FISCAL DISCIPLINE & EXCHANGE RATE REGIMES

A CASE FOR CURRENCY BOARDS?

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Abstract

Empirical evidence shows that fixed exchange rates do not provide more fiscal discipline than flexible regimes, despite the fact that, in principle, fixing the exchange rate imposes important restrictions on seignoriage revenues. A more detailed analysis of seignoriage allows to explain the channels whereby monetary financing is possible in the short and medium run even in a exchange rate peg. More precisely, it is argued that the traditional concept of monetary seignoriage is misguiding and that fiscal seignoriage, defined as the actual revenues accruing to government from the Central Bank, is a key variable to determine fiscal discipline. The paper shows that a peculiar version of fixed regimes, the currency boards, may effectively restrain fiscal policy by ruling out fiscal seignoriage. An indirect confirmation of these hypothesis is advanced by observing the empirical link between monetary seignoriage and fiscal seignoriage, and their relation with fiscal discipline.

1- Introduction

During the nineties, the process of economic reform has gathered pace in Latinamerica, while a group of Eastern European countries has gone through a complete transformation to become market economies. The worldwide upsurge in the magnitude, scope and speed of financial movements has eased the implementation of the reform processes by providing the much needed inflows of capital, but, at the same time it has increased their vulnerability. Under these circumstances, macroeconomic stability has become the cornerstone for successful reform programs: in a context of financial globalisation, countries which have been perceived by markets to have weak fundamentals, particularly in terms of inflation, public finance and/or current account, have suffered from swift reversals in the inflows of capital, which have put at stake the process of reform. While contagion or domino effects have also damaged countries with sound macroeconomic fundamentals, it is also true that their strains have been only transitory and that after some period of difficulty they have improved their position on more solid basis.

The quest for macroeconomic stability has traditionally had in the choice of exchange rate regime one of its central elements. Many countries have based their programs of economic stabilization on regimes of rigid or semi-rigid exchange rates. The rationale for this strategy is the following: Inflation is perceived as an structural problem, and fixing credibly the exchange rate allows to tie down inflation expectations; this induces a more disciplined behaviour in economic agents, facilitating overall economic reform. Price stabilization also contributes to discipline public accounts: in emerging market economies fiscal systems and, thus, the ability to obtain revenue are weak; as a consequence, the financing of the deficits is partially done through money creation by the Central Bank (seignoriage revenues). The fall in inflation should drastically reduce seignoriage revenues, promoting fiscal reform and fiscal discipline.

Nevertheless, the empirical evidence is at odds with this theoretical prior. In figure 1 we observe that fixed exchange rate regimes have only attained a limited macroeconomic stability in emerging markets, compared to countries with flexible exchange rate regimes[1]:

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[1] These data refer to emerging market economies in Latin America and East Europe. Details on the sample are given in the annex

inflation performance is better but fiscal discipline does not improve: the total deficit is about the same, and the primary deficit (net of interest payments) is slightly higher. The weakness of the fiscal systems and the inability to finance them in an orthodox way tend to fuel inflation through monetization of deficits even when they are low, leading to the collapse of the peg in fixed regimes.

During the last years, in the above mentioned context of economic globalization, the failure of some fixed regimes to provide sound macroeconomic basis to the economy has generated deep financial and economic crisis. The cases of Mexico and Brazil have made it clear that pegging the exchange rate is a risky strategy; as a consequence, fixed regimes as a way to promote economic discipline have fallen out of favour.

In contrast, a special type of exchange rate arrangement, the currency board, has shown its strength in this context of financial turmoil. At first sight, a currency board might just be considered a hardened version of a fixed regime, in which the exchange rate is predetermined by law and the growth in the monetary base is backed by foreign reserves. The aim of this article is to show that currency boards are intrinsecally different from standard fixed exchange rate regimes because they deter monetary authorities from financing fiscal deficits. Moreover, we argue that this fiscal constraint is one of the main reasons for its current success to the extent that they can effectively deliver fiscal discipline.

The structure of the paper is as follows. In section two, we briefly develop the traditional view which links fiscal discipline to the process of money creation. In section 3, it is shown how fixed exchange rates should be expected to generate fiscal discipline by reducing inflation and seignoriage, and empirically test this hypothesis. Section four develops the idea which is central to our discussion, namely, that the conventional concept of seignoriage is a bad indicator for fiscal discipline, and that a more restrictive concept, which we denote as fiscal seignoriage, is more relevant to assess the disciplinary effects of the exchange rate regimes. In section five, we study how currency boards differ from standard fixed regimes in that they suppress fiscal seignoriage, by severely and effectively constraining the ability of the monetary authorities to finance public deficits. For this reason, they are expected to impose a much tighter constraint on fiscal policy and to induce a higher degree of fiscal discipline. Section 6 concludes.

2- Seignoriage as a source of deficit financing

The traditional approach to deficit monetization focuses on the following government budget constraint, which reflects the identity between the fiscal financing needs and sources, expressed in real terms:

$$d + (i - \pi)b = \dot{b} + \dot{m} \qquad (1)$$

Financial requirements are given by the total deficit, which is the sum of the primary deficit (d) and the cost of the stock of debt in the hands of the private sector (b), measured by the real interest payments. The real interest rate is the difference between the nominal interest rate and inflation (i-π). The government can finance this deficit through two sources: in an orthodox way, by issuing debt in the capital markets, that is, by increasing the stock of debt in the hands of the private sector ($\dot{b}$)[2], or by asking the Central Bank to buy her debt and pay it with money created for this purpose. The revenue collected from this operation is known as seignoriage, which is commonly computed as the real increase in the monetary base, that is, the sum of banknotes and bank reserves ($\dot{m}$).

Industrialized countries usually follow an orthodox financing of the public expenditure, through taxes and, when deficits appear, through debt. On the contrary, emerging economies usually lack developed tax systems and capital markets. Under these circumstances, seignoriage becomes a relevant source of revenue: in principle, monetary authorities can increase the monetary base and transfer the resulting revenues to the government in a discretionary way; the excess real balances will be adjusted by increases in the level price.

Indeed, revenues from seignoriage have typically been considered as an special form of taxation. To see this, note that the increase in the monetary base can be decomposed into two components:

$$\dot{m} = \left[\frac{\dot{M}}{P} \right] = \frac{\Delta M}{M} \cdot \frac{M}{P} = \lambda m \qquad (2)$$

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[2] A dot refers to rate of growth in the variables.

where P is the price level and high case letters refer to nominal variables. The first component is the rate of growth in the nominal monetary base (λ) and the second is the monetary base in real terms. In this expression, m is the tax base and λ is the tax rate.

Let us then consider the simplest form of money demand:

$$\theta \frac{M}{P} = kY \qquad (3)$$

in which real balances depends on the income level and k is a constant parameter. Note that the real money supply is the monetary base times the money multiplier (θ). Differentiating this expression, we obtain

$$\lambda = \pi + \frac{k}{\theta} \dot{y} \qquad (4)$$

The rate of growth in income is usually of low order and the money multiplier usually takes values higher than unity. Thus, when inflation is moderate or high, the first term in the expression dominate and λ is expected to be closely associated with the inflation rate. Therefore, seignoriage is traditionally considered as an inflation tax[3].

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[3] Inflation may have additional effects on the deficits. The first effect can be observed in expression (1): the interest payments term will be reduced by inflation as long as the nominal interest rate on debt does not reflect properly inflation expectations; this implies that only unexpected inflation can reduce the cost of debt service. The sign and magnitude of this effect depends on the inflation premium required for investing in domestic currency. Another effect, which is positive, is related to the fiscal drag; it refers to the higher taxes paid in progressive systems when the price level rises and taxes are not adjusted for inflation. Finally, the so-called Olivera-Tanzi effect is negative, as it arises from the lags in the collection of taxes which may be relevant in situations of very high inflation.

Seignoriage and inflation may thus play a central role in financing expenditures. Fischer (1982) computes seignoriage for developing countries and shows that it accounts in some cases for more than 20% of total revenues. Edwards and Tabellini (1991) observe that for Latin American countries the seignoriage in terms of GDP sometime reached dramatic magnitudes. For the largest countries, it was around 20% in Argentina between 1973 and 1987, 8.24% in Brazil (1983-87) and 4% in Mexico (1978-83). In our sample, the median of seignoriage is higher than 1.5% of GDP.

In this context, Sargent & Wallace (1981) suggested that inflation is a fiscal, rather than a monetary phenomenon because monetary policy is dominated by the financing needs of the government. Although this is probably a too radical view of the inflationary process, it well reflects the importance that fiscal aspects may have to explain inflation under certain circumstances.

An implicit assumption in these arguments is that the monetary base is discretionally managed by the Central Bank; or, in other words, that monetary seignoriage is supply driven. This assumption is however rather strong because the Central Bank is far from having a complete control on the base money. The monetary base consists of banknotes and commercial bank reserves. As our demand of money suggest, real incomes is a central determinant of the monetary base, in particular, of banknotes. Compulsory bank reserves are determined by reserve regulations, while non-compulsory reserves depend on the nature and efficiency of the payment system, and usually displays low interest elasticity. Therefore, the central bank may have difficulties to control the base money demand outside the compulsory reserves. Moreover, attempts to increase the monetary base beyond the desired holdings of banknotes and reserves may not be successful unless the Central Bank is ready to accept the interest rate adjustments necessary for the private sector to increase the base money and make use of the expanded liquidity.

3- Exchange rate regimes and fiscal discipline

3-a) Fixed regimes as disciplinary devices

A credible fix of the nominal exchange rate (e) will anchor monetary policy to the reference currency and, admitting that some form of Purchasing Power Parity is expected to hold, it will also stabilize inflationary expectations and reduce the ability to collect seignoriage.

This is evident if we replicate expression *(3)* for the foreign country (denoted by an asterisk) assuming for simplicity that the parameters take the same value, and compare the values of λ and $\lambda*$:

$$\lambda = \lambda * + (\pi - \pi*) + \frac{k}{\theta}(\dot{y} - \dot{y}*) \tag{5}$$

The PPP theory, in terms of expectations, states that the expected depreciation of the exchange rate equals the inflation differences, $\dot{e}^{e} \approx \pi - \pi*$. Therefore, if the exchange rate is credibly fixed, $\dot{e}^{e} = 0$, and the seignoriage revenues of the anchor country are low, as expected, only a higher economic growth than the anchor country would provide higher seignoriage revenues.

Therefore, a fixed exchange rate does not only reduce inflation but it should also constrain seignoriage relative to a flexible regime, thus inducing more fiscal discipline. In principle then, fixing the exchange rate provides an attractive way to macroeconomic stabilization.

3-b) Data and econometric considerations

Before dealing with the empirical evidence of exchange rate regimes on fiscal seignoriage , it is important to make several considerations regarding the data base and the variables and techniques to use, which will be also relevant for the rest of the analysis.

The first regards to the choice of the sample. We take observations of 24 emerging and transition countries, of which 15 belong to Latinamerica and 9 are European states in

transition. The sample for the former runs from 1972 to 1998, and for the latter it starts, in the majority of cases, in 1990. From this wide sample we have excluded the observations corresponding to currency boards (17 additional observations) schemes, which will only be considered in the last section, and inflation and seignoriage outliers, leaving a sample of 373 observations. Countries must then be labeled according to their regime, which is not a straightforward task. As explained with more detail in the Annex, the IMF adopts a "strict" definition which leaves out important stabilization efforts through semi-fixed exchange rate regimes, such as crawling pegs. Therefore, we consider two alternative samples: the IMF sample and a modified sample, in which, by examining more closely the nature of the exchange rate regimes, we expand the proportion of fixed exchange regimes from 49% to 60%. In estimation the different regimes are defined by a dummy variable which takes the value of one for fixed regimes and zero for the flexible cases; obviously, the distribution of the dummy will change depending of the sample it is used.

Secondly, focusing on the link between regimes and deficits, we have to consider which concept of deficit reflects more adequately fiscal discipline: overall deficits or primary deficits, v.g. deficits net of interest payments (d in expression (1)). It can be argued that the concept of deficit on which the fiscal authorities have some discretion is the primary deficit; furthermore, the bulk of interest payments may not be independent of the regime, since inflation is relevant to determine the real cost of debt (see footnote 3). Finally, very high inflations as those eventually observed in our sample may completely distort the figures on interest payments, and therefore the magnitude of overall deficits. However, in all the contributions to this literature the results have always been presented either in terms of the overall deficits or both[4]. Thus, although the analysis of the primary deficit provides a better assessment of fiscal discipline, we will present the results for overall and primary deficits.

Another set of considerations is of econometric nature. The database allows the use of panel techniques in the analysis. In panel data estimation, individual effects are customarily included, but we consider that in some of our regressions this is inadequate. In particular, when regressing the variables against the regime dummies the results on the regression would be distorted; since introducing individual effects implies to subtract the cross-country averages from the variables in the regression, this would imply that what is regressed is the (cross-country) deviation of the dependent variable on the (deviation of) the

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[4] Edwards and Tabellini (1991), Gavin & Perotti (1995), Tornell & Velasco (1998)

regime dummy, therefore distorting the relevant relation to explore which is the <u>level</u> of deficit on the exchange rate regime[5]. In the rest of the cases (relation between deficits and seignoriage), we test on individual effects and introduce them when they turn out to be significant. Another problem which may arise in the data is heteroskedasticity, which leads to an important loss of efficiency in estimation, although the estimates are still unbiased and consistent. Since we are interested in the significance of the parameters rather than in their value, it is important to correct the estimations for heteroskedasticity. This is done by testing and in its case controlling for cross-country variances.

Finally, we must acknowledge the effect of economic activity on the deficit, which is expected to be countercyclical. Economic expansions have two consequences for the public finances: first, the higher tax and tariff revenues associated with the expansion reduce the fiscal deficit; the second effect is evident from (4): expansion leads to a higher demand and an increase in seignoriage. However, the special characteristics in expenditure and revenues flows make the effect of the activity on the budget unclear. In particular, Gavin & Perotti (1997) show that under certain circumstances the deficit is procyclical. In any case, in the regressions below we control, when required, for the effect of the cycle, defined as deviations of growth from the sample average in each country.

3-c) Empirical evidence

Figure 1 in the introduction showed in a broad way that fixed regimes reduce inflation but they fail to improve the fiscal performance. In this section we formally explore the effect of fixed exchange rate regimes on fiscal discipline, which is proxied by the ratio of fiscal deficits to GDP, by using a large sample of data and panel regression techniques.

The effect of the fixed regime on the fiscal balance appears in table 1. We have regressed the two measures of the deficit (as a proportion of GDP) against the regime dummy in both samples, and we have controlled by the lagged value of the deficit and the cyclical position of the economy and correcting for cross-sectional heteroskedasticity[6]. The value of the dummy is not significantly different from zero, regardless of the chosen fixed

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[5] Note also that, if individual effects were considered, there would be no difference between countries with only one type of regime in the whole sample, since the resulting dummy value (which would be defined as deviation from the mean value of the regime) would be in both cases equal to zero.

[6] Other controls include terms of trade or the real exchange rate, but they did not turn out to be significant when included in the deficit regressions.

regime sample; in other words, fixing the exchange rate has no significant effect neither on the overall nor on the primary deficit. For the IMF sample the sign is even positive, suggesting that the fixed regimes would be associated, albeit non-significantly, with higher deficits. Also note that the effect of the cycle on the overall deficit, which appears in the last row is negative and significant, implying that deficits are significantly countercyclical; this result is contrary to the results of Gavin & Perotti (1997).

All in all, the effect of the fixed regime on fiscal discipline challenges the conventional wisdom: fixing the exchange rate does NOT generate disciplinary effects on fiscal policy.

3-d) Explanations

There have been some efforts in the literature to explain this apparent paradox. Although we will follow a different approach it is convenient to be familiar with them.

The first is based on the effects of exchange rate pegs on economic activity. The Exchange-rate-based stabilization schemes (hereafter, ERBS) usually bring about rapid disinflation (due to the anchoring of external prices) and an economic expansion. Economic evidence is quite robust (see Kiguel & Leviatan (1992) and references in Calvo & Vegh (1998)) and this result is confirmed in our sample, in which a regression of growth on the regime yields a highly significant positive sign[7].

From a theoretical perspective, this initial expansion can be explained by inflationary inertia in the service sectors, which, in the aggregate, push down real interest rates (Rodriguez (1982)); or by the imperfect credibility of the new regime which incentives present relative to future consumption, inducing a consumption boom in the initial stages of the peg (Vegh (1992)). In both cases, the expansion is coupled with a growing current account deficit and the appreciation of the real exchange rate. In the medium run, demand exhausts its expansionary impulse and leads to recession and, most of times, to the collapse of the fixed regime. This is the characteristic boom-bust cycle of ERBS.

Given the higher fiscal and monetary revenues accruing to the government in the expansionary phase, the government budget constraint is relaxed and this has perverse

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[7] The parameter and t-ratio (in brackets) of the fixed regime dummy is 1.13 (2.83).

effects on fiscal discipline. From here, it follows that the end of the expansion is usually accompanied by a strong deterioration of the fiscal stance, which contributes to the abandonment of the peg, as Kaminsky et al (1996) show. Moreover, regressing interest payments on the regime dummy indicates that fixing the exchange rate is associated with a lower cost of debt[8]. This may be due either to lower debt levels at the times of fixed regimes or, more probably, to a lower cost in debt financing. Both factors indicate that fixing the exchange rate eases the financial budget constraint of fiscal authorities which can borrow more freely and cheaply in international capital markets.

The second contribution, by Tornell & Velasco (1998) has a more analytical flavour and it is focused on the policy incentives induced by the peg, relative to other stabilization programs based on flexible exchange rates. It is evident that ERBS has very appealing macroeconomic implications in the short run for the policymaker, in terms of inflation, activity and public accounts. On the contrary, in monetary based stabilizations (i.e with flexible rates) the short-run trade off is less attractive, since the decline in inflation is slow and activity initially recedes. As a consequence, exchange rate based stabilizations induce less fiscal discipline than monetary stabilization, since fiscal indiscipline do not have short-run inflationary effects in the first case. In contrast, fiscal profligacy within a flexible rate regime has immediate effects on inflation, and this exerts a deterrent effect on fiscal authorities.

4- Monetary v. Fiscal Seignoriage

The contributions outlined above provide valid arguments to explain the failure of fixed regime in capping fiscal deficits, while they recognize their positive effects on inflation. Returning to our previous model, this suggests that monetary seignoriage is constrained under fixed regimes. Since the regression results show that even after controlling for the position in the cycle, that is, after taking into account the positive effects of the expansion, fixed regimes do not reduce the deficits, it is not obvious then how these deficits are financed by the government. One possibility is debt which, as suggested above, is easier to allocate in fixed rate regimes. The other possibility is that monetary seignoriage, which is the central link between inflation and fiscal deficits, is an inadequate proxy to assess the

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[8] The parameter is -0.15 (-2.33) for the IMF-modified sample. It is non-significant for the IMF sample

financing of deficits through the process of money creation. We explore this second hypothesis.

4-a) Fiscal seignoriage

Klein & Neumann (1991) first pointed at the misguiding use of the concept of seignoriage in the context of public finances. Seignoriage, understood as the rate of growth in money creation is identified with an inflation tax, which, in strict terms, represents the opportunity cost of holding money. However, this private cost of holding money does not match the benefit accruing to the fiscal authorities. On the one hand, inflation generates a deadweight loss from which nobody benefits; on the other hand, and more importantly, the revenues from money creation do not necessarily flow to the fiscal authorities. It is evident that in the context of fiscal analysis, seignoriage should refer to the revenues effectively accruing to governments from the process of money creation. Indeed, stressing the difference between the first concept, to which we will refer as monetary seignoriage, and the second, denoted as fiscal seignoriage, turns out to be crucial in what follows.

Let us consider the balance sheet for flows of the Central Bank, expressed in domestic currency:

Changes in CB Balance Sheet

Reserves ($e\dot{r} + \dot{e}r$)	Monetary base ($\dot{m}$)
Private credit ($\dot{c}$)	Other net liabilities
Public Debt ($\dot{f}$)	

Let us now recall the process of deficit monetization, as traditionally described: public debt holdings by the Central Bank increase and simultaneously money is printed out increasing the monetary base, v.g. $\dot{f} = \dot{m}$. This process reveals that the financing needs of the Government are satisfied by the Central Bank through an increase in the holdings of public debt $\dot{f}$ and that this variable is usually approximated by the changes in the monetary

base. However, in view of the Central Bank balance sheet this description is extremely problematic.

First, note that the holdings of public debt are assets to the Central Bank, and that it may even obtain interest income from them; on the contrary, the traditional view assumes that public debt holdings just 'sink' into the Central Bank accounts and, of course, they generate no yield to the monetary authority. This is equivalent to say that the Central Bank and the Government can consolidate their balances, since debt holdings (and its yields) would disappear from this consolidated balance.[9] This is probably a too strong assumption for industrialized countries, but it is more realistic for the countries in our data set, at least for the first part of the sample. Thus, either if we accept such extreme view or if we just recognize the privileged financing of deficits by Central Banks, we consider that the increase in government debt holdings by the Central Bank, f , is a good proxy for the financing needs of government provided by the monetary authorities[10].

Second, an more importantly, note that the Central Bank can keep on transferring resources to the government even if the monetary base is kept constant through adjustments in its balance sheet. Note that by reducing the level of reserves and the credit to the private sectors, the Central Bank can increase its holdings of public debt. More precisely, the holdings of government debt can be accommodated by changes in any other component in the Central Bank balance sheet, not just by increases in the monetary base:

$$\dot{f} = \dot{m} - (\dot{c} + \dot{e}r + e\dot{r}) \qquad (6)$$

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[9] See Klein and Neumann (1991). It is also important to note that this privileged financing affects the profit and loss accounts of the Central Bank. As a matter of fact, central Bank in emerging countries usually display important losses because they are also used by the government as privileged source of financing for the public sector firms or sustain dual exchange rate systems. Edwards (1997) computes the magnitude of Central Banks losses, which in extreme cases amount to more than 4% of GDP. In our sample, it is not possible to compute these losses, which are conveyed in the deficit variable.

[10] Privileged financing is expected to be highly correlated with the increase in f. It would also be useful to distinguish in the claims to governments between credits to the public sector and debt. The first item is more clearly associated with financing of deficits, while the second can be argued to be used for open market operations. Data do not allow for this distinction.

We will thus denote the increase in public debt holdings by the Central Bank, $\dot{f}$, as fiscal seignoriage, the actual revenues accruing to the government from the Central Bank to finance public deficit, in order to distinguish it from monetary seignoriage, $\dot{m}$, which just refers to the increase in the monetary base.

This distinction affects the budget constraint identity since the actual financing of the deficit by the monetary authorities is given by the fiscal seignoriage instead of the monetary seignoriage:

$$d + (i - \pi)b = \dot{b} + \dot{f} \qquad\qquad (1')$$

and therefore fiscal seignoriage is the relevant variable to analyze how government deficits are financed by the monetary authorities and how exchange regimes affect the ability to finance public deficits.

4-b) Empirical evidence

The discrepancy between fiscal and monetary seignoriage could a priori explain the protracted ability of fixed regimes to finance fiscal deficits, and therefore the lack of effects of fixing the exchange rates on fiscal discipline. To prove this hypothesis empirically we proceed in two steps: first, we test the link between deficits and the two alternative concepts of seignoriage and then how the exchange rate regime affects monetary and fiscal seignoriage.

The previous decomposition suggests that the relevant variable to explain how deficits are financed is the fiscal seignoriage and not the monetary seignoriage. Table 2 explores this hypothesis by regressing the fiscal deficit (overall and primary) on monetary and fiscal seignoriage, respectively, as a proportion of GDP. In all the cases, a lag of the dependent variable is included and the effects of the cycle are controlled for, when required. The results endorse our hypothesis: monetary seignoriage cannot explain fiscal deficits in any of the specifications, and the sign is even negative, albeit non-significant (implying that higher monetary seignoriage are, if anything, associated with lower deficits, which is contrary to the conventional hypothesis). On the contrary, fiscal seignoriage is significantly

and positively correlated with fiscal deficits, both overall and, more clearly, primary deficits[11].

Second , we consider the effects of fixing the exchange rate on fiscal and monetary seignoriage, with the corresponding lags and controls. Fixing the exchange rate should reduce monetary seignoriage through disinflation, but not necessarily fiscal seignoriage, which can be accommodated in the short and medium run by the Central Bank. Table 3 presents the results: the negative sign of the fixed regime dummy and its robust significance in every case confirms that fixed regimes reduce monetary seignoriage. On the contrary, the effects on fiscal seignoriage are non- significant, and the sign is even positive.

These results suggest that the constraints imposed by the exchange rate regime on monetary seignoriage are overcome through adjustments in private credit and reserves in the balance sheet of the central bank. This allows to preserve fiscal seignoriage according to the financing needs of the fiscal authorities and regardless of the regime choice.

For our purposes, it is also interesting to consider the signs of the cycle effects. The effect is non-significant in the monetary seignoriage regression. On the contrary, the negative and significant sign of the cycle on fiscal seignoriage is more intriguing but we can advance the following interpretation:. Economic expansions reduce fiscal deficits and therefore the financing needs of governments. Since fiscal seignoriage can be discretionally managed, it is reasonable to think that it is lower in good times. This is an alternative route to stress that fiscal seignoriage is the relevant variable to study how deficits are financed.

The outcome of the statistical analysis can be summed up as follows: in table 1 we have shown that, contrary to intuition, fixed exchange rate regimes have no effect whatsoever on fiscal deficits. This result can be explained by considering the distinction between monetary and fiscal seignoriage. Since fiscal deficits are financed by means of fiscal, not monetary seignoriage (table 2) and fixed regimes tend to reduce monetary but not fiscal seignoriage (table 3), it follows that pegging the exchange rate does not constraint deficit financing and therefore it will not provide fiscal discipline.

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[11] These results coincide with those of Sikken & de Haan (1998) which explore similar relations with alternative specifications in an univariate context.

It could then be argued that for a fixed exchange regime to be sustainable, fiscal seignoriage should also be reduced. The reduction of foreign reserves and private credit to preserve fiscal seignoriage revenues can only be transitory because they are finite. But note that this is precisely the bottom line of first generation models of speculative crises (Krugman, 1979): depletion of reserves eventually bring about the collapse of the regime. And this is what we actually observe in practice: fixed exchange rate regimes have been abandoned sooner or later in emerging countries amid speculative attacks which cannot be encountered.

From the approach followed in this analysis, it is clear that the key to fiscal discipline, and eventually also to exchange rate sustainability is to design a exchange rate regime which effectively reduces fiscal seignoriage. Next, we show how the currency board regime may be up to this requirement.

5- The currency board as a disciplinary device

Around thirteen currency boards operate in the world when this paper is being written. Of these, only five can be considered as stabilization devices to stop deterioration of the macroeconomic environment. Argentina was the first big, relatively closed economy which adopted this scheme in 1991 when it was suffering hyperinflation, and it was followed by some European transition economies, like Estonia, Lithuania and Bulgaria and Bosnia[12].

So far, none of these regimes has been abandoned. Although their experience is short, this is a remarkable record in a decade of big financial crises which have affected emerging countries and have led to the collapse of neighbour economies, like Russia, Mexico or Brazil. This positive outcome is probably related to the special characteristics of currency boards.

A currency board arrangement can be defined as *'a monetary regime based on an explicit legislative commitment to exchange domestic currency for a specific foreign*

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[12] The starting date and parity with the reference currency of these arrangements are: Argentina (April 1991, fixed parity 1:1 with the US dollar), Bulgaria (July 1997, fixed parity 1000:1 with the Deustche mark), Lithuania (April 1994, fixed parity 4:1 with the US dollar), Estonia (January 1992, fixed parity 8:1 with the deustchemark) and Bosnia (august 1997, fixed parity 1:1 with the Deustche mark). The rest of currency board correspond to colonies or are reminiscent of colonial times: Hong Kong, Djibouti, member countries of the Eastern Caribbean Central Bank, Cayman Islands, Falkland Island, Gibraltar and Brunei. A detailed account of currency board operation and a evaluation of the regime can be found in IMF (1997) and references therein.

currency at a fixed rate, combined with restrictions on the issuing authorities -the currency board- to ensure the fulfillment of its legal obligation. This structure implies that domestic currency be issued only against foreign exchange and that it remains fully backed by foreign assets.' (IMF,1997)

Therefore, the Currency Board replaces the Central Bank as issuing institution and the growth in the monetary base is determined by the evolution of foreign assets. This is the relevant feature of currency boards, because it implies that the authorities all but renounce to accommodate the excess demand for liquidity. Moreover, currency boards are set by law, sometimes implying a constitutional amendment, like in Argentina. Thus, the explicit commitment for exchange rate management currency is higher than in standard fixed exchange regimes. Both factors tend to enhance the credibility of the currency board and they may contribute to explain its robustness. However, here we would like to stress the fiscal discipline aspects, which have been largely ignored in the analysis and which, in our view are quite relevant to explain the success of currency board regimes.

By definition, in a currency board the increase in monetary base equals the increase in the value of foreign reserves:

$$\dot{m} = \dot{e}r + e\dot{r}$$

This implies that the credit to the private sector and, more remarkably, the claims to the Government disappear from the Central Bank balance sheet. Thus, fiscal authorities cannot be financed by the monetary authority and fiscal seignoriage disappears. To be more precise, the only source of revenue for the Government from the monetary institutions are the profits that the currency board may make, in particular, from the yields on foreign reserves[13].

Returning to our previous discussion, the superiority of currency boards as disciplinary devices is now evident. Fiscal deficits are related to the ability to generate fiscal

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[13] For example, in 1998 Argentina obtained 965 millions of pesos in interest payments for its foreign exchange reserves (around 2% of actual tax revenues). Central Bank's benefits accounts in 1998 around 863 millions of pesos, equivalent to 0,3% of GDP.

seignoriage and the only exchange rate regime which rules out fiscal seignoriage is a currency board. Therefore, currency boards should discipline public finances[14].

The adoption of currency boards has been usually implemented in a context of high macroeconomic instability, so that the persistence of previous instability may be evident in the first observations within the currency board regime. In spite of this, figure 1 suggest that fiscal performance of currency boards slightly better. Figure 2 displays with more detail the evolution of the main variables in the currency board regimes of Argentina, Estonia, Lithuania and Bulgaria, before and after the adoption of the arrangement. Some data are missing due to unavailability or to the short duration of the currency board. In any case, we observe that deficits tend to fall, sometimes with some lags, after the arrangement, even in Argentina, which has went through a deep recession after the Mexican crisis. More remarkable is the comparison between monetary and fiscal seignoriage. Monetary seignoriage has been reduced due to inflation stabilization but it is still relatively large in some cases; on the contrary, fiscal seignoriage -as expected- has been drastically eliminated in contrast with the previous situation. Figure 3 summarizes this information of seignoriage after the adoption of the currency board and compares it with the performance of fixed and flexible regimes. While monetary seignoriage is similar in currency boards and fixed regimes, fiscal seignoriage is zero in currency boards.

For the sake of completeness, table 4 presents the regression results of a currency board dummy on the relevant variables, comparing its performance with the rest of fixed exchange rate regimes (both IMF and modified-IMF samples). The dummy on both the overall and primary deficit is not significant, although it has the expected sign. On monetary and fiscal seignoriage, the currency board dummy is significant for all the cases. This more formal analysis can only be indicative due to the lack of observations (only seventeen) and

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[14] Note that currency boards do not necessarily require a strictly fixed exchange rate to operate. Although the management of currency boards has always been implemented within fixed exchange rates regimes, currency boards also would eliminate fiscal seignoriage if they were run in a managed float or in a crawling peg, that is allowing for changes in the nominal exchange rate ($e \neq 0$). As the condition states, changes in er could then be backed by equal changes in the monetary base. Also note that the effects of a currency board on fiscal discipline are very similar to those of the dollarization of the economy. In this second case, there is no need for the Central Bank or the currency board to operate, and the revenues from holding foreign reserves would disappear. On the positive side, the interest rate differentials between the currency board country and the reference should be expected to dwindle too, as the peg of the exchange rate is perceived as irrevocable and the exchange rate premium disappears.

the aforementioned inertia of fiscal variables at the initial observations of the currency[15]. It is expected that the effects of the currency boards are only reflected in the medium run; given the short life of most currency boards this justifies the lack of empirical evidence arising from the statistical analysis.

6- Conclusions

This paper has analyzed the role of exchange rate regimes in providing fiscal discipline. The empirical analysis has shown that, despite its theoretical appeal, fixed regimes are unable to constrain fiscal authorities because they do not reduce the ability of the Central Bank to finance fiscal deficits.

The traditional view states that monetary seignoriage (the increase in the monetary base) allows to finance fiscal deficit and that fixed regimes, by capping this source of revenue from the Central Bank generates fiscal discipline. This argument is refutable on two basis. On the one hand, it implicitly assumes that the management monetary base is completely discretional by the monetary authority in a flexible regime, while it depends on other structural factors; on the other hand, even if we accept the discretionality argument, monetary seignoriage turns out to be a bad indicator of the financing resources provided by the Central Bank to the Government. The relevant variable has been shown to be fiscal seignoriage, that is, the revenues effectively accruing to the fiscal authorities from the Central Bank activity.

Thus, even if fixed regimes effectively constraint monetary seignoriage they have not limited fiscal seignoriage and therefore they have not induced fiscal discipline. Indeed, maintaining the flow of fiscal seignoriage in fixed regimes may require the depletion of foreign reserves. All in all, in a world of rapid shifts in capital flows, fixed regimes without strong macroeconomic discipline seem to be a perfect recipe for failure since they are taken as preferred targets for speculative attacks.

In this context, currency boards have become an attractive regime for stabilization. One reason is the perceived higher commitment to the peg, endorsed by legislation, that the currency board provides. The second reason, to which have paid our attention in this paper,

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[15] The results are also influenced by the poor fiscal performance of Lithuania, which still suffers from high overall and primary deficits. When Lithuania is excluded from the sample (leaving only thirteen currency boards observation),the currency boad dummy is significant and displays the expected sign for the deficits.

is that they impose effective constraints on public finances by suppressing fiscal seignoriage and therefore they should act as strong disciplinary devices for fiscal policy. The fact that all the currency boards have survived the bouts of financial crises in the last years confirms the success of these arrangements.

Nevertheless, the choice of the exchange rate regime must be consistent with the economic, social and political circumstances to fulfill its goals. More precisely, the constraints on monetary and fiscal management imposed by currency boards require a very wide support of economic and social forces within the country. In this sense, a currency boards can be identified with a deep institutional change, which transform the way economic policy operates. It is no wonder then that currency boards have been adopted either in countries anxious to avoid previous experiences with hyperinflation (like Argentina) or with an overriding goal on which the whole population agrees, as it happens in East European countries with prospective EU adhesion. This important social consensus pushes ahead reforms and it is the actual basis for the sustainability of these regimes.

Table 1 Fiscal deficits and the exchange rate regime

Sample	Overall deficit	Primary deficit
IMF		
Fixed regimes	0.04 (**)	0.26 (**)
(t ratio)	(0.20)	(1.14)
IMF modified (a)		
Fixed regimes	-0.07 (**)	-0.01 (**)
(t ratio)	(-0.39)	(-0.02)
Real business cycle (b)	(-)	(0)

Note: estimation via weigthed least squares, heteroskedasticity corrected by cross sectional variance. An asterisk indicates that the variable is not significant at 90 per cent level, and two asterisks mean that the variable is not significant at 95 per cent level.

(a) The exchange rate regime defined according to IMF 'strict' definition adding some episodes of exchange rate based stabilizations through not strictly fixed exchange rates.

(b) We show in brackets the sign of the effect of the real business cycle on the variables. A zero is shown when this effect is statistically not significant.

Table 2 Fiscal deficits and seignorages

Seignorage	Overall deficit	Primary deficit
Monetary seignorage	-0.02 (**)	-0.07 (**)
(t ratio)	(-0.63)	(-1.53)
Fiscal seignorage	0.05 (*)	0.07 (**)
(t ratio)	(1.75)	(2.03)
Real business cycle (a)	(-)	(0)

Note: estimation via weigthed least squares, heteroskedasticity corrected by cross sectional variance. An asterisk indicates that the variable is not significant at 90 per cent level, and two asterisks mean that the variable is not significant at 95 per cent level.

(a) We show in brackets the sign of the effect of the real business cycle on the variables. A zero is shown when this effect is statistically not significant.

Table 3 Seignorages and the exchange rate regime

Sample	*Monetary seignorage*	*Fiscal seignorage*
IMF		
Fixed regimes	-0.47	0.04 (**)
(t ratio)	(-2.55)	(0.16)
IMF modified (a)		
Fixed regimes	-0.65	0.15 (**)
(t ratio)	(-3.57)	(0.60)
Real business cycle (b)	(0)	(-)

Note: estimation via weigthed least squares, heteroskedasticity corrected by cross sectional variance. An asterisk indicates that the variable is not significant at 90 per cent level, and two asterisks mean that the variable is not significant at 95 per cent level.

(a) The exchange rate regime is defined according to IMF 'strict' definition adding some episodes of exchange rate based stabilizations through not strictly fixed exchange rates.

(b) We show in brackets the sign of the effect of the real business cycle on the variables. A zero is shown when this effect is statistically not significant.

*Table 4 Fiscal variables and seignorages in currency boards (CB) regimes*

Sample	Overall deficit	Primary deficit	Monetary seignorage	Fiscal seignorage
IMF				
CB regimes	-0.39 (**)	-0.48 (**)	-0.82	-0.51
(t ratio)	(-1.06)	(-1.28)	(-2.63)	(-2.38)
IMF modified (a)				
CB regimes	-0.29 (**)	-0.33 (**)	-0.73	-0.56
(t ratio)	(-0.73)	(-0.80)	(-2.21)	(-2.74)
Real business cycle (b)	(-)	(0)	(+)	(0)

Note: estimation via weigthed least squares, heteroskedasticity corrected by cross sectional variance. All regressions refers to a subsample including only fixed exchange rate regimes. An asterisk indicates that the variable is not significant at 90 per cent level, and two asterisks mean that the variable is not significant at 95 per cent level.

(a) Exchange rate regime is defined according to IMF 'strict' definition adding some episodes of exchange rate based stabilizations through not strictly fixed exchange rates.

(b) We show in brackets the sign of the effect of the real business cycle on the variables. A zero is shown when this effect is statistically not significant.

Figure 1 Economic performance of emerging market economies
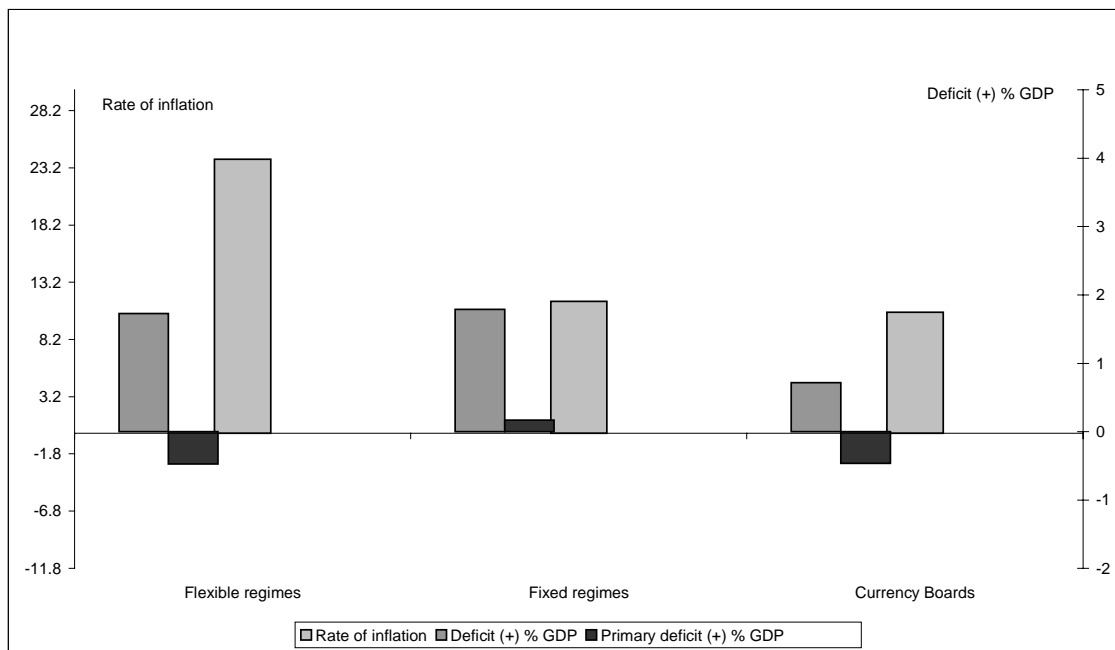
Note: sample median for each variable. Exchange rate regimes is defined according to IMF 'strict' definition, that is, considering fixed exchange rate regimes as those labelled as 'pegged to a single currency' or 'pegged to a composite of currencies'.

Figure 2 Economic performance of emerging market economies with currency board regimes
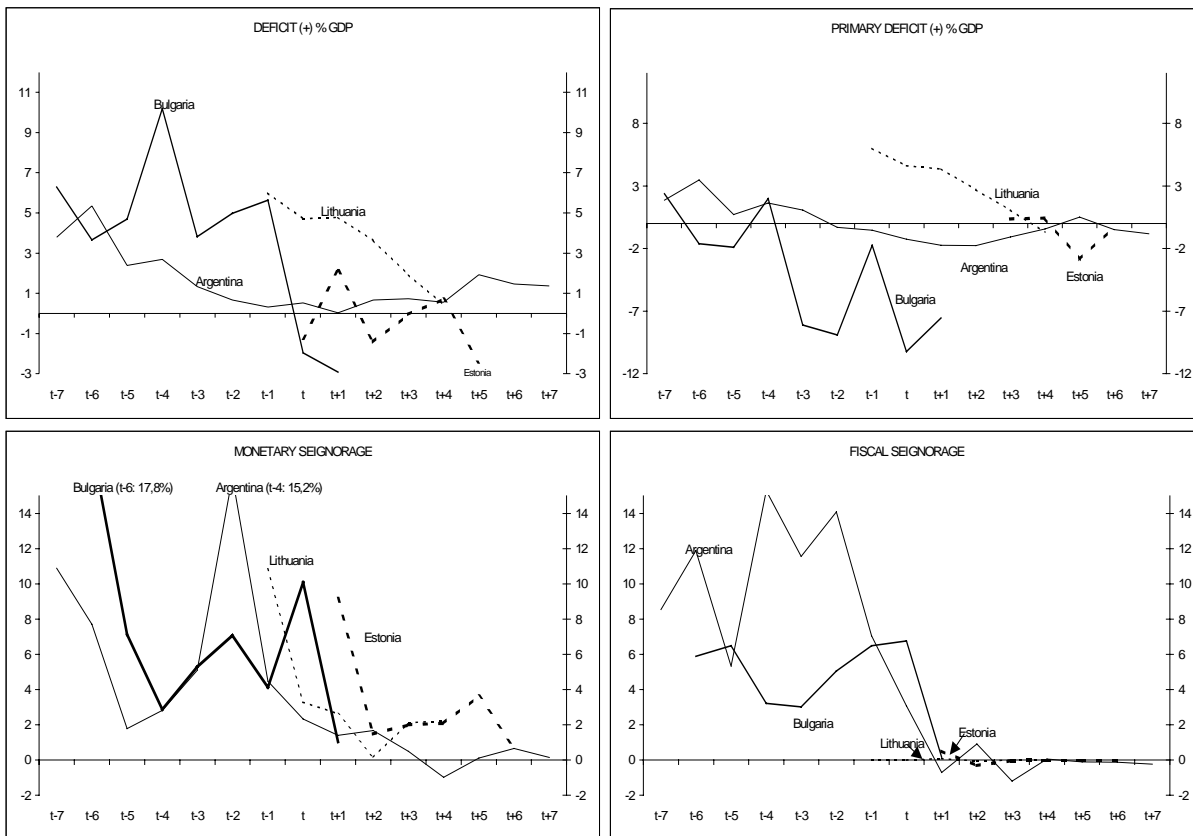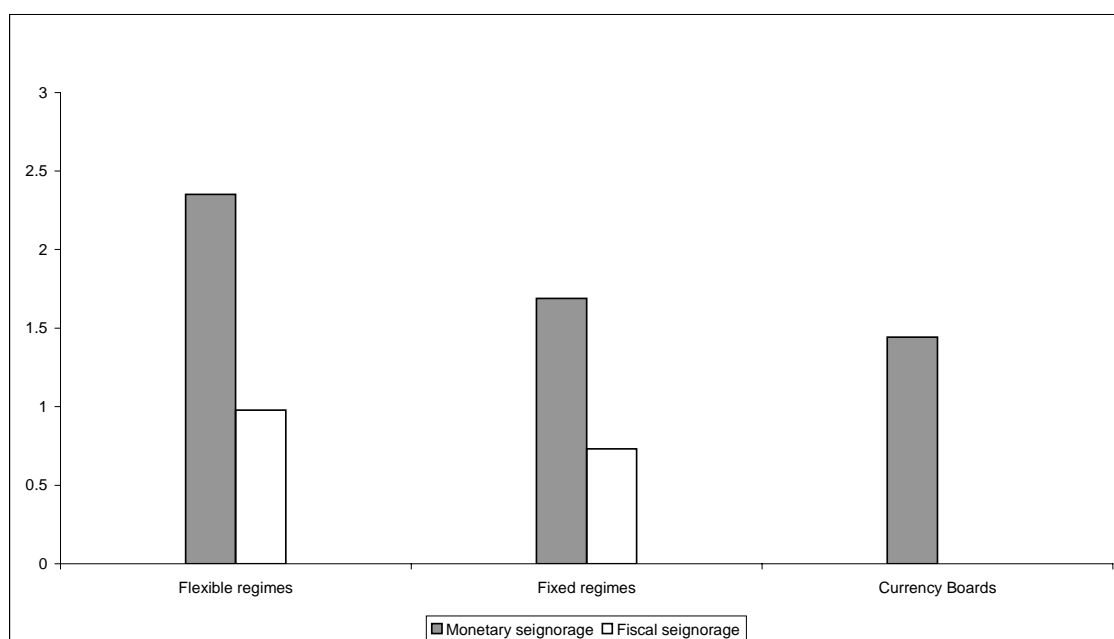
Figure 3 Economic performance of emerging market economies

Note: sample median for each variable. Exchange rate regimes is defined according to IMF 'strict' definition, that is, considering fixed exchange rate regimes as those labelled as 'pegged to a single currency' or 'pegged to a composite of currencies'.

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ANNEX: DATA SOURCES AND METHODOLOGIES

This section presents an overview of the data we have used in the empirical tests. We have selected 24 emerging and transition countries, of which 15 are from Latin America, and the other 9 are European transition countries[16]. The choice is made on the basis that for these countries the choice of exchange rate regime has played and continues to play a central position in policy strategies.

The data are taken from the IMF "International Financial Statistics". They include the official exchange rate, in units of local currency per US dollar (line ae), claims on governments of monetary authorities (line 12a, and, it they exists, lines 12b and 12c, which refer to local governments and public enterprises), reserve money (line 14), consumer prices (line 64), the government deficit or surplus (line 80), and nominal and real GDP (lines 99). Data for interest payments on public debt from the IMF "Government Finance Statistics" are used to construct series of primary deficit In general, we have data from 1972 to 1998 for Latinamerican countries, and from 1990 to 1998 for European transition countries.

We define "monetary seignoriage" as the annual change in reserve money scaled by nominal GDP, as in Fischer (1982), and fiscal seignoriage as the annual change in monetary authorities claims on government scaled by nominal GDP. It is immediate to see that these calculations are equivalent to the definitions appearing in the text. Consumer price indices are used to calculate the rate of inflation, and the cyclical position is computed as deviations from average growth. We have eliminated from the sample some data which could be considered as "outliers" (see the main text). We have defined inflation outliers as those in the last decile of the sample, leaving observations whose inflation rate is less than 131% a year, and seignoriage outliers as those which fall beyond the 95th centile; this excludes observations whose monetary seignoriage is higher than 14% of GDP and whose fiscal seignoriage is higher than 18% of GDP. This leaves a maximum of 370 observations although for some variables, most notably primary deficits, the availability of data is lower.

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[16] Selected countries are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru, Uruguay, Venezuela, Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia and Romania.

The more difficult issue we had to deal with was the definition of the exchange rate systems of each country in each year. Our main source of information had to be, in principle, IMF "Exchange Rate Arrangements And Exchange Restrictions: Annual Report", in which the IMF classified exchange rate arrangements as "Pegged", "Limited flexibility", and "More flexible arrangements". So first of all we construct the "IMF sample" of the main text taking fixed exchange rate regimes as those labeled as "Pegged" according to IMF at the end of each year, as in Gavin & Perotti (1997).

But this definition poses many problems, as it does not include some Exchange Rate Based Stabilizations (ERBS) instrumented via not strictly fixed exchange rates, like crawling pegs or crawling bands, which are labeled as "More flexible arrangements" by the IMF. The IMF itself recognizes this problem in a recent publication (IMF(1999)), and reclassifies many countries' arrangements. Finally, the last available issue of IMF "Exchange Rate Arrangements…", corresponding to 1999, labels the exchange rate regimes not as fixed or flexible like previously, but as currency boards, crawling pegs, target bands, etc., letting the reader to decide which is a pegged exchange rate an which is not. One of the best examples of the possible inadequacy of IMF's previous definition is the Brazilian *Plano Real,* a "genuine" ERBS dated in July 1994 which was instrumented within a crawling peg system since 1995, and which was labeled as "managed floating" by the IMF.

Having this in mind, we have filtered the IMF sample and constructed an alternative to be used along with the former. We have added some episodes of semi-fixed exchange rate arrangements that countries implemented with a clear stabilization objective[17]. Finally, when a country changes its system we have changed its definition if the change occurs in the last six months of the year. In Table A.1 we show the differences between IMF stricter sample and our sample:

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[17] This could be the reason why we consider Brazil 1994 as a ERBS, although it was a crawling peg system, and a Money Based Stabilization Bolivia 1986, a country which currency has been depreciating against the US dollar at a much slower pace than the Brazilian's one. However, in IMF (1999) Bolivia is considered again as a fixed exchange rate, as "the deviations of the market exchange rate from the official exchange rate (…) are extremely tight (…), and that the regime is in practice a crawling peg aimed at maintaining the competitiveness of the economy". These considerations show that the definition of the regime is not a easy issue. To define theses episodes we have consulted, among others, Kiguel & Liviatan (1992), Tornell & Velasco (1998), Hamann (1999) and IMF (1999).

Table A.1 Differences between samples

Country	Date	IMF sample	Modified sample
Argentina	1979-1980	Flexible	Fixed (*Tablita*)
Argentina	1985-1986	Flexible	Fixed (*Plan Austral*)
Bolivia	1997-1998	Flexible	Fixed
Brazil	1986	Flexible	Fixed (*Cruzado*)
Brazil	1994-1998	Flexible	Fixed (*Plano Real*)
Chile	1978	Flexible	Fixed
Chile	1985-1997	Flexible	Fixed
Colombia	1992-1998	Flexible	Fixed
Ecuador	1995-1998	Flexible	Fixed
Honduras	1997-1998	Flexible	Fixed
Mexico	1988-1994	Flexible	Fixed
Uruguay	1978-1982	Flexible	Fixed (*Tablita*)
Uruguay	1992-1998	Flexible	Fixed
Venezuela	1996-1998	Flexible	Fixed
Hungary	1995-1998	Flexible	Fixed
Latvia	1994-1996	Flexible	Fixed
Poland	1991-1998	Flexible	Fixed

Source: IMF (1999).

Finally, in table A.2. we show the median of the main variables for the different exchange regimes, distinguishing between the two alternative regime samples:

Table A.2 Main features of the samples

	IMF sample	*Modified sample*
Number of observations		
Flexible regimes	218	152
Fixed regimes	155	221
Currency Boards	17	17
FLEXIBLE REGIMES		
Sample median		
Overall deficit	-1.73	-1.76
Primary deficit	0.48	0.18
Inflation	23.94	24.62
Monetary seignoriage	2.35	2.44
Fiscal seignoriage	0.98	1.19
Real GDP growth	3.75	3.44
FIXED REGIMES		
Sample median		
Overall deficit	-1.79	-1.59
Primary deficit	-0.17	0.31
Inflation	11.54	15.21
Monetary seignoriage	1.69	1.78
Fiscal seignoriage	0.73	0.73
Real GDP growth	4.71	4.61
CURRENCY BOARDS		
Sample median		
Overall deficit	-0.71	-0.71
Primary deficit	0.46	0.46
Inflation	10.60	10.60
Monetary seignoriage	1.44	1.44
Fiscal seignoriage	-0.00	-0.00
Real GDP growth	4.91	4.91

Source: own calculations.