far more complex than theory prescription. Taking this into consideration, capital flows depend upon exchange rate expectations, which in its turn can be changed by the signaling and behavior of CB itself.

According to Frenkel and Taylor (2006, p.8) *"The fact that no single form of transaction or arbitrage operation determines the exchange rate means that monetary authorities have some leeway in setting both the scaling factor between their country's price system and the rest of the world's, and the rules by which it changes"*. This is the key issue: which are those economic policy instruments not mentioned in the "Trilemma"[5] are capable of influencing RER?[6] In what follows, we identify them for DCs, taking into account theoretical and historical matters.

We rank three economic policy instruments of which CB can enforce only two. The other one requires CB coordination with government institutions responsible for economic policy. Therefore, we assigned it as macroeconomic policy coordination.

i) Central Bank (CB) intervention: Since 1990, when capital account was deregulated, Development Countires (DCs) have increased their international reserves holding. Such

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[3] Following Frenkel and Taylor (2006), the "Trilemma" does not hold. Even under free capital mobility, the monetary authority can buy and sell bonds in domestic and foreign markets, or even embrace monetary control policies, which regulate money supply regardless other forces that drive the exchange rate.

[4] First, CB buy dollars, selling domestic currency. Then, the monetary base and international reserves rise. At the same time, CB sell domestic bonds, returning the monetary base and the interest rate to the initial value.

[5] We discuss instruments beyond the "Trilemma" framework, apart from capital control, once it is not necessarily desirable. Specifically, we do not discuss exchange rate regime, interest rate level and financial integration, assuming that other policies allows the combining of these three ones.

[6] A key message of the "Trilemma" is the scarcity of policy instruments (Aizenman, 2010).

reserves provide self-insurance against volatile finance flows, which are associated with the growing exposure to sudden-stops and deleveraging crises (Aizenman, 2010).

Aizenman (2010) states that the link between hoarding reserves and financial integration adds a fourth dimension to the "Trilemma". In the short-run, hoarding and managing international reserves increase DCs' financial stability and capacity to run independent monetary policy. Latin American countries liberalized their financial markets rapidly since the 1990s, reducing the extent of monetary independence and maintaining a lower level of exchange rate stability, whereas Emerging Asian economies stand out by achieving significant levels of exchange rate stability and growing financial openness, without giving up greater monetary independence. According to the author, the main difference between these two groups of economies is the higher level of international reserves holding of the latter.

Rajan (2012) argues that the higher level of international reserves holding of Emerging Asian economies suggests that CBs are more sensitive to exchange rate appreciation ("fear of appreciation"). To avoid it, CBs intervene to defend the exchange rate, while maintaining monetary autonomy.

Theorethically, the author assumes that CB has control over international reserves holding. Thus, the monetary authority objective function has two core goals: keeping optimal international reserves level and exchange rate in its target. If CB intervenes more when the exchange rate appreciates, it signals its preference over a devalued currency (Rajan, 2012).

In this context, the central point is to assess CB capability of sterilizing monetary effects of international reserves holding. For Frenkel (2007), the condition for combining exchange rate management and monetary autonomy is the existence of an excess supply of international currency at the exchange rate target. That is, when international liquidity is high, if CB does not intervene, local currency will appreciate due to favorable conditions in current and capital accounts. To cope with it, the monetary authority can achieve the exchange rate target by purchasing the excess of foreign currency supply and can control the interest rate by issuing treasure or CB's bonds to sterilize the monetary effects of this intervention.

However, the author argues that the "Trilemma" holds in situations of deficits, since the CB ability to intervene in the money market relies on its available amount of reserves. Therefore, CBs could not adopt the exchange rate target without affecting the interest rate in situations of excess demand for international currency.

In addition, sterilizing buying operations cannot be applied in every circumstance. Its sustainability depends on the interest rate earned by the international reserves, on the local interest rate, on the exchange rate trend and on the evolution of the variables determining supply and demand of monetary base. Frenkel (2007) concludes that there is a maximum local interest rate above which the policy of sterilization becomes unsustainable[7].

Broadly, CBs can manage exchange rate by sterilized interventions. Nonetheless, deficit conditions or sterilization costs bound its action.
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ii) Capital control: Besides sterilized interventions, capital control measures can help to manage RER. In fact, it is possible to mix regulated capital markets, which would allow

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[7] The Brazilian experience between 1994 and 1998 illustrates this issue. The difference between the interest rate paid by the public debt and the income earned from international reserves discloses the high costs of sterilization. In addition, since the growth rate of public revenue was much smaller than the interest rate paid by the public debt, sterilization policy sustainability was undermined (See Palma, 2012).

capital flows, though discouraging speculative ones, with exchange rate stability and monetary autonomy.

Financial flows intensify boom-bust cycles, particular in DCs, as happened in many Latin American countries, mainly after capital account deregulation (Ocampo, 2003; Palma, 2012). During upswings, the external lending boom enhances domestic credit and private sector spending. The rise of domestic asset prices, as well as the excess of liquidity, reinforces credit and spending growth. This behavior also increases the vulnerability of the financial system during the subsequent downswing, when debtors have difficulties serving their obligation and it becomes clear that loans did not have adequate backing.

According to Ocampo (2003), monetary policies have limited degrees of freedom to smooth out the dynamics of boom-bust cycles irrespective of the exchange rate regime. Furthermore, the accumulation of foreign currency and maturity mismatches on the balance sheets of both financial and non-financial agents during upswings are an additional source of vulnerability. Hence, capital-account regulations potentially have a dual role: i) as a "liability policy" to improve private sector external debt profiles; ii) and as a macroeconomic policy that provides some room for counter-cyclical monetary policies.

The former recognizes that a maturity profile that leans towards long-term obligations will reduce domestic liquidity risks. In other words, an essential component of economic policy during booms should be measures to improve the maturity structures of both the private and public sectors' external and domestic liabilities. On the equity side, foreign direct investment should be preferred to portfolio flows, which are more volatile (Ocampo, 2003).The latter allows monetary authorities to cope with boom-bust cycles, providing some room to "lean against the wind" during periods of financial euphoria by adopting contractionary policies and/or reducing exchange rate appreciation pressures. During crises, capital account regulations improve authorities' ability to mix additional degrees of monetary independence with a more active exchange rate policy (Ocampo, 2003).

In this vein, Magud, Reinhart and Rogoff (2011) claim that capital controls can prevent exchange rate appreciation. According to them (p.26-27, 2006), "capital controls on inflows seem to make monetary policy more independent, alter the composition of capital flow, reduce real exchange rate (although the evidence is more controversial)", but "seem not to reduce the volume of net flows (and hence, the current account balance)". At the same time, "limiting private external borrowing in the 'good times' plays an important prudential role because more of than not countries are 'debt intolerant'". Therefore, besides preventing exchange rate overvaluation, they contribute to a better public sector' debt profile.

Thus, capital account regulations measures are favorable to domestic economy, though they may not influence RER.

iii) Macroeconomic policy coordination: it connects the fiscal stance with wage management policies. Assuming that economic policies aim at keeping a competitive RER, the dispute between capitalists and workers must be considered. Bhaduri and Marglin (1990) (and its subsequent developments) presented a model for handling such an issue. In simple terms, a RER devaluation decreases real wage (exchange rate pass-through), harming the working class, but simultaneously increasing capitalist's profitability. On one hand, the fall of the wage mass has a negative impact on aggregate demand. On the other hand, if the economy is profit led, the most important is to keep capitalists' profitability.

Theoretically, Rapetti (2011) suggests that exchange rate devaluation diminishes wages in the tradable sector, prompting output and employment growth (considering a profit led regime) in both tradable and non-tradable sector. In the medium run, the profitability rise in the tradable sector would stimulate investments therein (with increasing returns to scale through learning by doing, for instance), boosting the capital accumulation process and reinforcing employment, output and aggregate demand growth. As a result, workers would bargain better wages and non-tradable prices would also grow fast (income effect), which would hamper tradable sector profitability. Therefore, the management of productivity gains, labor costs (wages) and non-tradable prices are fundamental to keep a virtuous cycle.

In this context, the author argues that countries, which intend to implement a strategy based on competitive RER, need to coordinate macroeconomic policy (exchange rate and wage management, and monetary and fiscal policy) to avoid a raise in non-tradable prices and wages. Since in a competitive RER regime monetary policy is subordinated to exchange rate policy, fiscal policy has a greater responsibility in the managing of the pace of domestic demand, which can be curbed by rising fiscal surplus. Instead of it, government may choose to manage real wage, so that labor costs do not rise above productivity gains of the tradable sector. In sum, a competitive RER policy relies on macroeconomic policy coordination (Rapetti, 2011).

As ranked above, there are at least three different ways of managing RER through policy instruments beyond the "Trilemma" framework. Empirically, Kubota (2011) ran some tests based on the following active economic policies: exchange rate regimes, capital controls, foreign exchange market intervention, fiscal and external policies (financial and trade openness), liability dollarization and fiscal surplus. Though the results are mixed, they point out that foreign exchange rate intervention and fiscal discipline are effective on small to medium devaluations, i.e., below 20%. Flexible exchange rate arrangements have a positive impact on pursuing a competitive RER, irrespective of the RER target, i.e., even for devaluations over 20%. Lastly, portfolio flows have an adverse effect on devaluations.

Based on Kubota (2011) results, it seems that embracing competitive RER strategies is not a trivial matter, although Gala (2007a, 2007b) points out that the outstanding economic growth of Asian economies compared to Latin American ones were due to exchange rate management. Therefore, disclosing how the former countries accomplish it is a key issue, particularly considering its contractionary and inflationary effects and the obstacles to coordinate macroeconomic policy.

3. Empirical indicators and identification strategy

3.1 Empirical indicators

As aforementioned, there at least three ways to prompt competitive RER policies, circumventing the "Trilemma" approach: intervention in exchange rate markets through (often-sterilized) reserve accumulation, capital controls' measures, and wages and demand management policies. In what follows, we show how to measure each of them:

a) Intervention in exchange rate markets: Following Levy-Yeyati et al (2013), we subtract government deposits at the CB from its net foreign assets[8]. More specifically, we define net reserves in dollar in month m as:

$$R_m = \frac{Foreign\ Assets_m - Foreign\ Liabilities_m - Gov\ Deposits_m}{e_m} \tag{1}$$

where e is the dollar price in terms of domestic currency.

Then, we compute the ratio between CB reserves and M2 (M1 plus quasi-money).

$$R2_m = \frac{R_m}{M2_m} \tag{2}$$

The intervention measure to country c in year y is the annual average change of this ratio.

$$Interv.exrate_{c,y} = \sum_{1}^{12} \frac{1}{12} (R2_{c,y,m} - R2_{c,y,m-1}) \tag{3}$$

Thus, a positive integer $Interv.exrate$ implies a strong degree of intervention, since the index will be positive only if reserve accumulation exceed the increase of monetary aggregates. In such cases, CB would by foreign currency to avoid exchange rate overvaluation ("fear of appreciation"). In other words, CB would buy foreign currency to enlarge its own reserves and not to widen the monetary base in face of a raise of the demand for money. On the other hand, negative values of this index indicate that CB is selling reserves to defend domestic currency from devaluations.

Besides this index, the authors suggest another way to measure intervention in the exchange rate market:

$$Interv.exrate2_{c,y} = \sum_{1}^{12} \frac{1}{12} \frac{R_{c,y,m} - R_{c,y,m-1}}{\left(\frac{MBase_{c,y,m-1}}{e_{c,t,m-1}}\right)} \tag{4}$$

in which changes in net foreign reserves are normalized by monetary base. While reserves accumulation can be explained by exchange rate policy, GDP growth can foster the demand for money, which in its turn would prompt a rise in precautionary demand for international reserves. This behavior is linked to crises proximity, currency mismatch and fear of International Monetary Fund (IMF) – avoid IMF rescuing in cases of foreign currency shortage. In addition, financial depth (measure by the ratio M2/GDP) would bring about international reserves accumulation as well, assuming that foreign currency liquidity works as a bumper in response to the risk of capital flight. In such cases, $interv.exrate2$ would be a biased index due to endogeneity problems, since it does not differentiate between a raise in international reserves caused by GDP growth and those associated with interventions in exchange rate[9].

b) Capital controls: capital control data are usually assigned by a binary variable from IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Its value is equal to unity when there are restrictions on capital account

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[8] According to the authors, oil producing countries and countries with important privatization programs are examples of cases where the latter correction matters.

[9] We use this alternative index to verify the effect of intervention in the exchange rate market. The first index $Interv.exrate$ is more careful insofar it considers only international reserves accumulation above monetary aggregate growth.

transactions, and zero otherwise. Kubota (2011) claims that this measure does not consider capital controls intensity.

To circumvent this drawback, we employ Chinn-Ito (2006) index of capital account openness, which considers different kinds of financial restrictions. Their measure relies on a dummy variable, which codifies records of restriction on financial transactions between countries in line with the AREAER. The higher the index, the less the extent of capital control in that country.

c) Macroeconomic policy coordination: we measure it through two indicators: fiscal policy and wage management.

The former we measure by government effort to curb its consumption, assuming that the great majority of government expenditures concern non-tradable goods. Doing so, it helps to smooth non-tradable inflationary pressures and, consequently, alleviates RER overvaluation forces. We employ the ratio government final consumption/GDP to portray it.

The best proxy for wage management would be unit labor costs, which is the average cost per unit of output, i.e., the relation between wages and productivity. Nonetheless, this measure is not available for DCs. Therefore, on the one hand, we verify the labor costs trend – GDP per person employed, and on the other hand, we consider the unemployment level. When the unemployment rate is high, wages will not be pushed up as more people are employed.

Thus, from a theoretical and empirical approach, it seems reasonable to infer that employment growth, in a low labor supply scenario, connected with productivity slowdown, would hamper a competitive RER strategy. In contrast, if unemployment rates keep high, there not would be such effects.

3.2 Identification Strategy

The estimation strategy involves a sample of 14 countries, from which 7 are Asian and the others 7 Latin Americans, based on data from 1980 to 2010[10][11]. The goal is to assess whether macroeconomic policies are able to affect RER, keeping it at competitive level.

The dependent variable is the extent of RER undervaluation when it takes place otherwise zero when RER is in equilibrium or overvalued, in line with Rodrik (2008) index. According to it, the equilibrium RER is computed by amending it to Balassa-Samuelson (BS) effect, i.e., non-tradable prices are cheaper in DCs.

First, we regress RER[12] against GDP per capita ($rgdpch$)[13]:
$$\ln RER_{it} = \alpha + \beta \ln(rgdpch_{it}) + f_t + u_{it} \qquad (5)$$

where i is an index for countries and t is an index for time period, f_t is the time specific effect and u_{it} is the idiosyncratic error. This regression yields an estimated $\hat{\beta} = 0.18$ with a very high absolute value of t-statistic around 42.

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[10] Asian countries: China (CHN), Hong Kong (HKG), South Korea (KOR), Indonesia (IDN), Malaysia (MYS), Singapore (SGP). Latin American countries: Argentina (ARG), Brazil (BRA), Chile (CHL), Mexico (MEX), Peru (PER), Venezuela (VEN) and Colombia (COL).

[11] Some data (particularly, exchange rate regime) are available only until 2010.

[12] The proxy variable to RER is the inverse of pl_gdpo (Price Level of Output-side real GDP at current PPPs in mil. 2005US$) from Penn World Table 8.1

[13] .This variable is from Penn World Table 8.1 (rgdpo/pop).

The next step is to calculate the difference between the actual RER and the BS adjusted rate:

$$\ln UNDERVAL_{it} = \ln RER_{it} - \ln \overline{RER_{it}} \qquad (6)$$

where $\ln\overline{RER_{it}}$ is the predicted values from equation (5). Whenever $\ln UNDERVAL$[14] is positive, it indicates that the exchange rate is set so that goods produced at home are cheap in dollar terms: the currency is undervalued. When $\ln UNDERVAL$ is below unity, the currency is overvalued.

The explanatory variables are the economic policy instruments used to promote RER undervaluation. Besides intervention in exchange rates (interv.exrate), capital controls (cap.control), government expenditures (spend.gov), worker productivity (produtiv) and unemployment rate (unemp.rate), we use control variables representing those in the Trilemma framework: exchange rate regime (dummy.fixed and dummy.intermed), financial integration (finan.integ) and interest rate (i). These control variables can affect RER due to the following reasons: i) RER and interest rate are linked (Barbosa, Jayme Jr and Missio, 2017); ii) and exchange rate regime (Libman, 2017) and financial integration influences the ability to keep a competitive RER (Kubota, 2011).

The general form of the equation to be estimated is:

$$\begin{aligned}
\ln Underval_{i,t} = \ {} & \beta_0 + \beta_1 interv.exrate_{i,t} + \beta_2 cap.control_{i,t} \\
& + \beta_3 spend.gov_{i,t} + \beta_4 produtiv_{i,t} + \beta_5 unemp.rate_{,t} \\
& + \beta_6 i + \beta_7 finan.integ_{i,t} + \beta_8 dummy.fixed_{i,t} \\
& + \beta_9 dummy.manag._{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}
\end{aligned} \qquad (7)$$

Table 1 summarizes the list of variables.

Table 1: List of the variables in the research

Abbreviaton	Variable	Comments	Unit of measurament	Source
underval	Real exchange rate undervaluation	Undervaluation index following Rodrik (2008)	Index	Own elaboration based on PWT 8.1
underval1	Real exchange rate undervaluation	Undervaluation index following MacDonald and Vieira (2012)	Index	Own elaboration based on PWT 8.1
interv.exrate	Intervention in exchange rate	Index of variation of the ratio international reserves/M2	Index	Own elaboration based on IFS data
interv.exrate2	Intervention in exchange rate	Index of variation of international reserves normalized by monetary base	Índex	Own elaboration based on IFS data
cap.control	Capital controls	Financial openness index	Index	Chinn-Ito (2006)
spend.gov	Government expenditures	Government final consumption expenditures normalized by GDP	%	IFS
Produtiv	GDP per worker	GDP per worker (productivity proxy – rgdpo/emp)	US$ Dollar 2005	PWT 8.1
unemp.rate	Unemployment rate	Unemployed rate (% of work force) – national estimates	%	WDI
i	Interest rate	Interest rate set by monetary authority	%	IFS

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[14] Underval is in logarithmic form. For robustness check purposes, we will employ Macdonald and Viera's (2012) index of undervaluation.

Abbreviaton	Variable	Comments	Unit of measurament	Source
finan.integ	Financial integration	External liability normalized by GDP. It includes the stock of debt and portfolio equity liabilities, foreign direct investment, debts and financial derivatives	%	Own elaboration based on Lane e Milesi-Ferreti (2007)
dummy.fixed	Fixed exchange rate regime	Classification of exchange rate regime in line with Ilzetzki,Reinhart and Rogoff (2008) methodology and grouped following Coudert and Couharde (2009)	Discrete variable	Ilzetzki,Reinhart e Rogoff (2008)
dummy.intermed.	Intermediate exchange rate regime Intermediário	Classification of exchange rate regime in line with Ilzetzki,Reinhart and Rogoff (2008) methodology and grouped following Coudert and Couharde (2009)	Discrete variable	Ilzetzki,Reinhart e Rogoff (2008)

Note: IFS – International Financial Statistics; WDI – World Development Indicators; PWT – Penn World Table
Source: Own elaboration.

To test our model we employ discrete choice models (logit) and censored regressions[15] (tobit) within an unbalanced panel dataset. In the former case, the potential outcome is discrete. In the latter case, we do not observe values of the dependent variable above or below certain magnitude owing to a censoring or truncation mechanism.

In discrete choice models, underval takes on the value 1 or 0 depending on the threshold set. We set three thresholds: RER is undervalued irrespective to its extent, RER is over 10% undervalued (modest undervaluation), or RER is over 20% undervalued (significantly undervaluation). In censored regression, whenever RER is overvalued, it is recorded as zero.

In panel data sets, the presence of individual effects complicates matters significantly in face of the incidental parameter problem. Application of these models become more complex due to non-observed heterogeneity (individual fixed effects)[16].

Logit Model

For logit models, Chamberlain (1980) suggests maximizing the conditional likelihood function to obtain the conditional estimates for β. In order to test for fixed individual effects one can perform a Hausman-type test based on the difference between Chamberlain's conditional maximum likelihood estimation (MLE) and the usual logit MLE. The latter estimation is consistent and efficient only under the null hypothesis of no individual effects. Chamberlain's estimator is consistent whether H_0 is true or not, but it is inefficient under H_0 because it may not use all data (Baltagi, 2005).

It is important to highlight that conditional logistic regression differs from ordinary logistic regressions in that the data are divided into groups and, within each group, the observed probability of a positive outcome is either predetermined due to data construction or in part determined because of unobserved differences across the groups.

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[15] Censored regression can be put into one of two categories. In the first case there is a variable with quantitative meaning, y^*, and we are interested in the population regression, $E(y^* \parallel x)$. However, y^* is not observable for part of the population. A second kind of application of censored regressions is where the dependent variable, y, is an observable outcome, which takes on the value zero with positive probability but it is a continuous random variable over strictly positive values. This is an example of corner solution outcome. In such cases, we are interested in features of the distribution of y given x, sucha as $E(y \parallel x)$ and $P(y = 0 \parallel x)$ (Wooldridge, 2002).

[16] See Wooldridge (2002), Greene (2003) and Baltagi (2005).

Thus, the likelihood of the data depends on the conditional probabilities, i.e., the probability of the observed pattern of positive and negative responses within a group is conditional on the number of positives outcomes being observed. Terms that have a constant within-group effect on the unconditional probabilities – such as intercepts and variables do not vary – cancel in the formation of these probabilities and so remain not estimated.

Groups that contain all-positive or all-negative outcomes provide no information because the conditional probability of observing such groups is 1 regardless of the values of parameters β. Thus, they are dropped off estimations.

Therefore, first, we run the Hausman test to decide which model is more appropriate. Then, we run the estimations, bearing in mind that, in logistic models, the exponentiated coefficients are interpreted as odds ratio, i.e., $\frac{odds\ (if\ the\ correspondign\ variable\ is\ incremented\ by\ 1)}{odds\ (if\ variable\ not\ incremented)}$, or, equivalently:

$$\frac{\dfrac{p(event \parallel x+1)}{1-p(event \parallel x+1)})}{\dfrac{p(event \parallel x)}{1-p(event \parallel x)})} \tag{8}$$

where p is the probabity of event, and $p/(1-p)$ is the called the odds of an event.

Hence, if the coefficient is 1.5, then the odds of the event are 50 percent greater when the economic policy is on. If it is 0.5, then the odds halves as x increase.

Tobit model

In tobit models the individual fixed effect cannot be swept away and as a result β and σ_v^2 cannot be consistently estimated for T fixed, since the inconsistency is transmitted to β and σ_v^2. In order to overcome this issue, Honoré (1992) suggest trimmed least square estimators. These are semiparametric estimators with no distributional assumptions on the error term.

Since it removes the fixed effect, it affects marginal effects calculation. Nonetheless, the author suggests that marginal effects can be computed from the observed coefficients multiplied by the number of non-censured observations, i.e., $\beta_j * Prob(y > 0)$. Hence, keeping other variables constant, we have the marginal effect of the $j-th$ element of x.

Thereby, the econometric tests will involve conditional logit estimators and Honoré's (1992) approach. For robustness check, we will test the same models with $underval$ and $underval1$, and with $Interv. exrate$ and $Interv. exrate2$.

4 Results

The first step is to verify RER behavior in Latin American countries compared to Asian ones. Following Rodrik (2008) procedure, we notice that there were periods in which it was undervalued, while in others it was overvalued. Particularly, from 1970 to 2009, based on five-year average, the Argentine Peso was overvalued, whereas the Colombian Peso was undervalued or near equilibrium (Figure 1).
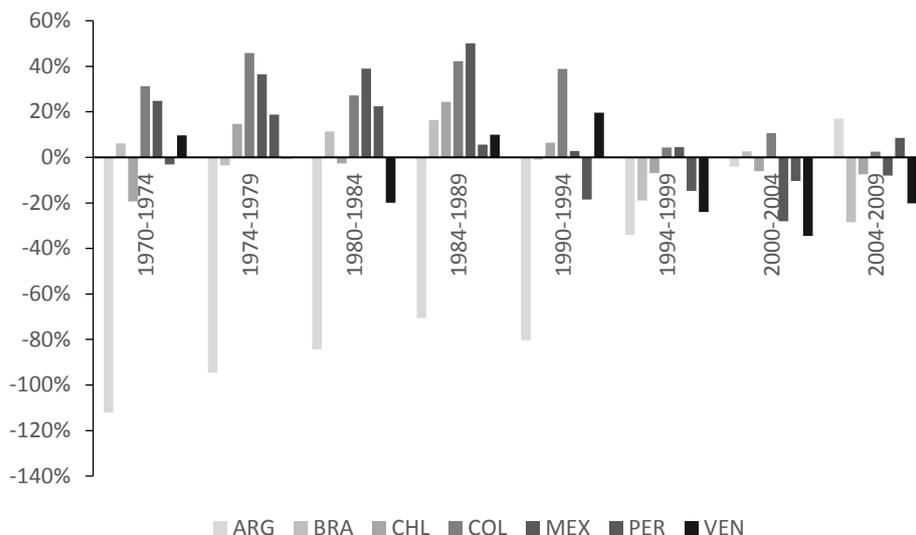
Figure 1: Real Exchange Rate undervaluation: selected Latin American countries (1970-2009)

On the other hand, Asian countries display a RER devaluation trend (Figure 2). Except for Singapore and South Korea (and, partially, Hong Kong), their currency were undervalued. Thus, there are strong indications that they keep a competitive RER policy over this period.
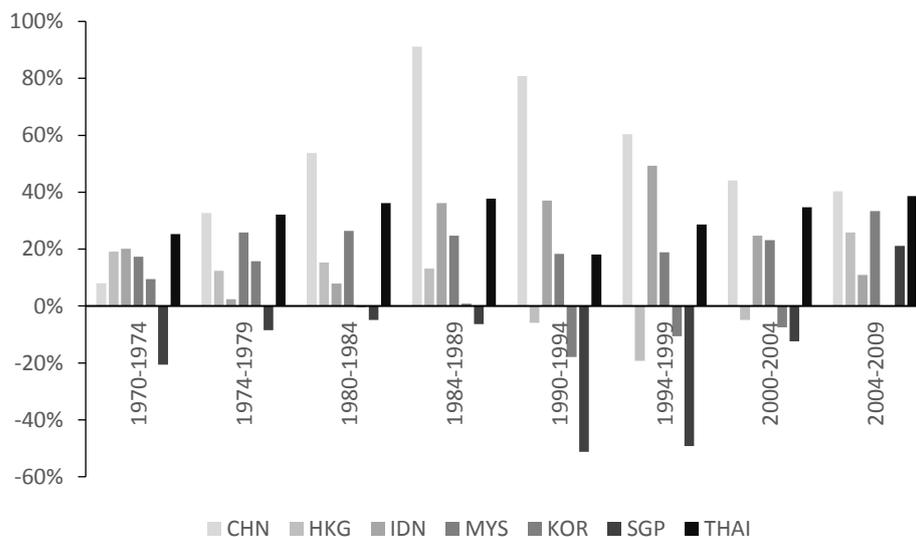
Figure 2: Real Exchange Rate undervaluation: selected Asian countries (1970-2009)

Hence, it is important to figure out which mechanisms these countries used to manage its RER. As aforementioned, we are interested in three channels: i) intervention in exchange rate; ii) capital control; iii) fiscal policy and wage management.

4.1. Econometric Results

Concerning the broad sample (all countries), the results show that the smaller the capital controls (or the bigger the financial openness index), the smaller is the probability

of attaining a competitive RER. Given that Chinn-Ito index ranges from -1.88 to 2.38, the odds of significant undervaluation halve[17] as it increases by 1 – Table 2 (estimative V).

Robustness check tests indicate that interventions in the exchange rate can help to sustain a competitive RER policy. We must note that the variable, which stands for intervention in the exchange rate, has mean zero with a standard deviation about 0.005. Then, the OR value is not intuitive. Therefore, its direction matters most: whenever above 1, CB intervenes to prompt devaluations.

Productivity increase has almost nil effect on the odds of a RER undervaluation. Though unemployment rate was significant (estimative III), it goes in the opposite direction, decreasing by 40% the odds of a RER undervaluation. Hence, wage management policies may not be a necessary condition to attain a competitive RER. Nevertheless, fiscal policy may help to sustain it, according to estimates (IV) and (VI).

Regarding the control variables, financial integration coefficients were significant in estimates (III) and (V), enlarging about 10% the OR. In other words, it seems to contribute to undervaluing RER. These results may be inconsistent, since the financial openness index has the opposite effect, or alternatively countries may should seek a way to take advantage of financial integration, but at the same time set strict rules to evade speculative capital.

Fixed exchange rate regime is associated with smaller odds of RER undervaluation. So, such regimes may be engendered to avoid inflation through RER overvaluation. Finally, interest rates were not significant.

Table 2: Determinants of the probability of keeping RER undervaluation above 0%, 10% and 20% - Condition logit and logit estimations

	Underval > 0%	Underval1> 0%	Underval > 10%	Underval1> 10%	Underval> 20%	Underval1> 20%
	OR	OR	OR	OR	OR	OR
	(I)	(II)	(III)	(IV)	(V)	(VI)
interv.exrate	0.0530	-	25355.2312	-	191.2422	-
interv.exrate1	-	421.1430*	-	1.5414	-	59.3337
cap.control	0.6239***	0.5569***	0.3472***	0.7778	0.5524**	0.2292***
spend.gov	0.9138	0.9079	0.9407	0.8515*	0.9095	0.7774**
Produtiv	1.0001***	1.0000	1.0001*	0.9999*	1.0000	0.9995***
unemp.rate	0.9725	1.0238	0.6638***	0.9807	0.8697	0.9164
i	0.9996	0.9997	0.9993	0.9999	0.9992	0.9707*
finan.integ	1.0013	1.0111	1.0997***	1.0188	1.0448***	0.9917
dummy.fixed	0.0200***	0.0701***	0.0000	0.0511**	0.1000**	0.7915
dummy.intermed.	0.3688	0.6648	0.9458	0.3703	0.4557	6.1331
Wald (χ^2)	63.54***	36.87***	123.44***	26.71***	75.77***	174.91***
Hausman (χ^2)	31.19***	20.98***	10.98**	117.74**	22.22***	
N.	269	271	269	266	302	339

Notes: * p<0.10, ** p<0.05, *** p<0.01. i)Wald test: H_0: all the coefficients are zero; ii) Teste de Hausman: H_0:Difference in coefficients not systematic ; iii) OR (*odds ratio*)); iv) time *dummies* are not significant in any estimates; v) in estimates (I) e (III) 63 observations were dropped because China, Malaysia and Thailand currencies were more than 10% undervalued; in estimate (V) 30 observations were dropped because Korea's currency were not more than 20% undervalued; vi) estimate (VI) corresponds to standard logit, since due to low variability of the dependent variable, it was not possible to estimate by conditional logit. .

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[17] A one-unit increase corresponds near 25% of Chinn-Ito index.

Table 3 displays the results for Latin American countries. In general, they are very similar to the results from the whole sample. We highlight two points: the coefficients of interventions in the exchange rate and the coefficients of exchange rate dummies are not significant.

Table 3: Determinants of the probability of keeping RER undervaluation above 0%, 10% and 20% in Latin American countries - Condition logit and logit estimation

	Underval> 0%	Underval1> 0%	Underval > 10%	Underval1> 10%	Underval> 20%	Underval1> 20%
	OR	OR	OR	OR	OR	OR
	(I)	(II)	(III)	(IV)	(V)	(VI)
interv.exrate	494079.6332		2549929.9301		7.7777	
interv.exrate1		1.3367		0.4087		7600236.5644
cap.control	0.4676***	0.4617***	0.2668***	0.4825***	0.3727***	0.0757
spend.gov	1.0590	0.9373	0.8971	0.7732***	0.7963**	0.1612**
Produtiv	1.0001**	1.0000	1.0001	0.9999**	0.9999**	0.9998
unemp.rate	0.6400***	1.0734	0.6424***	1.2299***	1.0924	0.7768
I	0.9996	0.9998	0.9992	0.9995	0.9983	0.9497
finan.integ	1.1003***	1.0060	1.1157***	0.9983	1.0176*	0.8457*
dummy.fixed	0.2441	-	0.0000	-	-	-
dummy.intermed.	0.5688	1.2515	2.9161	2.7442	1.1250	1.1323
Wald (χ^2)	67.54***	32.69***	76.85***	36.27***	47.17***	60.13***
Hausman (χ^2)	31.19***		16.93***		11.35	
N.	175	155	175	155	149	155

Notes: * p<0.10, ** p<0.05, *** p<0.01. i)Wald test: H_0: all the coefficients are zero; ii) Teste de Hausman: H_0:Difference in coefficients not systematic ; iii) OR (*odds ratio*)); iv) time *dummies* are not significant in any estimation;; v) estimative (V) corresponds to standard logit, because Hausman H_0 is not rejected; vi) estimates (II), (IV) and (VI) corresponds to standard logit, since due to low variability of the dependent variable, it was not possible to estimate by conditional logit; and the variable dummy.fixed is not estimated, because it provides devaluation odds perfectly (if it equals zero, the currency is undervalued); 26 observations were dropped.

Besides, the unemployment rate has an ambiguous effect: according to estimate (III), as it increases, the odds ratio of RER undervaluation decreases, while the opposite effect takes place in estimate (IV). Similarly, the financial integration outcomes are ambiguous, looking at estimates (V) and (VI).

Table 4 shows the results for Asian countries. It should be noted that conditional logit estimates, apart from estimate (I), do not reach a maximum point. This happens due to collinearity issues regarding those variables that stand for the real exchange rate regime (fixed and intermediated) within the same group. Since we cannot reject the null-hypothesis of the model consistency under a logistic model by Hausman test, we estimate all of them according to unconditional logistic approach.

Table 4: Determinants of the probability of keeping RER undervaluation above 0%, 10% and 20% in Asian countries – Logit estimations

	Underval > 0%	Underval1> 0%	Underval > 10%	Underval1> 10%	Underval >20%	Underval1 > 20%
	OR	OR	OR	OR	OR	OR
	(I)	(II)	(III)	(IV)	(V)	(VI)
interv.exrate	0.0040		56327.9928		9.2119e+23	
interv.exrate1		151831.6944***		866.3127		47.2845
cap.control	1.2330	4.2175***	1.4090	4.2463***	1.3123	0.2869
spend.gov	1.3662***	1.6179**	1.4470***	1.2561	1.2641**	1.4922
Produtiv	0.9999***	0.9997***	0.9999***	0.9996***	0.9999***	0.9993***
unemp.rate	1.1122	0.9546	0.9317	0.6670**	0.9418	0.6988**
i	1.0265	0.9335	1.0066	0.8542*	0.9702	1.1055
finan.integ	1.0058**	1.0098***	1.0070***	1.0055	1.0082***	1.0337**
dummy.fixed	0.0000***	5.9440	0.0000	0.0322	0.8157	0.3557
dummy.intermed.	0.0000***	0.0443***	0.0000	0.0105*	0.1571	4.4468
Wald (χ^2)	472.46***	30.83***	55.73***	141.26***	53.41***	136.98***
Hausman (χ^2)	2.72		-		-	
N	157	158	157	158	157	158

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. i)Wald test: H_0: all the coefficients are zero; ii) Teste de Hausman: H_0:Difference in coefficients not systematic ; iii) OR (*odds ratio*)); iv) time *dummies* are not significant in any estimation;; v) estimative (I) corresponds to standard logit, because Hausman H_0 is not rejected vi) the remaining estimates corresponds to standard logit, because conditional logit is not estimable.

Capital controls are not favorable to competitive RER policies – estimates (II) and (IV), i.e., financial openness stimulates it. In fact, even financial integration may be worthwhile. Intervention in exchange rate plays an important role as well – estimative (I).

Government expenditures instead of harming a competitive RER strategy seems to foster it. The odds ratio rises near 30% for each 1% rise in government expenditures, depending on the devaluation RER level. Finally, a rise in interest rates and adoption of an intermediate exchange rate regime have an adverse effect on undervaluation RER policies.

Comparing the results of both group, there are substantial differences. First, capital controls and restrictive fiscal policies were important to Latin American countries, but not to Asian ones. Second, intervention in the exchange rate had the expected effect only in the latter group. For both groups we cannot be certain that either rise in wages above productivity or the exchange rate regime chose were critical to the implementation of competitive RER strategy.

In face of such results, it is demanding to disclose theoretical underlying reasons that support them. Dooley, Folkerts-Landau and Garber (2003, 2014) suggests that the Bretton Woods System does not evolve, it just occasionally reloads a periphery. In the 1950s, the United States (US) was the center region with essentially uncontrolled capital and goods markets. Europe and Japan, whose capital had been destroyed by the war, constituted the emerging periphery. These countries chose a development strategy of undervalued currency, controls on capital flows and trade, reserve accumulation, and the

use of the center region as a financial intermediary that lent credibility to their own system. The US, in turn, lent long-term capital to periphery through FDI mostly.

The Asian countries strategy resembles Europe and Japan. They undervalued their currency, accumulated reserves and encouraged growth through exportation. On the other hand, Latin American countries chose to close their markets and foster a system of import substitution. Such strategy was inhospitable to trade and to the importation of long-term capital flow. Moreover, it spurred a local production of goods that could not compete globally, building an inefficient capital stock that would end by having little global value. In the beginning of the 1990s, following the Washington Consensus, these countries joined the center directly, opening their economies to trade and their capital market to foreign capital (Dooley, Folkerts-Landau and Garber, 2003).

The authors argue that Asian countries replaced Europe and Japan. Their framework includes a "trade account region", a "capital account region" – Europe, Canada and Latin American – and a "center country", the US. The main concern of the trade account region is to export to the center country. To do so, CBs have consistently intervened to limit appreciation of their currencies. In contrast, capital account regions, like the Latin American, opted for a financial integration where private investors are concerned about the risk/return of their international investment position. To escape from low yields, they invest in the region, appreciating domestic currencies and discouraging export. Lastly, the US is the intermediary of the system, which wants finance for its own growth and foreign savings to spur capital formations.

Hence, while in Asia the probability of keeping an undervalued currency is positively associated with intervention in the exchange rate market and financial openness, in Latin American countries it is the other way around. In other words, the first group, which carried on an export-led strategy, benefited from foreign capitals, whereas the second one, which drew mainly speculative capital, were not able to intervene in exchange rate market.

Moreover, there is an interest rate ceiling above which sterilized interventions cannot be applied (Frenkel, 2006). The monetary authorities in Latin American countries, even not considering hyperinflation periods in Brazil, Argentina and Peru, set their interest rate well above from the Asian ones. For instance, from 2000 to 2010 the difference between them was in average 5% per year. On the other hand, the latter group accumulated much more reverses. The difference is about 30 billion (excluding China), increasing particularly after capital account liberalizations in the 1990s. Therefore, intervention in exchanged rate markets in Asian countries relied on low interest rate and massive international reserves.

Last but not least, it is important to highlight that competitive RER strategy is the main common feature in Asian countries growth. Besides that, Akiuz et al (1998) argues that different routes were taken based on state intervention. From imposing restrictions on luxury goods consumption, subsidizing key sectors, investing in education and technology, to establishing join ventures, the role played by government was crucial. Thereby, government expenditures when administrated by a competent bureaucracy, relatively insulated from political pressures, can even help RER competitive policies.

The second test relies on Tobit estimation following Honore's approach. We assume that there are non-observed effects for each country (historical, cultural and social) correlated with explanatory variables. Table 5 presents the average marginal effects of the regressions.

Table 5: Determinants of the probability of keeping RER undervaluation – Tobit estimation

	Broad sample		Latin American countries		Asian countries	
	Underval	Underval1	Underval	Underval1	Underval	Underval1
	(I)	(II)	(III)	(IV)	(V)	(VI)
interv.exrate	-0.1798		0.0115	-	2.3029*	-
interv.exrate1	-	0.1481**	-	0.1388	-	0.1907**
cap.control	-0.0155	0.0044	-0.0413***	-0.0152***	-0.0218*	-0.0084
spend.gov	-0.0048	-0.0077	-0.0095*	-0.0104***	0.0093	0.0100*
Produtiv	0.0000	0.0000*	0.0000	0.0000	0.0000***	0.0000
unemp.rate	-0.0054	-0.0064***	-0.0066	-0.0033	-0.0040	-0.0046**
i	-0.0001*	0.0000	0.0000	0.0000	0.0092***	0.0063***
finan.integ	0.0005	0.0004	0.0020**	0.0013***	0.0003***	0.0003
dummy.fixed	-0.1173	-0.0736	-0.1212***	-0.1079	-0.1192**	-0.0819
dummy.intermed.	-0.0878*	-0.0603	-0.0111	-0.0023	-0.0989***	-0.0603*
Wald (χ^2)	65.11***	26.99***	201578.32***	595.65***	988.11***	496.41***
Censured Fraction	0.55	0.41	0.45	0.32	0.66	0.51
N.	332	339	175	188	157	158

Average Marginal effects (Tobit fixed effects)

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$; i) Wald test: H_0: all the coefficients are zero.

The results are quite similar. For Latin American countries, the main difference is that the fixed exchange rate regime has a negative effect – near 12% – on RER undervaluation. This indicates that such a regime is associated with strategies to circumvent inflation pressures. Since 1980, "importing" credibility through fiscal and monetary discipline has been its main advantage.

For Asian countries, the coefficient of financial openness has the opposite signal, contributing around 2% to lessen RER undervaluation extent. Indeed, this result is more in line with the theoretical background, which states that capital controls can be a useful tool to avoid RER overvaluation.

In sum, we endorse the following results: intervention in exchange markets helps to keep an undervalued RER; though capital controls have mixed results, they are important under strategies based only on financial integration ("capital account regions"); wage management policies are not significant; and expansionary fiscal policies are not necessarily harmful to competitive RER strategies.

4 Concluding Remarks

In this paper, we assess ways of implementing a competitive RER policy. Looking at Asian countries growth, which relied on undervalued currencies, we seek to identify those channels that allowed them to manage their RER successfully. In contrast, we compare them with Latin American countries, which did not embarked on such strategy, attaining low growth rates.

First, the theoretical background disclose that most countries combines different levels of financial openness with a dirty float exchange rates regime and a relatively

autonomous monetary policy. Through the analyses, three economic policy tools emerge as shortcuts to keep a competitive RER strategy: intervention in exchange rate markets, capital controls, wage management and restrictive fiscal policies aiming at maintaining tradable sector profitability.

The empirical results point out that intervention in the exchange rate in order to accomplish an undervalued RER policy prove to be an effective tool for Asian countries. Restrictive capital controls policies does not seem to be a general rule. Countries, which followed an export-led strategy, were able to keep a competitive RER, even with greater financial openness – from a greater (Hong Kong) to a lesser extent (China). Hence, they become an export platform to US and have accumulated massive international reserves to manage RER.

In contrast, Latin American countries, which only integrated financially, were more susceptible to speculative capital and RER overvaluation pressures. Moreover, the lack of enough reserves, associated with high interest rates, hampered competitive RER policies.

Overall, managing wages is not critical in the maintaining of an undervalued currency. Fiscal policies, in their turn, can help or harms such a strategy. In fact, restrictive fiscal policies seems to be important in Latin American countries, while the opposite applies in Asian ones. A possible explanation is the role played by each government in promoting growth.

In sum, if Latin American countries want to follow a similar route to Asian ones, they need to impose restrictive capital controls and intervene in exchange rate markets by increasing their international reserves and lowering interest rates. Also, they might should keep government consumption under control.

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