Abstract:

There is a growing literature that analyzes the impact external crises have on developing economies in relation to the Exchange Rate Regime (ERR) adopted. Most research has used a traditional macro model to evaluate econometrically the impact on GDP growth and inflation in relation to the adopted ERR. One of the difficulties these studies encounter is how to categorize ERRs, because the formal (de jure) regime stated by the monetary authority is often not what it does in practice (the de facto regime).

In our view there are serious weaknesses underlying empirical tests that rely on traditional macro models, because many developing economies experience low substitutability between imports and domestic production. In this paper we propose a macro-model to represent the operative mechanisms in a process of balance of payments adjustment that provides an analytical framework to compare alternative exchange rate regimes in Latin America. The model is predicated on Post Keynesian principles that better reflect the underlying issues developing economies experience with substitutability. We also propose an alternative set of criteria to categorize ERRs, developing a matrix of five possible regimens.
Introduction

The global financial crisis was sparked by the collapse of the US housing bubble and was quickly transmitted to the rest of the world through the deterioration of mortgage-backed assets held by global investors. The financial crisis then triggered a global recession as the decline in the US economy, the “engine of growth” for the global economy, caused a decline in world trade.

Despite the recent crisis, there has been a growing literature analyzing how external shocks generated in the advanced economies are transmitted to developing economies; with particular emphasis on evaluating a country’s Exchange Rate Regime (ERR). The central question of analysis has been, what type of ERR acts as the best “shock absorber”?

Most of the literature focuses on empirical analysis of the impact that an ERR has on GDP growth and inflation, and econometric tests are set up using traditional macro models. One of the most difficult issues to address in these studies has been to determine a way to categorize the ERRs, because the formal (de jure) regime listed by the monetary authority is often not what it does in practice (the de facto regime). In our view there are serious weaknesses underlying the empirical tests that rely on macro models which may not be suitable for developing economies, specifically related to substitutability between imports and domestic production.

The purpose of this paper is two-fold: first, we propose a macro-model to represent the operative mechanisms in a process of balance of payments adjustment, in order to provide an analytical framework to compare alternative exchange rate regimes in Latin America predicated on Post Keynesian principles that reflect the underlying issues that developing economies experience with substitutability; second, we propose a set of criteria to categorize ERRs, developing a matrix of five possible regimes.

1. Alternative Views on Exchange Rate Regimes

The Conventional Approach

In the neoclassical perspective, in response to any change in market conditions, internal or external, prices adjust to generate a new equilibrium. The underlying adjustment process is fulfilled by economic agents maximizing profits and utilities for given budget constraints. Budget restrictions are expressed in real terms; that is, nominal expressions are irrelevant because it is believed that agents use real values to make decisions. In the neoclassical analysis the real exchange rate is the price of foreign resources, and, as with any price, it is the mechanism that allows and economy to adjust and reach equilibrium (with the external sector in this case). In fact, it is believed that the nominal exchange rate is an expression of the underlying real exchange rate. While it is impossible to observe the real equilibrium exchange rate, it is assumed that it is a tendency, a long run result.

Certainly, the Neoclassical perspective accepts that the price-adjustment process can be interrupted or distorted by the actions of the State and/or market failures (like imperfect information), but the optimal policy is to allow markets to operate without direct government intervention. The role of the State is to promote market efficiency (for example, the State can provide “prudential” supervision in financial markets). With respect to the external sector, traditional neoclassical economists [such as Friedman (1953) and IMF experts (Rogoff, et al, 2003)] recommend an exchange rate regimen
that lets the nominal exchange rate float freely in order to generate an equilibrium that corresponds with the relative scarcity of international resources. That is, a nominal floating exchange rate regime, as an expression of the underlying real exchange rate, is the mechanism that equilibrates international commerce and capital flows (international savings).

The Post Keynesian Approach: a First Look

Keynes and Post Keynesians reject the Neoclassical model’s assumption that agents make decisions based upon given real resources, especially with respect to monetary markets: the interest rate (the price of domestic currency) and the exchange rate (the price of foreign currency) are conventional prices; they do not express scarcity. In this perspective, economic agents are subject to uncertainty: they are not able to make probabilistic scenarios of the future, so their actions are oriented as a defense to uncertainty; decisions are made based on some degree of optimism (animal spirits) or convention. In a monetary economy, the interest rate is determined by the interaction of the quantity of money and liquidity preferences which is an expression of the state of uncertainty, and therefore can be subject to many psychological factors and interpretations. All else given, the interest rate will define the level of investment spending (aggregate demand), and production (aggregate supply) will adjust to demand. In this perspective nominal magnitudes are relevant because agents are restricted by nominal budgets.

From the Post Keynesian perspective, the nominal exchange rate is also a monetary phenomenon subject to uncertainty. Harvey (1999) argues the nominal exchange rate is determined by the nominal movements of international capital, and therefore can be affected by speculative movements of these flows. In this perspective, international capital flows determine the nominal exchange rate, and in turn this rate determines trade flows: nominal movements of capital determine the nominal exchange rate which determines the real resource movement of commerce.¹

The currency markets are the largest in the world and unregulated, so they are especially susceptible to speculation, which can destabilize economies, especially developing or emerging economies. Many Post Keynesians (Davidson 2002) recommend some type of fixed or pegged exchange rate regimen (controlled by monetary authorities) in order to reduce speculative motivations, complemented with some direct State control of, or tax on, foreign capital, especially for short term capital flows.

Given the expanded integration of the global economy, developing economies are increasingly affected by global economic “events:” a sneeze in the advanced economies can generate pneumonia in the developing economies. There is a growing literature (Calvo and Mishkin, 2003) and debate about which Exchange Rate Regime best absorbs external shocks. While most Neoclassical economists would argue that a free floating exchange rate regimen is the best shock absorber, in practice, some (Calvo and Reinhart, 2002) argue that many developing countries have developed a “fear of floating” because the authorities of these countries have experienced and observed a strong pass-through from a depreciation of the domestic currency to inflation. These experiences have led many developing countries to pursue more rigid nominal exchange rate mechanisms. There is also some disagreement over the optimal ERR among Post

¹ Harvey (2005) has also proposed various conventions that could be important in the determination of the exchange rate.
Keynesians. For example, Smithin (2001) argues that a flexible ERR would better offset the destabilizing effects of an external shock than a fixed ERR.

**Developing Economies and the Post Keynesian Perspective**

Ferrari and de Paula (2008) summarize the objective of an Exchange Rate Regime in the Post Keynesian view: “.... in light of Keynesian theory and taking into account the emerging economies’ reality in today’s global world, an exchange rate regime proposal for emerging countries with the capability to mitigate their external vulnerability and fragility and their dependence on foreign capital [our italics], thus making possible the implementation of domestic economic policies that would permit macroeconomic stabilization—understood, following Keynes, as being the combination of price stability and full employment”. (p.227)

Some Post Keynesians, Bougrine and Seccarecci (2004), based on the assumption of high substitution from imported to national production, claim that a flexible exchange rate regimen is better than a fixed one. It is argued that a floating ERR is better able to reduce negative impacts on aggregate demand that arise from the Balance of Payments accounts. For example, a decrease in exports can be partially offset by an increase in domestic production (there is an assumed high degree of substitutability).

The model constructed in this paper is oriented toward Latin American nations, and for these countries, as both Thirlwall (1982) and Prebisch (1950) have suggested, the assumption of high substitution between imports and domestic production is incorrect. Thus, for these nations, it is difficult to argue from a Post Keynesian perspective that a floating ERR can perform better than a pegged ERR. Additionally, there are other crucial assumptions necessary to characterize Latin American economies, such as balance of payments restrictions and distributive conflicts, which also have important effects on aggregate demand.

Thirlwall (1982, 2003) proposed that international flows resulting from the balance of payments represent a nominal restriction on the growth of developing countries. These countries require foreign currency to pay for the import requirements for growth (e.g. capital equipment), but the types of goods (natural resources) that these countries are able to export are subject to diminishing returns, and have low price and income elasticities. Thus, growth in these countries will have a nominal restriction from the balance of payments. The key element in Thirlwall’s analysis is that international currency is a scarce resource, and since there is not perfect substitution from domestic to international currencies, it is not possible to substitute imports by domestic production; and therefore, the foreign exchange flow that comes from exports is limited by production and demand. This particular pattern of commerce impedes the substitution of imports by domestic production. Given this lack of substitutability, then shocks from the balance of payments are not self-correcting through real (or nominal) exchange rate movements, and adjustment must come from a decline in income (and increased unemployment) necessary to reduce imports. If the adjustment mechanism is a reduction in imports, then the next issue is to determine which class of citizens must reduce imports, and by what level? Based on Kalecki, some Post Keynesians (Blecker 1999) have argued that inflation is a result of an interaction between costs and mark-ups: inflation is the result of a distributive conflict, which (usually) causes a reduction in the real income of a particular class of

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2 If the sum of the elasticities for imports and exports is less than one, then the Marshall-Lerner condition does not hold, and a depreciation of the exchange rate actually worsens a trade deficit.
individuals. In the case of a shortfall generated from the balance of payments (e.g. a fall in exports), prices, including the exchange rate, must be adjusted in order to cause a the necessary reduction in imports. Thus the exchange rate regime is a complementary element of the adjustment mechanism. In this paper we have incorporated the assumptions of Thirlwall and Kalecki to construct a Post Keynesian model in order to analyze the impact from external shocks (like the current global crisis) on the economies of developing countries. A second purpose of the model is to provide criteria for evaluating which ERR might operate as the better shock absorber.

2. A Post Keynesian Model of Exchange Rate and Balance of Payments Adjustment.

The model is based on two types of nominal budget restrictions: first, a balance of payments restriction; and second, the nominal budget restrictions for three types of agents or classes--the owners of national production for the domestic markets, the owners of national production for the external markets, and labor. The objective of this model is to analyze the nominal restrictions that Harvey (1999) and Thirlwall (2003) have shown in conjunction with the distributive conflict that arises from an income reduction originating from an external shock. Based on this model, we show that the process of the balance of payment adjustment is achieved by a combination of changes in the exchange rate, inflation rate, and real income.

a) Income and Income Distribution

Let us assume, in order to focus on balance of payment relations, an economy without government (or zero net State deficit) and no investment.

\[ Y = p_n C_n + X p_x e = Y_n + Y_x + Y_w \]

- \( Y \): nominal national income, expressed in local currency
- \( C_n \): domestic production for domestic markets
- \( X \): exports quantity
- \( p_n \): price of domestic production for domestic markets
- \( p_x \): price of production for external markets (exports)
- \( e \): nominal exchange rate
- \( Y_n \): nominal profits from production for domestic markets
- \( Y_x \): nominal profits from production of exports
- \( Y_w \): worker’s nominal income

b) Agents budget restriction

b.1. Owners of national production for the domestic markets.

\[ D_n = Y_n - G_n \]

- \( D_n \): net balance.
- \( G_n \): consumption expenditures of Owners of national production for the domestic markets

\[ Y_n = p_n C_n - Y_{wn} \]
\[ G_n = p_n C_{nn} + M_n p_m e \]
Y \text{wn}: wages paid to workers in production for domestic markets.
C \text{nx}: consumption of Owners in PDM.
M \text{x}: owners of PDM consumption of imports.
p_m: price of imports.

**b.2. Owners of export production.**

\[ D_x = Y_x - G_x \]
\( D_x \): net balance of owners of exports.
\( G_x \): consumption expenditures of owners of exports

\[ Y_x = X p_x e - Y_{wx} \]
\[ G_x = p_n C_{nx} + M_x p_m e \]

\( Y_{wx} \): nominal amount of wages paid to worker in exports
\( C_{nx} \): consumption of Owners of exports.
\( M_x \): owners of exports’ imports

**b.3. Workers’ Budget**

\[ D_w = Y_w - G_w \]
\( D_w \): net balance of workers.
\( G_n \): consumption expenditures of workers

\[ Y_w = Y_{wn} + Y_{wx} \]
\[ G_w = p_n C_{nw} + M_w p_m e \]

\( C_{nw} \): consumption of workers
\( M_x \): workers’ imports

In order to fulfill budget restrictions, it is necessary that:

\[ D_t = D_n + D_x + D_w = Y - G = Y - (G_n + G_x + G_w) \]

\[ D_n = p_n C_n - Y_{wn} - (p_n C_{nn} + M_n p_m e) \]
\[ D_x = p_x X e - Y_{wx} - (p_n C_{nx} + M_x p_m e) \]
\[ D_w = Y_w - (p_n C_{nw} + M_w p_m e) \]

In this model an external shock is represented by changes in variables X, p_m (Vx = X* p_m) and p_x--amounts and prices of exports and price of imports, represented by dX, dp_m and dp_x. The endogenous variables are e, p_n, D_n + D_x. D_t is determined by the balance of payments.

c) **Balance of Payments as a National Budget Restriction**

The Balance of Payments can be represented as:

\[ M p_m e = X p_x e + B_k e - R e \]
\( M_{p_m} e \): Total imports expressed in domestic currency

\( B_k \): Capital balance net result

\( R \): Change of Central Bank’s stock of foreign reserves

Terms are aggregated in order to obtain the net national balance:

\[
Dt = D_n + D_x + D_w = (R - B_k) e = (X p_x - M p_m) e
\]

Following Harvey (2005), we assume \( B_k \) is exogenously determined by conventions, not by current prices. \( R \) is also exogenous since it is determined by the Central Bank. So the commercial deficit \((X p_x - M p_m)\), and its expression in the agents’ balance \( Dt \), are essentially determined by \( R \) and \( B_k \), but its nominal expression in terms of local currency will be defined also by the exchange rate level.

A commercial trade balance \((X p_x = M p_m)\) implies that the aggregate deficit is zero \((Dt = 0)\), but it does not imply that budgets of each agent are in equilibrium \((D_n = D_x = D_w = 0)\) because it is possible that \( D_n + D_x + D_w = 0 \). A commercial deficit (surplus) implies that one or more units have a deficit (surplus), but these deficits are the expression of capital flows (external debt) not compensated by the State \((R - B_k)\).

Our main assumptions are that the consumers’ substitution between imports and domestic products is zero (or close to it), and that exporters can not substitute for a decline in exports by production of merchandise for domestic markets. Under these conditions, if an external shock in the commercial balance occurs, (a reduction of \( Vx = X p_x \)), even if it is balanced by the government using reserves, it will generate a deficit to exporters \((D_x)\). But it also creates a lack of foreign currency, so the exchange rate could change and other balances \((D_n \text{ and } D_w)\) could be affected. This is the form that the distributive conflict takes in our model: when there is an external shock, agents try to avoid their resulting deficit.

d) Workers’ Budget \((D_w)\).

We assume that the units used to define labor contracts are in terms of wages per period (Month, week, etc), so wages are not directly or immediately affected by production. Taking into consideration that most Latin American countries are characterized by high secular unemployment rates and by the strong presence of informal markets, it is not hard to assume that in the short run wages in nominal terms are fixed. Hence, we assume that, in the short run, the share of income that corresponds to workers is constant \((Y_{w,0} = Y_{w0})\), and we assume that workers spend all of their income \((D_w = 0)\). In brief, we are assuming a short run in which workers have a constant nominal budget. Consequently, for workers, if a price changes, the adjustment is made via quantities; they cannot increase wages.

e) Exports and exchange rate

The owner of export enterprises can not control the price of exports \( p_x \) or the amount exported \( X \), but they use national currency for their expenditure; thus the level of the exchange rate can compensate for fluctuations in their sales denominated in local currency \((e(V_x))\).
Let us assume that the owner of exports has an inverse linear demand \((F_{nx})\) of \(C_n\), and a similar function \(F_{mx}\) for imports. For simplicity these function do not include income effects.

\[
C_{nx} = c_x + \alpha_x P_n ; \alpha < 1, \\
M_x = m_x + \beta_x (P_m e) ; \beta < 1.
\]

Substituting these expressions in the nominal restriction of the owner of exports:

\[
D_x = e (V_x - m_x P_m - \beta_x P_m^2 e) - Y_{nx} - P_n (e_x + \alpha_x P_n)
\]

\[
\Phi_1 = \frac{\partial D_x}{\partial e} = V_x - m_x P_m - 2\beta_x P_m^2 e ; \quad \frac{\partial^2 D_x}{\partial e^2} = -2\beta_x P_m^2
\]

It is positive, if \(\frac{V_x - m_x P_m}{2\beta_x P_m^2} < e ; \beta_x > 0\)

\[
\Phi_2 = \frac{\partial D_x}{\partial V_x} = e
\]

\[
\Phi_3 = \frac{\partial D_x}{\partial P_n} = -(C_x + 2\alpha_x P_n)
\]

In order to analyze the effect of an external shock we take

\[
dD_x = \frac{\partial D_x}{\partial V_x} dV_x + \frac{\partial D_x}{\partial e} de + \frac{\partial D_x}{\partial Y_{nx}} dY_{nx} + \frac{\partial D_x}{\partial P_m} dP_m + \frac{\partial D_x}{\partial P_n} dP_n
\]

After a negative shock on \(V_x\), the owners of exports wish to avoid a reduction in their net budget, and the exchange rate can help them in this process. In the presence of floating foreign currency markets, after a negative (positive) external shock, exporters will experience a reduction (increase) in their income, \(dD_x < 0\) \((dD_x > 0\), and a reduction (increase) of the supply in the foreign currency market that causes upward (downward) pressure on the exchange rate.

We also have assumed that \(dY_{nx} = 0\) and \(dP_m = 0\)

\[
0 = \Phi_2 dV_x + \Phi_1 de + \Phi_3 dP_n
\]

We have,

\[
a \ldots de = -\frac{1}{\Phi_1} (\Phi_2 dV_x + \Phi_3 dP_n)
\]
There is an inverse relation between the exchange rate and the nominal value of exports. Since there is no substitution between exports and production for domestic markets, exports are not a function of the exchange rate: an external shock creates a lack of foreign currency causing a rise in the exchange rate, which allows \( D_x \) to remain at the same level it was before the shock.

**f) The pass-through from exchange rate fluctuations to inflation**

When an external shock increases the exchange rate, the cost of imports valued in local currency increases. This increase can lead to \( dD_n < 0 \), which the owners of enterprises whose production is sold in domestic markets want to avoid. If they experience a deficit (surplus), then they can increase (decrease) their prices \( (p_n) \). This result is not due to the assumption of a specific competitive regime, rather it is due to the fact that an increase in the exchange rate has created a nominal deficit for these owners, and the only way to eliminate the deficit is to increase their prices. When other prices \( (e, p_x, \text{ or w}) \) are reduced, these owners will have a surplus, but exporters and workers will have deficits that force reductions in \( p_n \) or increases in \( e \) or \( w \)--this is the distributive conflict. In our model there is a specific \( dp_n \) that allows \( D_n \) to maintain its pre-shock level (there is a specific price that makes \( dD_n = 0 \)).

Let us assume that the owners of production for domestic markets have a linear demand \( F_{mn} \) for their imports, \( Mn = m_n + \beta_n(P_me) \), and there is a similar function for workers’ domestic consumption, \( C_{nw} = c_w + \alpha_wP_n \).

Since \( C_n - C_{nn} \) (their sales) = \( C_{nx} + C_{nw} \), the restriction for the referred owner, \( D_n = p_n(C_n - C_{mn}) - Y_{wn - M_n}p_m e \), changes to:

\[
D_n = p_n[(c_x + \alpha_xP_n) + (c_w + \alpha_wP_n)] - Y_{wn} - (m_n + \beta_nP_me)(P_me)
\]

\[
\lambda_1 = \frac{\partial D_n}{\partial P_n} = (cx + cw) + (\alpha_x + \alpha_w)(P_n)(2)
\]

\[
\lambda_2 = \frac{\partial D_n}{\partial e} = -mnP_m + \beta_nP^2_me(2)
\]

The total derivative is:

\[
dD_n = \frac{\partial D_n}{\partial P_n}dP_n + \frac{\partial D_n}{\partial Y_{wn}}dY_{wn} + \frac{\partial D_n}{\partial P_m}dP_m + \frac{\partial D_n}{\partial e}de
\]

Based on the previous argument, we take \( dD_n = 0, dY_{wn} = 0, dP_m = 0 \), and we have:

\[
0 = \lambda_1dP_n + \lambda_2de
\]

That is,

\[
( b )..... dP_n = -\frac{\lambda_2}{\lambda_1}de
\]

Since \( \lambda_1 > 0 \), and \( \lambda_2 < 0 \) this relation is positive: an increase in the exchange rate will cause an increase in the prices domestic goods.
Prices that keep the former level of \(D_x\) and \(D_n\)

Substituting equation (b) into (a),

\[de = -\frac{\Phi_2}{\Phi_1} dV_x - \frac{\Phi_3}{\Phi_1} (-\frac{\lambda_2}{\lambda_1}de)\]

We can then find the changes in \(e\) and \(p_n\) that maintain the budgets of the owners:

\[de^* = -\left(\frac{\Phi_1 \Phi_2 \lambda_1}{\Phi_1 \lambda_1 - \Phi_3 \Phi_1 \lambda_2}\right)dV_x\]

And

\[dp_n^* = -\frac{\lambda_2}{\lambda_1} de^*\]

An increase in the exchange rate (depreciation of local currency) will produce an increase in domestic prices, i.e. inflation.

\[g)\quad \text{Inflation and domestic consumption of national production}\]

\[C_n = C_{nn} + C_{nx} + C_{nw}\]

Since we assumed linear relations, the relation \(d(C_n)/d(p_n)\) is linear.

Given the assumption that workers receive a fixed income and have a net zero balance, when there is a change in prices \((p_n, e)\), workers keep their budget in equilibrium by adjusting their consumption of imports.

Based on the conclusions of this model, Graph 1 summarizes the adjustment process triggered by a foreign nominal shock. A nominal reduction in exports \((\downarrow V_x)\) creates a deficit on the exporter’s budget. The concomitant lack of foreign currency pressures the exchange rate to increase \((\uparrow e = \text{depreciation})\). When the depreciation occurs, the domestic-consumption-producer incurs a deficit, so they increase prices \((\uparrow p_n)\). Since workers’ budget is constant, the increase in inflation forces workers to reduce imports \((\downarrow M_w)\) and domestic consumption \((\downarrow C_{nw})\), so the real income of workers and national income are both reduced.

In this context inflation can be expressed as \(\pi (p_n) + (1 - \pi) (e p_m)\), where \(\pi\) is the percentage of production in domestic markets out of the total consumption. The processes that generate new budget equilibriums require articulated changes in the levels of exchange rate, inflation and real income.
Graph 1: The Adjustment Process

In the next section we use this model to evaluate different ERRs.

3. Assessing ERRs within the Framework of the Model

A shock from outside will be absorbed through linked changes in the exchange rate, in the nominal prices of domestic production (both create inflation) and in real income. Of course the adjustment process is not as easy and direct as it is represented by our model, because expectations about these variables can be changed by conventions (increased optimism/pessimism), leaving room for speculation.

The best ERR must be the one that allows the smallest depreciation of the national currency, and smallest decline in inflation and income along the period of adjustment. An ERR can influence these outcomes in three areas by: 1) reducing speculative fluctuations of the exchange rate; 2) reducing the pass-through from depreciation to inflation to the necessary level that eliminates the deficit in Dn, so as to prevent the vicious cycle of inflation – depreciation (an excessive increase in e would create an excessive increase in pn, which could be interpreted as sign for further depreciation of the local currency); and 3) minimizing the reduction of real national income. The idea is that confidence in the ERR lets investors know that the reduction in demand caused by the external shock was absorbed and macroeconomic conditions are reliable.

Under the pattern of international exchange that governs international commerce in Latin America, an external shock entails, inevitably, inflation and recession. An efficient ERR is able to control speculative movements that can worsen the situation. So, in the current circumstances of Latin American countries, for an ERR to be the best shock absorber it must effectively avoid speculative shocks on these three variables and on accumulative rounds of inflation - depreciation.
4. Effective Practice in Exchange Rate Control: a Proposal for ERR Classification

It is common to classify exchange rate regimes as fixed (no sovereign currency, monetary unions and currency boards), mixed (crawling peg with or without bands, and conventional controlled exchange rate), and floating. These classifications are useful to evaluate the original intention of the monetary authority in each country to use their international reserves as an instrument to control the exchange rate; however sometimes the ERR in practice is different from the announced.

The mere fact that Central Banks accumulate international currencies is an indication of intervention in the foreign currency markets. However, not all countries of Latin America have a sovereign currency. In fact there are two main groups of ERRs: those with a sovereign currency; and those without.3

For the group of countries with a sovereign currency, we must classify the ERR considering their real, not the announced, disposition to control the exchange rate; however, it is also important to consider the real capacity to influence the exchange rate. Once we take into consideration the real capacity and disposition to alter the exchange rate level, the effective ERR can change according to the circumstances and the personality and ideology of the monetary authorities.

The principal problem in the adoption of an ERR is not the capacity to control the currency or the disposition to control it, but the difficulty to define a target level for the exchange rate. The main obstacle to define an adequate exchange rate level comes from the dual impact that international reserves have on economic performance: first, as a stock of international currencies, they operate as a guarantee for international debt, and the amount of this guarantee reduces interest rates by reducing the country’s risk premium; second, a high level of accumulated reserves is can also be an indication of an undervalued exchange rate. This could be indicative of a competitive advantage, but, as Thirlwall suggested, domestic production cannot substitute for imports; therefore the growth in exports or capital inflows that created the reserves, does little to foster growth of domestic industries. In these circumstances, the accumulation of international reserves can promote inflation and low growth (as can be shown in our model). In fact, it is possible that an over-valued domestic currency could promote national investment, since it is less profitable to invest in financial assets denominated in foreign currencies (Mantey 2008). Under these conditions choosing an ERR is not an easy task because Latin American countries need to accumulate reserves in order to present guarantees for their international debt and prevent speculative runs against the local currency, but the reserve accumulation could result in an undervaluation of the exchange rate that reduces growth.

3There are three countries in Latin America that made the unilateral decision to use American dollars as their domestic currency, rejecting their own sovereign money. Our model can represent this situation by making the exchange rate \( e = 1 \) and letting import prices \( p_m \) take the place of \( e \) in the representations. The conclusion remains the same: an external shock will trigger increases in prices, \( p_m \) and \( p_n \) (inflation), and a reduction of real national income. The fundamental reason is simple: the lack of foreign currency forces a distributive adjustment. In this regime there are no instruments that the State can use to drive expectations and to reduce or nullify speculation.
a) ERR Indicators

Are there actions by Central Banks that allow us to determine their *de facto* ERR? In practice, many Latin America countries have moved from a fixed or peg ERR to a less controlled ERR (see Appendix 1). Although these regimes do not commit to a nominal exchange rate level, they do accumulate foreign currency; in fact, many of these countries have accumulated significant amounts of international reserves. Consequently, this type of ERR promotes a lower value of the domestic currency, often with the idea of promoting an export-led growth strategy, or possibly the result is involuntary since the rate of change of the stock of foreign reserves is determined by financial criteria. Under this type of ERR, the Central Bank influences the exchange rate level, but lets the market determine the final level of the exchange rate. In addition, the accumulation of foreign exchange provides Central Banks with reserves to intervene in the case of speculative attacks.

This type of ERR is not a pure float because there are accumulated reserves; it is not controlled because there is not a target exchange rate level. We can call it a mixed ERR because foreign reserves are accumulated, which could also indicate an undervalued domestic currency. The level of reserves, however, is determined by financial criteria (usually considering the level of international debt), consequently this type of ERR does not define a specific target for the exchange rate. Additionally, the presence of reserves itself means a potential instrument against speculative attacks to the domestic currency, so this ERR is also mixed because it allows regulative interventions in the foreign exchange markets.

From the above discussion we can characterize a mixed ERR by the presence of international reserves, non-announced exchange rate targets, and by eventual interventions in the foreign exchange market against speculative movements. However, it is possible that the rate at which reserves are accumulated is too small to affect the exchange rate level; if so, then this mixed ERR is closer to, and effectively, a free floating ERR. It is also possible that in a mixed ERR there are frequent regulative interventions by the Central Bank which are highly effective; in this case, the exchange rate becomes effectively controlled, although the exchange rate target is not announced.

We can quantify the impact of foreign reserve accumulation (or losses) in relation to the level of the exchange rate in order to resolve whether an ERR is freely floating or there is intervention (controlled or mixed). We can also quantify the intensity of Central Bank interventions in order to evaluate their intention to control the exchange rate. We define a *regulative intervention* when the level of reserves and the exchange rate move in the opposite direction over a given period (the Central Bank lost international reserves but the local currency depreciated). Given this definition, it is possible to quantify the number (quarterly) of regulative interventions over some measured period of time.

b) ERRs in Relation to the Model

Our principal identity is $D_t = D_n + D_x + D_w = (R - B_k) e = (X_p - M_p) e$. We have shown that an exogenous shock on the commercial balance $(dV_x)$ will produce an adjustment in the exchange rate $d\varepsilon^* = \left( -\frac{\Phi_1 \Phi_2 \lambda_1}{\Phi_1 \lambda_1 - \Phi_1 \Phi_2 \lambda_2} \right) dV_x$ that will trigger inflation $d\pi^* = -\frac{\lambda_2}{\lambda_1} d\varepsilon^*$ and recession. But the exchange rate can also change in response to
changes in the stock of foreign reserves or international capital flows, both of them are exogenous in our model.

In the previous section we discussed how Central Banks have two main objectives with respect to the accumulation of foreign reserves: to create guarantees against default (financial objectives); and to control instabilities or speculative movements in exchange rates (exchange rate objectives). Therefore, the **decision** to adopt an ERR can impact the exchange rate in these two ways:

\[ \text{de} = E(R) + I(INV) \]

\( E(R) \) is a function that expresses the impact from the accumulation of international currencies on the exchange rate.

\( I(INV) \) is a function that represents the capacity of the central bank to reduce speculative movements that affect the exchange rate. Therefore the total change in exchange rate is

\[
de^* = -\left( \frac{\Phi_1 \Phi_2 \lambda_1}{\Phi_1^2 \lambda_1 - \Phi_1 \Phi_2 \lambda_2} \right) dV_x + E(R) + I(INV) \]

### e) “de facto” ERR classification

Based on these considerations, we propose to classify the “de facto” ERR using two indicators:

1. Effective intervention \( E(R) \). Elasticity of the exchange rate “\( e \)” to International Reserves “\( R \),” \( E = \frac{\%\Delta e}{\%\Delta R} \) as an expression of the capacity of the monetary authority to modify the exchange rate level.

2. Intention to control \( I(INV) \). Capacity of effective control of “excessive” or speculative movements in the exchange rate level, measured by the number of inverse movements in reserves and the exchange rate.

Table 1 lists the matrix of possible ERR types using these two indicators.

<table>
<thead>
<tr>
<th>Exchange Rate Regimes classification</th>
<th>Small elasticity</th>
<th>High elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ineffective regulation of ( e ) movements</td>
<td><strong>ERR-1.-</strong> nearly free flotation.</td>
<td><strong>ERR-2.-</strong> uncontrolled intervention (financial stability goal)</td>
</tr>
<tr>
<td>Effective regulation of ( e ) movements</td>
<td><strong>ERR-3.-</strong> controlled flotation</td>
<td><strong>ERR-4.-</strong> high and effective intervention (nearly to controlled)</td>
</tr>
</tbody>
</table>

Note: if \( E(R)=0 \), then we define ERR as a pure floating rate regime: **ERR0**.
- **ERR-O**, by definition, provides no mechanism to control external shocks, so it does not buffer any speculative movements as well.
- **ERR-1** can produce systematic but weak pressure to undervalue the domestic currency, but the monetary authority is incapable (or simply it does not try) of reducing speculative shocks.
- **ERR-2** can be seen as a regime with only financial goals, because the reserve accumulation produces strong pressure to undervalue the local currency, but it is not utilized to control speculative movements.
- **ERR-3** could be the best option for a country where local producers have some opportunity to compete in local markets against imports (where there is some substitutability). This is because reserve accumulation does not have a strong impact on the cost of imports, so local producers can import in order to export, then slowly substitute importations. This ERR also can operate as a an adequate shock absorber.
- **ERR-4** maybe the best option in a very specialized economy because of the ability to control the exchange rate with the scarce resource of international reserves, and its capacity to absorb external shocks.

d) A First Test

As a first test of our methodology, we apply these criteria to Mexico. We use data from the Banco de Mexico data base www.banxico.gob.mx.

TC: exchange rate (pesos /dollars).
RI: stock of foreign reserves of Banco de Mexico (thousands million dollars)
INV: is a dummy variable to cash the opposite direction movements.

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOG(RI)</td>
<td>0.103664</td>
<td>0.030254</td>
<td>3.426406</td>
</tr>
<tr>
<td>INV</td>
<td>-0.022038</td>
<td>0.017227</td>
<td>-1.732603</td>
</tr>
<tr>
<td>C</td>
<td>0.538736</td>
<td>0.147584</td>
<td>3.650373</td>
</tr>
<tr>
<td>LOG(TC(-1))</td>
<td>0.921989</td>
<td>0.134507</td>
<td>6.854568</td>
</tr>
<tr>
<td>LOG(TC(-2))</td>
<td>-0.31993</td>
<td>0.149268</td>
<td>-2.143321</td>
</tr>
</tbody>
</table>

- R-squared: 0.89675, Adj. R-squared: 0.887963
- S.D. dependent var: 0.017227, S.E. of regression: 0.030254
- Akaike info criterion: 0.045566, Schwarz criterion: 0.097585
- Hannan-Quinn criter.: 89.45034, Durbin-Watson stat: 102.0519
- Prob(F-statistic): 0

The results are an elasticity of 0.10 and an insignificant I(INV). For Mexico, over this period, the Central Bank operated in a regulatory manner—with intent to control the exchange rate (as we’ve defined it) in 53% of the quarters. Based on this analysis, Mexico would be classified as **ERR-2**.
Conclusions

We constructed a macro model to characterize Latin American countries by assuming non-substitution between domestic production and imports, and therefore the exchange rate has little influence on exports. The model is oriented to analyze the macroeconomic impact from an external shock (indicated by a decline in exports) on the exchange rate, inflation and income for a given nominal balance of payments restriction. It incorporated three classes of agents to demonstrate distribution conflicts. The model evaluates changes over the short run model because we have assumed nominal wages are fixed.

The main conclusions are:

1. An external shock necessarily causes exchange rate, inflation and real income adjustments. The exchange rate by itself cannot resolve the adjustments.

2. Starting from a given situation \( D_t = D_n + D_x = R - B_k \), after a shock each agent (specifically producers) tries to prevent a deficit on their budget. Changes in the exchange rate, price level \( (P_n) \), and consumption of domestic goods respond in order to try to keep the budgets \( D_n \) and \( D_x \) at the pre-shock level. These adjustments are indicative of the distributive conflict inherent in the model.

3. In our short run model, the exchange rate cannot foster export or import substitution, so the ERR must focus on controlling speculative movements in the exchange rate and inflation.

4. The criteria for categorizing an ERR is based on two factors that change the stock of foreign reserves. Central Banks pursue two main objectives which affect the stock of foreign reserves: a financial objective to create guarantees for the country’s international debt (but the accumulation of foreign reserves by the Central Bank could lead to undervaluing the local currency); and to control speculative capital flows.

5. Based on the objectives of the Central Banks, we derive two criteria for categorizing ERRs: the effectiveness of interventions, as measured by the elasticity between the change in the exchange rate and the change in reserves; and the capacity or willingness to intervene against speculative movements. We proposed a “de facto” ERR classification scheme with five ERR types.

6. Based on our model for Latin America, the ERR that has the greatest capacity to absorb external shocks must be considered “the best.” We suggest that **ERR-3** is optimal for countries with some capacity to substitute imports and foster domestic markets; and **ERR-4** is optimal for nations that are excessively specialized.

Our intention is to utilize this model as a basis for future empirical studies using Latin America as a test case.
References


Appendix 1: Announced Exchange Rate Regimes in Latin America

In the 1980s, Latin American governments experienced high pass-through from exchange rate depreciations to inflation. As a consequence, for many countries the preferred ERR was some type of fixed or mixed system, using the exchange rate as a nominal anchor.

Cuadro 1a. Esquemas cambiarios y monetarios de facto en América Latina, 1999

<table>
<thead>
<tr>
<th>Sin meta explícita/ otra meta</th>
<th>Moneda no independiente</th>
<th>Caja de convertibilidad</th>
<th>Tipo de cambio fijo</th>
<th>Banda cambiaria</th>
<th>Flotación</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moneda no independiente</td>
<td>Panama</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meta cambiaria</td>
<td></td>
<td>Argentina</td>
<td>Venezuela</td>
<td>Bolivia, Brasil, Chile, Rep. Dominicana, Ecuador, Guatemala, Jamaica, México, Nicaragua, Uruguay, Costa Rica, Honduras</td>
<td></td>
</tr>
<tr>
<td>Meta de agregados Monetarios</td>
<td></td>
<td></td>
<td></td>
<td>Bolivia, Colombia, Guatemala, Jamaica</td>
<td>Paraguay, Perú</td>
</tr>
<tr>
<td>Meta de inflación</td>
<td></td>
<td></td>
<td></td>
<td>Chile, Colombia</td>
<td></td>
</tr>
</tbody>
</table>

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Without sufficient reserves, controlled ERRs are difficult to defend against speculation. Because of the inability to prevent speculative attacks, Latin American countries have since moved toward more flexible ERRs.

Cuadro 2a. Esquemas cambiarios y monetarios de facto en América Latina, 2004

<table>
<thead>
<tr>
<th>Sin meta explícita/ otra meta</th>
<th>Moneda no independiente</th>
<th>Caja de convertibilidad</th>
<th>Tipo de cambio fijo</th>
<th>Banda cambiaria</th>
<th>Flotación</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moneda no independiente</td>
<td>Ecuador; El Salvador; Panamá</td>
<td></td>
<td></td>
<td></td>
<td>Argentina; Paraguay; Rep. Dominicana; Venezuela; Uruguay</td>
</tr>
<tr>
<td>Meta cambiaria</td>
<td></td>
<td></td>
<td></td>
<td>Costa Rica, Honduras, Nicaragua</td>
<td>Bolivia, Guatemala, Jamaica</td>
</tr>
<tr>
<td>Meta de agregados Monetarios</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Brasil; Chile; Colombia; México; Perú</td>
</tr>
</tbody>
</table>

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