Exchange rate arrangements and misalignments: contrasting words and deeds

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Abstract

The paper studies the misalignment[2]-exchange rate regime linkages by pursing three avenues. First, does misalignment vary across alternative *de jure* and *de facto* exchange rate systems? Second, can these misalignment-effects be explained by different probabilities of undervaluation and overvaluation episodes? Lastly, does delivering the promised exchange rate regime pay off?

The regression analysis reveals that misalignment is larger in fixed systems, with middle income and the CFA countries displaying the largest effect. This result likely stems from more (less) frequent overvaluation (undervaluation) episodes. Intermediate regimes are found to be associated with a smaller misalignment in middle income countries and a larger misalignment in low and high income countries. But only in the latter does this misalignment-impact appear to result from more frequent overvaluation episodes. In the other groups of countries it may come from over and undervaluation episodes with different magnitudes.

JEL classification: E42, E52, F31, F41

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2 Misalignment, real misalignment and real exchange rate misalignment are hereafter used interchangeably. Likewise, over (under) valuation, real over (under) valuation, real exchange rate over (under) valuation have the same meaning unless otherwise stated.

1. Introduction

The real exchange rate plays a prominent role in open economies (Obstfeld, 2004). Indeed, real exchange misalignment distorts the intra and inter-country allocation of productive resources and hampers the international competitiveness of domestic producers. It may as well be an omen for crisis. Misalignment may also trigger beggar-thy-neighbor policies. Ultimately, it would hamper economic growth and development.

Economic theory stipulates that the equilibrium real exchange rate is independent of the exchange rate system, it is solely determined by the economy's fundamentals. However, misalignment, that is deviations of the real exchange rate from its equilibrium level, depends on the existing exchange arrangement.

Indeed, the existence of nominal rigidities implies that the real exchange rate would adjust differently to changing economic conditions under flexible and fixed exchange regimes. In the former changes in the nominal exchange rate carry out the adjustment. In the latter the real exchange rate departs from equilibrium. The resulting misalignment persists as long as prices and wages adjust to restore equilibrium. Supportive evidence is provided by Sarno, Valente and Wohar (2003) in six industrial European countries[3] and Catao and Solomou (2005) for the gold standard system.

In a fixed regime a devaluation may hasten misalignment correction. However, besides not being always available[4] devaluation may prove problematic because of political costs (Collins, 1996), and uncertainty about the misalignment extent, the nominal-real exchange rate elasticity, and the nature and scale of the shocks buffeting the economy. The correction of mild misalignments would thus likely be achieved through price changes in fixed regimes and because of a sluggish downward price adjustment misalignment builds up. In the face of severe misalignment a consensus to devalue may ultimately emerge. These patterns of adjustment under fixed regimes were corroborated by Burstein, Eichenbaum and Rebelo (2005), Parsley and Popper (2001), and Goldfajn and Valdes (1999), the latter focusing only on overvaluation episodes.

The faster adjustment under flexible regimes also hinges crucially on policy credibility. Absent credibility, flexibility may become an additional source of monetary instability which impedes the real exchange rate adjustment (see, *e.g.*, Lothian and McCarthy, 2002). Instead, a fixed regime would eliminate this domestic source of instability but at the expense of monetary policy autonomy when capital is highly mobile. Moreover, as the failure of several exchange rate based stabilization programs illustrates, credibility is also critical to the success of fixed regimes (see, *e.g.*, Calvo, 1986; Calvo and Vegh, 1993; Guidotti and Vegh, 1999).

The exchange rate crisis literature has proved that those crises force the reinstatement of an exchange rate parity which is consistent with the economy's

3 The sample of countries includes Belgium, Finland, France, Italy, Portugal and Switzerland.

4 In hard pegs such as currency boards institutional reforms may be required before devaluing the currency or changing the regime altogether.

fundamentals. In particular, balance sheet effects[5] lead to “fear of floating” meaning that flexible regime countries are reluctant to let their nominal exchange rate fluctuate freely (Calvo and Reinhart, 2000 and, Céspedes, Chang and Velasco, 2004). Misalignment may thus appear and persist (Dornbusch, 2001; Frankel, 2005).

According to Aizenman and Glick (2005), a fixed system may lock a country in a “trap” which ultimately entails a costly exit. Indeed, when confronted with adverse shocks, the authorities should either stabilize the nominal exchange rate or stabilize the interest rate (Calvo and Mishkin, 2003; Obstfeld, 1996). When a speculative attack finally forces the transition to a more flexible regime, the nominal exchange rate sharply depreciates, thereby generating real undervaluation. The larger the foreign currency-denominated debt the more over-depreciated will the real exchange rate be (Cavallo *et al.*, 2007).

Lastly, the monetary approach to the equilibrium exchange rate stresses the importance of the relative growth of money supply in explaining short term exchange rate disequilibrium. For instance, the overshooting model predicts that misalignment will appear more often in flexible systems than in fixed ones.

All in all, the theoretical misalignment-effects of the exchange rate system are not clear-cut. Furthermore, the empirical research is still somewhat limited and has yet to produce conclusive evidence. This debate besides, it is now widely accepted that the exchange regime many countries announce may differ substantially from the one they actually implement (see Calvo and Reinhart, 2002). As a consequence, recent effort has concentrated on categorizing exchange rate regimes according to what countries do rather than what they declare, resulting in the so called *de facto* classification. This article takes advantage of the *de facto* classification developed by Reinhart and Rogoff (2003) to supplement the self-declared exchange systems, thus allowing us to contrast the misalignment-effects of actual and declared regimes.

More precisely, the paper endeavours to add broader empirical evidence on the misalignment-exchange rate regimes linkages by investigating the following questions. First, does misalignment vary across alternative *de jure* and *de facto* exchange rate systems? Second, can these misalignment-effects be explained by different probabilities of undervaluation and overvaluation episodes? Lastly, do countries that deliver the promised regime perform differently than those which do not?

To answer these questions, non stationary panels econometric techniques are used, in a first step, to estimate the relationship between the real exchange rate and its real and monetary determinants. The estimated relationship is then used to compute the equilibrium real exchange rate and derive misalignment indexes. In a second step, the misalignment-effects of alternative exchange rate systems are assessed.

5 Balance sheets effects mean that nominal exchange rate fluctuations affect firms' net worth and financing cost because of maturity and exchange rate mismatches in their assets and liabilities, especially in emerging markets.

The rest of the paper proceeds as follows. The next section defines and measures the equilibrium real exchange rate and misalignment. The third one turns to the econometric analysis. Concluding remarks are offered in the last section.

2. Equilibrium real exchange rate and misalignment: definition and measurement

2.1. Definition and concepts of equilibrium real exchange rate

This paper adopts Edwards' (1989a) definition of the equilibrium real exchange rate as "*the relative price of tradables to nontradables that, for given sustainable (equilibrium) values of other relevant variables such as taxes, international prices and technology, results in the simultaneous attainment of internal and external equilibrium*".

The equilibrium real exchange rate depends solely on real variables, called fundamentals, which vary over time meaning that the equilibrium real exchange rate itself varies over time. The actual real exchange rate, by contrast, depends on both the fundamentals and monetary variables. The real exchange rate thus deviates from its equilibrium due to the monetary variables and transitory changes in the fundamentals.

The equilibrium real exchange rate is not observable. To estimate it several approaches have been suggested in the literature[6]. Though simple, the purchasing power parity (PPP) approach – which predicts that the long term real exchange rate equals one (absolute PPP) or is mean-reversing (relative PPP) – lacks statistical fit and ignore the role of fundamentals.

Another group of approaches builds on the internal-external equilibrium. The behavioural equilibrium real exchange rate (BEER) defines the equilibrium real exchange rate as the level of the real exchange rate which is determined by fundamentals such as the terms of trade, net external financial flows, *etc.* Equilibrium is not imposed subjectively but is instead derived from econometric estimation. A shortcoming is that the BEER is not always used in a general equilibrium framework (Soto and Elbadawi, 2008). In the fundamental equilibrium real exchange rate (FEER) approach, the desirable and sustainable capital account balance is posited and the associated real exchange rate is taken as the equilibrium rate. In addition to being a subjective measure, the FEER is sensitive to hysteresis effects (Driver and Westaway, 2004) and it allows no role for either the fundamentals or the adjustment dynamics (Soto and Elbadawi, 2008). The third approach, the natural real exchange rate (NATREX) introduces the rate of time preference and productivity as fundamentals. In the long run, the current account is balanced, net foreign assets and the capital stock remain constant and the expected real exchange rate change is nil.

Finally, purely statistical approaches such as the Hodrick-Prescott filter allow a time varying long run real exchange rate but they are not theory-based and may produce misleading results.

6 Excellent reviews of these approaches were conducted by Driver and Westaway (2004), Isard (2007) and Hinkle and Montiel (1999).

Next, the paper turns to the estimation of the equilibrium real exchange rate.

2.2. Estimation of the equilibrium real exchange rate

The relationship between the real exchange rate and its real and monetary determinants is estimated in a first step. The equilibrium real exchange rate is then computed using the estimated coefficients associated with the fundamentals[7].

2.2.1. The econometric model

Empirical studies of the equilibrium real exchange rate rely more and more on panel cointegration techniques which – under some conditions – help deal with the short times series depth of typical macroeconomic series and improve the estimation accuracy and robustness. Examples include Dufrenot and Yehoue (2005), Goldfajn and Valdes (1999), Calderon (2002), Ricci, Milesi-Ferretti and Lee (2008).

While consensus still remains elusive, a number of variables are widely used as fundamentals in the empirical literature. They include the terms of trade (*logTOT*), productivity growth (*PROD*), net external financial flows (*FF*), government consumption (*logGC*) and openness to trade (*logTrade*). We also include monetary variables measuring monetary policy (*MP*) and devaluation (*Deval*) in the regressions because their exclusion may result in spurious results if they affect the real exchange rate and some of its fundamentals in the short run. The econometric equation is given by :

$$logRER_{it} = \alpha_i + \gamma_t + \beta_{1i} logTOT_{it} + \beta_{2i} \mathrm{PROD}_{it} + \beta_{3i} FF_{it} + \beta_{4i} logGC_{it} + \beta_{5i} logTrade + \theta_{1i} MP_{it} + \theta_{2i} Deval_{it} + \varepsilon_{it} \quad (1)$$

α_i and γ_t are country and time specific effects respectively. ε is a random disturbance term. β_1, β_2, β_3, β_4, β_5, θ_1 and θ_2 are parameters to be estimated whose expected signs are discussed below along with the measurement of the variables.

- **The dependent variable**

A consumer price index based effective real exchange rate[8] is used for four reasons. First, the notion of equilibrium real exchange rate rests partly on external equilibrium which is necessary evaluated vis-a-vis the rest of the world. Second, the effective real exchange rate indicates a country's competitiveness relative to its major trade partners and competitors. Third, a bilateral real exchange rate does not always correctly describe the evolution of the real exchange rate calculated vis-a-vis trade partners (Chinn, 2005). Lastly, labour unit costs face the availability hurdle, especially in developing countries (Hinkle and Montiel, 1999).

7 A similar approach was used by Edwards (1988), Baffes, Elbadawi and O'Connell (1997), Calderon (2002), and Dufrenot and Yehoue (2005).
8 This measure is widely used in the literature (see Edwards and Savastano, 1999).

The effective real exchange rate is calculated as:

$$RER = \prod_{i=1}^{10} \left(\frac{E_p}{E_d} * \frac{CPI_d}{CPI_p}\right)^{\omega_i}, \quad with \sum_{i=1}^{10} \omega_i = 1$$

E_p and E_d stand for the partner and domestic countries bilateral nominal exchange rate respectively, expressed as local currency units per US dollar. CPI_d and CPI_p are the consumer price index (or the producer price index when the former is missing) in the domestic and foreign countries respectively. ω_i measures the domestic country imports share[9] of trading partner country *i* over the period 1980-1986. An increase in *RER* represents a real appreciation of the domestic currency.

The above measure has some limitations. First, it uses fixed weights so that changes in the set of major trading partners are not captured. Second, the weighting scheme excludes exports whose evolution may differ from imports. Third, competition on third countries' markets is not taken into account.

- **Explanatory variables**

The impact of a permanent terms of trade change on the equilibrium real exchange rate is ambiguous because of a negative income effect and a positive substitution effect. However, empirical studies suggest that the income effect dominates the substitution effect so that a durable terms of trade improvement is expected to appreciate the equilibrium real exchange (see, Calderon, 2002). Terms of trade are measured by export as capacity to import, in constant local currency.

The productivity growth variable captures the Balassa-Samuelson effect, thus its expected coefficient is positive as in Dufrenot and Yehoue (2005). The tradable-nontradable productivity growth differential does not perform statistically well (see Ricci, Milesi-Ferretti and Lee, 2008). Therefore, we use the rate of growth of output per unit of labour[10] though this measure does not take into account the quality of labour.

When a country experiences a permanent rise in net financial inflows, demand for the domestic currency increases, thus tending to appreciate the equilibrium real exchange rate (Razin and Collins, 1997). In this paper, external financial flows are measured by the ratio of private capital flows to GDP in middle and high income countries. These countries are relatively better integrated to world capital markets, hence private capital flows play an important role. In low income countries where private financial flows are not likely play a major role, external financial flows are measured by the sum of net income from abroad and aid, as a percentage of GDP.

9 Only the ten largest (non oil exporting) trading partners are considered.

10 Productivity is measured by output *per capita* in Antigua and Barbuda, Dominica, Saint Kitts and Nevis, Saint Vincent and Grenadines, Seychelles and Vanuatu where labour data is missing.

The equilibrium real exchange rate response to a change in government consumption is ambiguous. An increase will induce a real appreciation if it falls mainly on nontraded goods and if the government's propensity to consume nontraded goods is larger than that of the private sector (Galstyan and Lane, 2008). If the additional government consumption falls mainly on tradable goods or on imports, the equilibrium real exchange rate will depreciate. The empirical literature reveals that when statistically significant, a rise in government consumption leads to an equilibrium real exchange rate appreciation (see, Goldfajn and Valdes, 1999, and Ricci, Milesi-Ferretti and Lee, 2008). We thus expect this impact even though the opposite may occur.

An increase in trade openness stemming from trade liberalization will likely depreciate the equilibrium real exchange rate. Indeed, a tariffs cut shifts demand from nontradable towards importable goods and production from importable towards nontradable and exportable goods, thereby depreciating the equilibrium real exchange rate (Dufrenot and Yehoue, 2005). Trade openness is measured by the sum of exports and import as a ratio of GDP.

The nominal variables entering the regressions represent monetary policy (*MP*) and devaluation (*Deval*). As regards the former, an excess growth of money supply relative to money demand raises demand for nontradable goods, appreciates the real exchange rate and exerts an overvaluation pressure. Monetary policy is measured by the excess growth of money stock (M2) over the previous year's GDP growth rate. The domestic credit growth rate (*gCredit*) will be used as a sensitivity check. Misalignment tends to dissipate over time but the self-correction process may be protracted. A devaluation may speed the process, especially when it is supplemented with sound macroeconomic policies (Edwards, 1998). We measure devaluation by changes in the effective nominal exchange rate[11] used to compute the real exchange rate.

Appendix 3 contains the data sources. The study period is 1970-2003. The sample is divided into three subsamples of low, middle and high income countries according to the World Bank classification in 2003 (see appendix 2). Real exchange rate, terms of trade, private financial flows, government consumption and trade openness data are in logarithm. All ratios and growth rates are in percentage.

2.2.2. Estimation strategy

Nonstationary dynamic panel estimators[12] of long run relationships are more efficient than time series estimators, especially in datasets with limited time series dimension. They include semi-parametric methods such as the fully modified ordinary least squares (FMOLS) of Pedroni (2000) and parametric methods such as the dynamic

11 The effective nominal exchange rate appears suitable to our analysis because it describes the evolution of the domestic currency relative to the currencies of the country's largest trade partners. Moreover, even if the official bilateral nominal exchange rate remains unchanged, an appreciation of the domestic currency against currencies of competitor countries may signal a competitiveness loss.

12 Nonstationary dynamic panel techniques have been gaining increased popularity in empirical studies of the real exchange rate (see, *e.g.*, Pedroni, 2001; Soto and Elbadawi, 2008 and references therein).

ordinary least squares (DOLS) of Kao and Chiang (2000) and Mark and Sul (2003).

This paper uses a panel FMOLS approach which permits heterogeneous cointegrating vectors and short run dynamics. Indeed, Dufrenot and Yehoue (2005) and Calderon (2002) found support for heterogeneous cointegrating vectors between the real exchange rate and its determinants. FMOLS also corrects for endogeneity and some basic form of cross sectional dependency and produces asymptotically unbiased estimators and nuisance parameter free standard normal distributions (Pedroni 2000). However, its small sample coefficients and t-statistics are biased when the cross-sectional dimension is larger than the time series dimension of the panel. For a given cross-sectional dimension, the bias falls as the time series dimension grows large. To reduce the small sample bias we divide our sample of countries into three subsamples of high, middle and low income countries[13].

The panel FMOLS estimator comes with a between and a within variants called group mean panel FMOLS and pooled panel FMOLS respectively. In practice, Pedroni (2000) recommends using the group mean panel FMOLS estimator for three reasons. First, it allows a consistent test of the null of homogeneous cointegrating vector against the alternative of heterogeneous cointegrating vectors. Second, when the true cointegrating vector is heterogeneous, it produces consistent point estimates. Third, it has relatively better small sample properties than the pooled estimator. Indeed, Pedroni's simulations reveal that the group mean FMOLS has very small biases which fall as the time series dimension rises. For similar cross-sectional and time series dimensions, the size distortions of the tests remain quite small. On the other hand, the pooled FMOLS tests are relatively powerful. Their power reach 100 percent for thirty individuals and twenty years at least. Given that our samples of middle and low income countries fall in this setting, the tests power is expected to be relatively satisfactory. In the sample of high income countries, the number of countries is smaller than that of years per country, hence ensuing good properties to the estimator.

Before running the FMOLS regressions, we conduct panel unit root tests and subsequently carry out cointegration tests in our samples.

- **Unit root tests**

We test for unit roots using the tests of Hadri (2000) and Maddala and Wu (1999). Hadri's test has a null of stationarity whereas Maddala and Wu's test postulates nonstationarity as the null. The results of Hadri's (2000) test, displayed in table 1, reject the stationarity hypothesis for all variables in all samples, whether individual linear trends or individual specific effects and linear trends[14] are added. Moreover, in high income countries, terms of trade and government consumption variables are I(2).

13 Razin and Collins (1997) and Dufrenot and Yehoue (2005) follow a similar approach.
14 The results which are not reported here are available from the author upon request.

Maddala and Wu's test results, reported in table 2, do not always agree with those of Hadri's test. In low income countries, the null of nonstationarity is rejected for external financial flows, productivity growth monetary policy and devaluation. In middle and high income countries the null is rejected for productivity growth, monetary policy and devaluation. In the remaining analysis we will adopt Hadri's test results.

- **Cointegration tests**

Panel cointegration tests are more powerful than those for time series data (McCoskey and Kao, 1999) and have normal asymptotic distributions. Pedroni's (1999) panel cointegration test, used in this paper, posits the absence of cointegration as null. It allows for heterogeneous short run dynamics and cointegrating vectors. The test provides four “between” statistics and three “within” statistics. The tests, especially the between variant, are less restrictive than Kao's (1999) tests which have an alternative hypothesis of homogeneous cointegrating vector. They are, like McCosky and Kao's (1999) cointegration test, free of nuisance parameters and robust to endogeneity.

Table 3 displays the test results. Monetary policy is measured by excess growth of money supply in model 1 and by domestic credit growth rate in model 2. The null of no cointegration is rejected in all samples at the 1% significance level, except for the panel-v statistics in high income countries which is only significant at the 5% level. The conclusion appears robust since it is accepted by the group-ρ statistics which is the most conservative statistics in small samples (Pedroni, 2004).

- **FMOLS results**

In each sample, two regressions of equation 1 corresponding to model 1 and model 2 are run. For low income countries[15] (N = 35, T variable), the results are:

logRER = 0.08 *logTOT - 0.05 *logGC - 043 *logTrade + 0.30 *PROD + 0.01*FF + 0.00 *Monet + 0.36 *Deval (2)
(6.31) (-5.95) (-11.86) (3.41) (4.17) (9.73) (9.70)

logRER = 0.09 *logTOT - 0.00 *logGC - 0.44 *logTrade + 0.34 *PROD + 0.01 *FF - 0.00 *gCredit + 0.35 *Deval (3)
(7.03) (-3.83) (-12.05) (3.65) (3.24) (6.22) (9.45)

Ceteris paribus, the actual and equilibrium real exchange rates appreciate by 0.8% following a permanent 10% improvement of terms of trade. A rise of 10 units in external financial flows or productivity growth leads to a 0.1% and 3% appreciation respectively. On the other hand, a 10 percent increase in trade openness or in government consumption depreciates the actual and equilibrium real exchange rates by 4.3% and 0.5% respectively. As regards the nominal variables, monetary policy has virtually no impact whereas devaluation contributes to a real depreciation. Starting with a real

15 Sudan, Central African Republic and Guinea were excluded from the estimation because the t-statistics of their coefficients are excessively high.

overvaluation, a 10% nominal devaluation leads to a correction of 3.6%.

For middle income countries (N = 45, T variable), the estimation gives:

$$\underset{\quad(9.93)\quad(-5.19)\quad(-25.59)\quad(-12.10)\quad(11.09)\quad(4.26)\quad(28.61)}{\text{logRER} = 0.21\,\text{logTOT} + 0.04\,\text{logGC} - 0.72\,\text{logTrade} + 0.13\,\text{PROD} + 0.07\,\text{logFF} - 0.00\,\text{Monet} + 0.64\,\text{Deval}} \quad (4)$$

$$\underset{\quad(6.71)\quad(1.73)\quad(-22.13)\quad(-14.41)\quad(6.68)\quad(-0.52)\quad(23.17)}{\text{logRER} = 0.09\,\text{logTOT} + 0.07\,\text{logGC} - 0.49\,\text{logTrade} - 2.33\,\text{PROD} + 0.02\,\text{logFF} + 0.00\,\text{gCredit} + 0.55\,\text{Deval}} \quad (5)$$

Both relations indicate that the actual and equilibrium real exchange rates appreciate when the terms of trade improve, government consumption rises, private capital inflows increase or productivity growth accelerates. However, when monetary policy is measured by domestic credit growth, the coefficient of productivity becomes negative[16]. On the other hand, the coefficient of government consumption rises substantially but is only significant at 10%. An increased openness to trade depreciates both actual and equilibrium real exchange rates. Monetary policy does not directly affect the real exchange rate whereas devaluation depreciates it.

The estimated relationships in the sample of high income countries (N = 24, T variable) can be written as:

$$\underset{\quad(-0.16)\quad(10.78)\quad(-20.11)\quad(5.07)\quad(2.63)\quad(1.24)\quad(12.82)}{\text{logRER} = -0.04\,\Delta\text{logTOT} + 0.80\,\Delta\text{logGC} - 0.46\,\text{logTrade} + 0.24\,\text{PROD} + 0.03\,\text{logFF} + 0.00\,\text{Monet} + 0.81\,\text{Deval}} \quad (6)$$

$$\underset{\quad(0.71)\quad(10.94)\quad(-21.77)\quad(5.97)\quad(4.25)\quad(0.62)\quad(13.87)}{\text{logRER} = -0.02\,\Delta\text{logTOT} + 0.78\,\Delta\text{logGC} - 0.55\,\text{logTrade} + 0.30\,\text{PROD} + 0.06\,\text{logFF} + 0.00\,\text{gCredit} + 0.89\,\text{Deval}} \quad (7)$$

According to equation 6, when government consumption, productivity growth, or private financial inflows increase permanently by 10%, the equilibrium real exchange rate appreciates by 8%, 2.4% and 0.3% respectively. It depreciates but not significantly so following a terms of trade improvement. When trade openness rises durably by 10%, a significant appreciation of about 4.6% of the equilibrium real exchange rate occurs. As in the two previous groups of countries, the impact of monetary policy is nil and devaluation leads to an even larger real depreciation.

Next, we compute the equilibrium real exchange rate and derive misalignment.

2.3. Misalignment indicators

Since the fundamentals may display transitory fluctuations, the equilibrium real exchange rate (*ERER*) is computed using their long term values (with the superscript HP) obtained from a Hodrick-Prescott filter. Based on model 1, we have the following relationships for low, middle and high income countries respectively:

16 This result may suggest that directly productive and productivity-enhancing activities are substitute in middle income countries.

$$\mathbf{ERER_{it} = 0.08 * logTOT^{HP} - 0.05 * logGC^{HP} - 0.43 * logTrade^{HP} + 0.30 * PROD^{HP} + 0.01 * FF^{HP}} \quad \mathbf{(10)}$$

$$\mathbf{ERER_{it} = 0.21 * logTOT^{HP} + 0.04 * logGC^{HP} - 0.72 * logTrade^{HP} + 0.13 * PROD^{HP} + 0.07 * logFF^{HP}} \quad \mathbf{(11)}$$

$$\mathbf{ERER_{it} = 0.80 * \Delta logGC^{HP} - 0.46 * logTrade^{HP} + 0.24 * PROD^{HP} + 0.03 * logFF^{HP}} \quad \mathbf{(12)}$$

Misalignment (MIS_{it}) is calculated as the difference between the actual (RER_{it}) and the equilibrium ($ERER_{it}$) real exchange rates:

$$MIS_{it} = logRER_{it} - ERER_{it} \qquad (13)$$

In order to eliminate individual and time specific effects, we subtract from MIS_{it} its individual specific mean ($\bar{MIS}_{i.}$) and its annual mean ($\bar{MIS}_{.t}$), and add the overall sample mean ($\bar{\bar{MIS}}$) to get the final misalignment (MIS_{it}^*):

$$MIS_{it}^* = MIS_{it} - \bar{MIS}_{i.} - \bar{MIS}_{.t} + \bar{\bar{MIS}} \qquad (14)$$

$$\text{with} \quad \bar{MIS}_{i.} = \sum_{t=1}^{T_i} MIS_{it}, \quad \bar{MIS}_{.t} = \sum_{i=1}^{N} MIS_{it} \quad \text{and} \quad \bar{\bar{MIS}} = \sum_{i=1}^{N} \sum_{t=1}^{T_i} MIS_{it}$$

A graphical analysis of the computed misalignment is conducted later in the paper.

3. Econometric analysis of the misalignment-effects of the exchange rate system

We offer a summary of previous empirical studies before laying out our methodology and discussing the estimation results.

3.1. Previous empirical evidence

Empirical studies of the exchange regime-misalignment linkages are still limited. Coudert and Coharde (2008) carried out mean comparisons tests across *de facto* regimes[17] in a sample of emerging markets and developing countries from 1974 to 2004. They found a larger overvaluation in fixed systems and a larger undervaluation in flexible regimes. The impact of fixed regimes persists when inflation is moderate. Undervaluation is statistically smaller in intermediate than in flexible regimes only with Reinhart and Rogoff's classification and in high inflation countries. Studying Middle East and North African manufacturing sector competitiveness over 1974-1999, Nabli, Keller and Veganzones (2004) uncovered that overvaluation cases totalled 88% of all fixed regime observations and 76% in more flexible regimes. Moreover, overvaluation larger than 25% was recorded in half of all fixed systems observations and in less than 30% in flexible regimes.

The exchange rate crisis literature sometimes links fixed regimes to persistent and growing overvaluation. In this vein, Kempa and Nelles (1999) model the probability of the 1992-1993 speculative attacks in the European Exchange Rate Mechanism

17 The authors used the databases of Levy Yeyati and Sturzenegger (2005) and Reinhart and Rogoff (2004).

(ERM) as an increasing function of each member currency's overvaluation which, in turn, stems from cumulative positive inflation differentials with Germany and the fixed bands for bilateral nominal exchange rate fluctuations. The authors show that speculative attacks started in countries with the most overvalued real exchange rates (Spain, Portugal, Italy and the United Kingdom) before spreading to other countries.

Alberola, Lopez and Serven (2004) compute the Argentine peso misalignment over 1991-2001 and find an initial decreasing undervaluation until 1997 followed by a rising overvaluation which culminated at more than 50% in 2001. They then evaluate the impact of the currency board and conclude that the divergent evolution of net foreign assets and productivity growth relative to the United States substantially fed the peso's overvaluation, except in 1993. After 1995, the inadequacy of the dollar as anchor currency significantly contributed to the overvaluation of the peso, particularly from 1997 when the dollar overvaluation fed the peso's. In a similar spirit, Sazanami and Yoshimura (1999) identified the overvaluation of the yen relative to the US dollar from 1995 on as the principal factor of a sharply rising misalignment of the currencies of Malaysia, the Philippines and Thailand vis-a-vis the yen. In Indonesia and Korea the real exchange rate was undervalued relative to the yen but that undervaluation fell steadily and sharply over the period preceding the 1997-1998 crisis though both currencies remained well-aligned against the dollar.

The aforementioned studies tend to corroborate a negative impact of fixed systems on misalignment. Nevertheless they have some limits. Indeed, computed misalignment indices generally fall in value when the number of fundamentals rises (see Coudert and Coharde, 2008). Moreover, Goldfajn and Valdes (1999) find that the probability of overvaluation always exceeds 65% in fixed systems. In contrast, it never exceeds 30% in flexible regimes and is always smaller than 7% in floats. Notwithstanding these differences, they attribute a non negligible share of the appreciation to permanent changes in fundamentals thus meaning that appreciation does not necessarily imply overvaluation. Coudert and Coharde (2002) reach a similar conclusion in a sample of five Central and Eastern European countries[18].

Goldfajn and Valdes' (1999) results suggest that fundamentals alone do not fully explain the larger real appreciation in fixed regimes (also see Baldi and Mulder, 2004). But, even if there is a relationship between the exchange system and misalignment, its extent would be much smaller than what Coudert and Coharde (2008) found. To deal with this problem, we use a large set of determinants frequently used in the literature. Another potential weakness of Coudert and Coharde's study is that they carry out their estimations in a single sample of more than one hundred countries of different development levels. This may be problematic given the weak performances of the FMOLS estimator in small samples with a cross-sectional dimension larger than the

18 Abdih and Tsangarides (2006) find similar evidence in the CFA Franc zone countries for the year 2005.

time series dimension. In addition, Dufrenot and Yehoue (2005) find that common factors among real exchange rate determinants differ between middle and low income countries. Lastly, Goldfajn and Valdes's sample includes the Bretton Woods period and they do not explain overvaluation episodes and their duration and correction.
Another value added of our study is the estimation of the effects of deviations of *de facto* regimes from *de jure* systems.

3.2. Econometric approach

This subsection presents the empirical models, outlines the estimation methodology and discusses the results.

3.2.1. Empirical models

3.2.1.1. Exchange rate systems and misalignment

To assess whether misalignment depends on the exchange rate system, the following equation is estimated:

$$MIS^{*}_{it} = \beta_0 + \alpha_1 FIX_{it} + \alpha_2 INTERM_{it} + \beta_1 \pi_{it} + \beta_2 \tilde{\Delta} logTOT_{it} + \beta_3 \tilde{\Delta} logTrade_{it} + \beta_4 \tilde{\Delta} logGC_{it} + \varepsilon_{it} \quad (15)$$

The variable MIS^{*}_{it} is defined in section 2.3. α_1 and α_2 measure the misalignment-impact of fixed and intermediate regimes respectively. Ɛ is a zero-mean disturbance. FIX_{it} ($INTERM_{it}$) is a dummy variable which takes the value one if the regime of country i during year t is fixed (intermediate) and zero otherwise[19].

Fixed regimes are expected to be associated with a larger misalignment, especially in low and middle income countries where adjustment mechanisms are limited or strongly constrained. The misalignment-impact of intermediate regimes is not clear-cut because these regimes offer both a nominal exchange rate anchor and some nominal exchange rate flexibility. The effect would likely depend on the level of development. Indeed, rich countries have strong institutions and deep financial markets which enhance their adjustment ability and make floating regimes more appealing than intermediate ones. Middle income countries are relatively more integrated to the world economy and finance than low income countries but less than high income countries. Their institutions are also not as developed as in high income countries (Rogoff *et al.*, 2004, and Calvo, 2000). These factors make intermediate regimes relatively attractive (Frankel, 1999 and 2003; Reinhart and Rogoff, 2003) in reducing misalignment. At the same time, fixed regimes may sometimes impose high costs in middle income countries by making them vulnerable to speculative attacks or by substantially restricting the economy's adjustment (Obstfeld and Rogoff, 1995). We therefore, assume that in middle income countries misalignment is smaller (larger) in intermediate (fixed) systems

19 Flexible exchange regimes are the excluded category.

than in flexible regimes.

The explanatory variables in equation 15 also include temporary terms of trade shocks ($\tilde{\Delta} logTOT_{it}$) and, deviations of trade openness ($\tilde{\Delta} logTrade_{it}$) and government consumption ($\tilde{\Delta} logGC_{it}$) from their long run levels. The expected effects of these three variables are similar to those of the terms of trade, trade openness and government consumption on the equilibrium real exchange rate. We also introduce the inflation rate – measured as deviation from the relevant sample yearly mean inflation – in accordance with previous evidence that the exchange system may affect misalignment (and its correction) differently according to the inflation rate (Sarno, Valente and Wohar, 2003, and Coudert and Coharde, 2008). Domestic inflation pushes nontradable goods price upwards hence tending to appreciate the real exchange rate. Likewise, high inflation – stemming form unsustainable policies – increases devaluation pressures which, in turn, feed inflation. High inflation makes it hard to defend the fixed exchange rate because it results in real overvaluation (Edwards, 1989b). Frequent devaluations will ultimately move the fixed regime close to a flexible one thus making the real exchange rate behaviour similar in both regimes.

3.2.1.2. Distinction of overvaluation and undervaluation episodes

Equation 15 does not make it possible to know whether a given misalignment-impact of the exchange system results from different probabilities of over and undervaluation episodes across alternative regimes. To pursue this avenue, we estimate the probability of overvaluation by replacing the misalignment variable (*MIS**) with an overvaluation variable (*OVER*[20]) in equation 15:

$$\begin{aligned} \mathrm{OVER}_{it} &= \beta_0 + \alpha_1 Fix_{it} + \alpha_2 INTERM_{it} + \beta_1 \pi_{it} + \beta_2 \tilde{\Delta} logTOT_{it} + \beta_3 \tilde{\Delta} logTrade_{it} + \\ &\quad \beta_4 \tilde{\Delta} logGC_{it} + \varepsilon_{it} \end{aligned} \qquad (16)$$

$$\text{with } \mathrm{OVER} = \begin{cases} 1 \ \ if \ \ MIS^*_{it} > 0 \\ 0 \ \ if \ \ MIS^*_{it} \leq 0 \end{cases}$$

According to our previous arguments, a higher probability of overvaluation is expected in fixed systems in all countries and in intermediate regimes in low and high income countries. In middle income countries, by contrast, the real exchange rate would tend to be relatively less overvalued in intermediate systems than in fixed and flexible ones. The overvaluation probability rises with inflation and a transitory increase in terms of trade or government consumption; It falls with a transitory rise in trade openness.

20 Episodes of over and undervaluation are symmetric by definition.

3.2.1.3. Deviations between actual and announced exchange rate regimes

Does reneging on the announced regime affect misalignment? To answer this question we re-estimate equation 15 replacing the exchange rate regime variables with new dummy variables that capture deviations of *de facto* regimes from *de jure* ones:

$$MIS^{*}_{it} = \beta_0 + \alpha_1 FF_{it} + \alpha_2 FN_{it} + \alpha_3 NF_{it} + \beta_1 \pi_{it} + \beta_2 \tilde{\Delta} logTOT_{it} + \beta_3 \tilde{\Delta} logTrade_{it} + \beta_4 \tilde{\Delta} logGC_{it} + \varepsilon_{it} \quad (17)$$

FF takes the value 1 if the regime of country i is classified as fixed by both the IMF and Reinhart and Rogoff (hereafter RR) during year t, and 0 otherwise. *FN* equals 1 if, during year t, country i declares a fixed regime but follows a *de facto* regime that is not fixed, and 0 otherwise. *NF* equals 1 if country i announces a regime that is not fixed but actually runs a fixed one during year t, and 0 otherwise. *NN* takes the value 1 if country i declares and runs a regime that is not fixed during year t, and 0 otherwise. *NN* is the excluded category so that the coefficients of *FF*, *FN* and *NF* measure their respective differential impact relative to *NN*.

We also assess whether deviations of *de facto* regimes from *de jure* regimes induce differences in the likelihood of over and undervaluation episodes by estimating equation 16 using the three new regime variables:

$$OVER_{it} = \beta_0 + \alpha_1 FF_{it} + \alpha_2 FN_{it} + \alpha_3 NF_{it} + \beta_1 \pi_{it} + \beta_2 \tilde{\Delta} logTOT_{it} + \beta_3 \tilde{\Delta} logTrade_{it} + \beta_4 \tilde{\Delta} logGC_{it} + \varepsilon_{it} \quad (18)$$

3.2.2. The estimation method, data and sources

All regressions are run by ordinary least squares. Equations with dependent binary variables are estimated by *logit*. Official regimes are taken from the IMF's "Annual Report on Exchange Arrangements and Exchange Restrictions". *De facto* regimes are drawn from Reinhart and Rogoff[21] (2003). The sample covers the 1973-1999 period. Appendix 2 contains more information about the variables and data.

3.2.3. Results and interpretation

Before proceeding further we graphically describe yearly average misalignment in fixed, intermediate and flexible exchange rate systems in each sample.

3.2.3.1. Descriptive analysis

Figure 1 displays yearly average misalignment across *de jure* regimes in low income countries. From the end of the 1970s to the mid 1980s, misalignment was the largest in intermediate regimes and the smallest in fixed ones. Over the period,

21 Observations labelled "dual missing" are excluded.

misalignment remained quite stable in fixed regimes whereas it dropped in flexible regimes and fell sharply in intermediate ones. After 1985, it became the largest in fixed systems and kept rising until the early 1990s. Countries with intermediate and flexible regimes experienced a fall in misalignment until 1987, year from which the trend reversed. Misalignments in those two regimes remained quite close and were always smaller than in fixed regimes. Afterwards, misalignment markedly rose in intermediate regimes and became the largest of all regimes.

Using RR's regimes, we obtain figure 2 which shows a succession of rising and falling misalignment periods. Misalignment in intermediate and flexible regimes moved together, albeit with some lags. The evolution of misalignment in *de facto* fixed regimes was the opposite of that of the other two regimes. Comparing all regimes, misalignment was the smallest in *de facto* fixed systems until the mid 1980s. Afterwards, it rose substantially and remained the highest until 1993. From then on, it fell considerably and became the smallest from 1994 to 1998.

We have compared the CFA countries to other fixed regimes in figure 3 which reveals an upward trend, broken off in 1994 in the former by the 50 percent devaluation of the CFA franc against the French franc. From then on, the trend resumed even though misalignment remained smaller than in other *de jure* and *de facto* fixed regimes. Misalignment in non CFA *de facto* fixed regimes displays large fluctuations over time.

Misalignments in fixed, intermediate and flexible regimes in middle income countries are displayed in figures 4 and 5. Misalignment remained relatively small over time, with a persistent undervaluation in *de jure* intermediate and floating regimes (figure 4). Misalignment was, most of the time, the smallest in intermediate systems and the largest in fixed ones. In the later, a slight overvaluation was generally observed.

The comparison of misalignment across *de facto* regimes, shown by figure 5, confirms the smaller levels of misalignment in middle income countries. The main difference with figure 4 is that misalignment was the smallest in flexible systems whose real exchange rate was overvalued most of the time. Moreover the real exchange rate was sometimes slightly overvalued sometimes weakly undervalued in intermediate regimes.

Average misalignment in high income countries is described in figures 6 and 7. Figure 6 reveals that misalignment tended to rise until the early 1980s. This movement continued in intermediate regimes until 1995. Misalignment subsequently fell until 1996 in fixed regimes and until 1998 in intermediate and flexible ones. Before 1985, the real exchange rate was the most undervalued in intermediate regimes and the most overvalued in fixed regimes. After 1989, intermediate regimes experienced the largest overvaluation and fixed regimes generally recorded the smallest undervaluation.

Using *de facto* regimes, differences in the evolution of misalignment appear much smaller (figure 7). Flexible regimes display the best performances whereas fixed regimes often have the largest overvaluation.

Firms conclusions cannot be drawn from the graphical analysis. So a formal econometric investigation is undertaken.

3.2.3.2. Exchange rate arrangements and misalignment

Table 4 (columns 1-4) shows the estimation results in low income countries. The first column indicates that misalignment is significantly larger in fixed and intermediate *de jure* regimes than in flexible ones. In economics terms, the misalignment-impact of the exchange regime is important. In fact, having a fixed regime raises average misalignment by about 5% per year and the adoption of an intermediate regime leads to misalignment that is 16% larger relative to floating systems. As a matter of fact, low income countries with intermediate regimes experience much larger misalignment than those with fixed regimes, but not statistically so according to the Wald test. It is also noticeable that both fixed regimes and floats perform better than intermediate regimes, and between the formers floats dominate fixes at the economic and statistical levels.

To assess whether the performances of fixed regimes in low income countries are dominated by the CFA countries, we separate out the latter (*CFA*) from other fixed regimes (*de jure NonCFA*). Column 2 of table 4 suggests that the relatively larger and significant misalignment in fixed regimes stems mostly from CFA countries whose misalignment is 6% larger on average. Nevertheless, the Wald test fails to reject the equality of the coefficients of CFA and other fixed countries even though the simultaneous equality of both coefficients to zero is rejected at the 4% probability level. On the other hand, only the effect of the CFA regime is significant at usual statistical levels. The results thus suggest a larger misalignment in fixed regimes which is mostly attributable to the CFA regime.

Apart from government consumption shocks, the remaining control variables appear in columns 1 and 2 with statistically significant coefficients. Misalignment rises in response to transitory positive inflation and terms of trade shocks. The opposite occurs when trade openness temporarily rises. Government consumption has no significant impact. Comparing columns 1 and 2, all estimated coefficients display satisfactory stability.

Columns 3 and 4 show the estimations of columns 1 and 2 respectively, using RR's regimes. A larger misalignment still shows up in fixed and intermediate systems, the former displaying better performances as with *de jure* regimes. The impact of the CFA regime remains unchanged at about 6%. Nevertheless, some differences appear between the two classifications of regimes. Indeed, the impact of fixed and intermediate regimes falls, dropping sharply (at least 50%) for the latter. When no distinction is made between CFA and other fixed countries, the effect of fixed regimes is no longer significant. Once this distinction is made, fixed regimes outside the CFA zone still have no significant impact and the sign of the coefficient becomes negative. Another major

difference between the two sets of results is that fixed regimes have an effect that is statistically different from intermediate regimes. In addition, fixed regimes outside the CFA zone still have an impact whose magnitude is statistically different from that of the CFA regime. An explanation of the larger misalignment in CFA countries relative to other fixed countries may be that the CFA Franc parity was modified only once – in 1994 – since the 1950s. The real exchange rate hence adjusted through changes in inflation and incidentally in the French franc parity vis-a-vis other currencies[22].

Also, whereas the magnitude of the effects of the CFA and other *de jure* fixed and intermediate regimes were not statistically different, the simultaneous equality of the three coefficients is rejected at the 3.8% level with RR's *de facto* regimes as the last line of table 4 shows. Moreover, the equality to zero of all *de facto* or *de jure* regime coefficients is rejected. In general, the effects of the control variables increase and government consumption remains insignificant. Globally, the stability of the coefficients estimated with RR's regimes slightly deteriorates when CFA countries are singled out.

The results for middle income countries are contained in table 5 (columns 1-4). In column 2, Gabon, the sole CFA country, is excluded. According to columns 1 and 2, *de jure* fixed systems significantly raise misalignment (about 6%). Contrary to low income countries, *de jure* intermediate regimes significantly reduce misalignment (about 5%) in middle income countries. Globally, the exchange rate system exerts a differentiated and important impact because fixed and intermediate regimes have statistically significant and different effects. Regarding the other right-hand variables, only openness to trade has a significant coefficient.

When *de facto* regimes are used instead, the finding about fixed systems remains unchanged. Even though misalignment is about 2.4% higher in intermediate regimes, the estimated coefficients lack statistical significance. The coefficient of terms of trade is always negative now. Finally, as in columns 1 and 2, transitory shocks to inflation and government consumption have no significant impact.

Tests of joint significance of the exchange regime variables successfully pass at the 1% level. As before, the magnitude of the impact of fixed regimes is statistically different from that of intermediate ones. So, table 5 confirms that the exchange rate system has a non trivial misalignment-impact in middle income countries.

In high income countries, nominal exchange rate flexibility offers the best misalignment-reduction capacity irrespective of the classification scheme used in table 6 (columns 1-4). Columns 1 and 2 also show that misalignment is marginally smaller in *de jure* intermediate regimes (about 2.6%) than in *de jure* fixed ones (at least 3%). With RR's regimes (columns 3 and 4), the estimated effects rise but the difference between

22 These are the countries used to compute the effective real exchange rate.

the effects of fixed and intermediate systems is smaller than with *de jure* regimes. In addition, the tests clearly indicate that the effects of fixed and intermediate regimes are of equal magnitude, whatever the classification of regimes.
The finding for high income countries can be explained by an overshooting of the nominal exchange rate following a rise in inflation in a context of high capital mobility.

As regards the remaining control variables, a temporary terms of trade improvement significantly raises misalignment whereas a transitory rise in government consumption significantly reduces it though not statistically so. The exclusion of the inflation variable in columns 2 and 4 does not substantially alter the results.

Taken together, these results highlight a non-neutrality of the exchange rate system in high income countries. They also suggest that flexible arrangements dominate fixed and intermediate regimes at the statistical and economic levels.

In summary, a larger misalignment is found in fixed regimes. Intermediate regimes are associated with higher misalignment in low and high income countries. This low performance may, in part, be explained by a limited credibility of monetary policy in the first group. In the latter, exchange rate flexibility offers a better adjustment ability in addition to a greater monetary policy autonomy. In middle income countries, intermediate regimes – when their impact is significant – reduce misalignment. This advantage may reflect the existence of balance sheet effects. It may also stem from these countries' intermediate level of financial and trade integration.
We now assess the exchange system impact on over and undervaluation episodes.

3.2.3.3. Exchange rate arrangements and episodes of over and undervaluation

The probability of overvaluation episodes is estimated in the three samples. The results for low income countries are given in table 4 (columns 5-8). All else equal, the probability of overvaluation is about 0.45% higher in *de jure* fixed systems than in flexible ones (column 5). It is about 0.43% and 0.46% higher in the CFA countries and other *de jure* fixed regimes (column 6) than in flexible regimes, respectively. All three effects display satisfactory statistical significance. Therefore the larger misalignment in *de jure* fixed systems may be explained by a higher (lower) probability of overvaluation (undervaluation) in these regimes. Though positive, the impact of *de jure* intermediate systems on the overvaluation probability is never significant. This result means that the significant difference of misalignment between intermediate and flexible regimes cannot be explained by more (less) frequent overvaluation (undervaluation) episodes in the former vis-a-vis the latter. It may nonetheless stem from larger (smaller) magnitudes of overvaluation (undervaluation) in intermediate than in flexible regimes.
Finally, the additional tests carried out suggest that the exchange regime variables are collectively different from zero. But the tests fail to accept the hypothesis of a

differentiated impact between fixed and intermediate systems, between CFA and non CFA fixed regimes, and across all regimes.

Using the RR's classification (columns 7 and 8), the results also suggest that the larger misalignment in intermediate regimes is not the consequence of a higher (lower) probability of overvaluation (undervaluation) in these regimes. Taken together, the overvaluation impact of *de facto* fixed systems is not different from flexible regimes.

Distinguishing CFA countries from other *de facto* fixed regimes reveals that in the latter overvaluation probability is 0.50% lower than in *de facto* flexible systems. But, it does not translate into statistically different average misalignments (see columns 1-4). Column 8 also indicates that the significant larger misalignment in the CFA countries may not be the result of statistically different over and undervaluation probabilities.

When *de facto* fixed regimes are merged into a unique category, the tests suggest the absence of a differentiated impact of fixed, intermediate and flexible systems. This result is coherent with the lack of statistical significance of the individual exchange regime variables in column 7. On the other hand, separating out CFA countries re-establishes the non neutrality of the exchange regime in column 8. In addition, CFA countries are statistically different from other fixed regimes and the hypothesis of equality of all exchange regimes coefficients is rejected with a probability of 2.5%.

The results for middle income countries are shown in table 5 (column 5-8). Overvaluation is 0.63% more probable in *de jure* fixed systems than in flexible ones. Excluding Gabon in column 7, overvaluation probability in fixed regimes marginally rises to 0.68%. As a consequence the larger misalignment evidenced in *de jure* fixed systems comes from more frequent overvaluation episodes. The same interpretation applies to the RR's classification (columns 7 and 8). On the other hand, it is not possible to attribute the smaller misalignment found in *de jure* intermediate regimes to less frequent overvaluation episodes. A probable explanation may be a combination of smaller sized overvaluation and larger sized undervaluation episodes in these regimes. By contrast, in intermediate *de facto* regimes, overvaluation episodes are more likely to happen (columns 7 and 8) though these regimes do not induce a misalignment that is statistically different from flexible regimes.

The tests displayed at the bottom of the table confirm that fixed, intermediate and flexible systems have a differentiated impact on overvaluation episodes whatever the classification used. They also corroborate the finding of statistically different misalignment-effects of fixed and intermediate regimes in columns 1 to 4.

All in all, table 5 suggest that the larger misalignment in fixed regimes is due to more (less) frequent overvaluation (undervaluation) episodes. Such an interpretation does not apply to intermediate systems where differences in average misalignments may likely come from different magnitudes of over and undervaluation episodes.

The structure of the results of high income countries, displayed in table 6 (columns 5-8), allows an easier interpretation. As shown above, average misalignments are larger in *de jure* and *de facto* fixed and intermediate regimes. These differences stem from a higher probability of overvaluation relative to flexible regimes. According to column 5 for instance, overvaluation is 1.16% and 0.96% more likely to occur in *de facto* fixed and intermediate regimes than in *de facto* flexible systems, respectively.

The tests at the end of the table confirm again the non neutrality of the exchange rate system. They also suggest that the impact of fixed and intermediate systems is quantitatively identical in high income countries.

In the previous analysis, we have sometimes reached different conclusions about *de jure* and *de facto* regimes. We endeavour to uncover what these differences are due to by assessing the effects of deviations of actual from announced regimes.

3.2.3.4. Misalignment and deviations between *de jure* and *de facto* systems

Does announcing a given regime and actually implementing another one affect misalignment in the same way as running the announced regime? This question is investigated by estimating equation 17.

Table 7 (columns 1-2) provides evidence that low income countries which announce a fixed regime – whether they deliver it or not – record a larger misalignment. Among these countries, those which actually run a more flexible system are the most affected, albeit not statistically so. Misalignment is substantially smaller (about 16%) and strongly significant when a country runs a fixed regime that was not announced in the first place. The table also shows that, among countries that declare and run a fixed regime, misalignment is larger though not statistically significant in the CFA members. By contrast, the other fixed countries display a relatively smaller but marginally significant misalignment. The hypothesis of an identical misalignment impact in these two groups is comfortably rejected with a probability of 1.5%. In sum, table 7 reveals that among countries running *de facto* fixed systems, those that did not promise it perform better than those which did. Among the latter, countries outside the CFA zone recorded smaller misalignment than those whose *de jure* and *de facto* regimes are flexible. Keeping their words does not provide the CFA countries with any misalignment advantage relative to countries with both *de jure* and *de facto* flexible regimes.

The “fear” of letting the nominal exchange rate fluctuate may be explained by the intention to reduce misalignment. Indeed, the additional tests carried out reveal that the impact of alternative exchange regimes is not identical. Once a country decides to fix its nominal exchange rate and announces it, actually keeping this promise or not does not induce any significant difference. Among countries which promise and deliver

a fixed regime, the misalignment of CFA countries significantly exceeds that of non member countries. Moreover, CFA countries reap no advantage by fulfilling their promise. Indeed, their real exchange rate is on average more misaligned than in countries that do not announce their *de facto* fixed regime.

Notice also that when a country has a fixed regime, not announcing it is relatively more beneficial. Finally, the effects of the different *de facto* fixed systems cannot be considered identical as do the effects of different *de jure* fixed regimes. Likewise, the exchange rate regime exerts a significant differentiated impact in these countries.

The distinction of over and undervaluation episodes is done in columns 3 and 4. It appears that, when a country announces a fixed regime, its real exchange rate deviates relatively more from equilibrium. In column 3, the probability of an overvaluation is 0.32% higher in countries fulfilling their promise and 0.63% higher in those that do not than in countries that promise and deliver more flexible regimes. Nevertheless this higher tendency to overvaluation does not translate into an average misalignment that is statistically different from that induced by exchange regimes that are not fixed both *de jure* and *de facto* (see column 1, table 7). The estimations do not reveal any significant tendency to overvaluation in countries with unannounced *de facto* fixed regimes. In column 4, the CFA countries are isolated. Their effect on over and undervaluation episodes is not distinguishable from that of *de jure* fixed regimes that are also fixed *de facto*. This is consistent with the results of columns 1 and 2. By contrast, the probability of overvaluation is smaller (about 0.44%) in non CFA countries with a *de facto* fixed regime. This significant impact indicates that the smaller misalignment in non CFA countries with both *de jure* and *de facto* fixed regimes stems from less frequent overvaluation and more frequent undervaluation episodes.

In terms of magnitude, the tests robustly reject the hypothesis of non neutrality of the exchange rate regime. *De jure* or *de facto* fixed regimes are associated with misalignment effects that are collectively different from zero. Again, CFA countries are significantly different from non member countries with both *de jure* and *de facto* fixed regimes, the latter performing better. Furthermore, announcing or not a regime that is *de facto* fixed does not appear to affect the size of the estimated effects whether the country belongs or not to the CFA zone. Finally, non CFA countries which fulfil their promise to fix their nominal exchange rate are different from those which do not.

The results for middle income countries, contained in table 8 (columns 1-2), clearly show that countries which declare a fixed regime have significantly higher misalignment irrespective of whether they deliver it or not. But misalignment is larger (at least 8%) in countries that keep their promise. Countries that fix their exchange rate without pre-announcing it are characterized by larger misalignment (more than 8%), the size of which is close to that of countries with both *de jure* and *de facto* fixed regimes. In

fact, the size of the estimated coefficients is identical independently of the deviations between *de jure* and *de facto* regimes as shown by the tests in the bottom of the table. In addition, the non neutrality of the exchange rate system is again confirmed. The main feature of table 8 is that, in middle income countries, having a *de jure* or *de facto* fixed regime substantially raises misalignment. This finding corroborates previous results obtained in this sample. The conclusion is also confirmed by columns 3 and 4 which indicate a relatively higher probability of overvaluation in all fixed regimes, be they pre-announced or not. Globally, the magnitudes of the coefficients of the exchange regime variables included in columns 3 and 4 are identical. As a matter of fact, independently of deviations of promises from facts, pre-announcing a fixed regime or running one in fact appears costly because it makes overvaluation episodes more frequent so that average misalignment grows larger.

The results for high income countries are similar to those of middle income countries. Indeed, columns 1 and 2 of table 9 reveals that, fixed regimes, whether pre-announced or not, significantly raises misalignment but the estimated effects are of substantial smaller sizes. As columns 3 and 4 show, the larger misalignment in fixed regimes is also the result of higher (lower) overvaluation (undervaluation) probabilities.

Conclusion

The paper has assessed the misalignment-effects of *de jure* and *de facto* exchange systems and those of deviations of actual regimes from announced ones in low, middle and high income countries.

Misalignment is found to be larger in fixed regimes than in flexible ones in all countries, with both *de jure* and *de facto* classifications. The most pronounced impact is observed in middle income and the CFA countries. In the former, the lower performance of fixed regimes may be explained by the usual case against fixed systems. Furthermore, the relatively higher trade and financial integration of these countries would tend to amplify the costs of nominal exchange rate fixity especially during financial crises or distress. The empirical results also suggest that the larger misalignment in fixed regimes stems from more frequent overvaluation episodes. These findings are consistent with the association of fixed systems to more frequent overvaluation episodes evidenced by Goldfajn and Valdes (1999). However, this interpretation does not hold robustly in low income countries with the RR's regimes.

Intermediate regimes are also associated with a larger misalignment in low and high income countries. In middle income countries, by contrast, misalignment is smaller in intermediate regimes than in both fixed and flexible systems. Furthermore, only in high income countries does this impact come from a higher probability of overvaluation episodes. In low and middle income countries, overvaluation and undervaluation with

different magnitudes may be a plausible explanation.

The better performance of intermediate regimes in middle income countries can be rationalized by Bordo's (2004) finding that corner regimes do not suit emerging countries. Indeed, hard pegs may eliminate exchange rate crises but only by banking crises more likely due to the lack of a lender of last resort. Moreover, the “original sin” leads to maturity and currency mismatches in financial assets and liabilities which make devaluation very costly. Floating will have no real effect if indexation is widespread or if the country has a history of profligate monetary and fiscal policies. Intermediate regimes thus remain a viable option for emerging countries which are increasingly integrated to global finance but still lack fully developed domestic financial markets.

Finally, the analysis reveals that low income countries with a fixed regime may benefit from not pre-announcing it. In doing so they may get a larger leeway when the economy is hit by adverse shocks because the nominal exchange rate may vary without such a change signalling any break of commitment. This finding may explained the observation by Levy-Yeyati and Sturzenegger (2005) of an increasing tendency of countries running *de facto* fixed systems to not commit to fixing their nominal exchange rate. On the other hand, in middle and high income countries, reneging on the promise to fix the exchange rate appears costly. And our results suggest that, in these countries, the “fear of floating” phenomenon documented by Calvo and Reinhart (2002) cannot be justified by misalignment considerations.

Larger misalignments may entail substantial economic costs. Therefore, countries which adopt fixed and intermediate regimes (except middle income countries) should enhance their economy's flexibility. This objective may be achieved through the development of sound and well regulated financial markets, stronger institutions, more flexible labour and goods markets, sound macroeconomic policies and regional and international monetary cooperation. But, as stressed by Obstfeld and Rogoff (1995), no substitute exists for the real exchange rate adjustment though it may be facilitated and its costs attenuated. As a matter of fact, whatever regime a country runs, enhancing the flexibility of the economy should always remain a medium and long run objective in order to facilitate adjustment to changing domestic and external economic conditions.

References

Abdih Yasser and Charalambos G., Tsangarides (2006). "FEER for the CFA Zone", IMF Working Paper WP/06/236.

Aizenman Joshua and Reuven Glick (2005). "Pegged Exchange Rate Regimes: a Trap ?", Federal Reserve Bank of San Francisco, Working Paper 2006-07.

Alberola Enrique, Humberto López and Luis Servén (2004). "Tango with the Gringo: The hard peg and real misalignment in Argentina", World Bank Policy Research Working Paper No. 3322.

Baffes John, Ibrahim A., Elbadawi and Stephen A., O'Connell (1997). "Single-Equation Estimation of the Equilibrium Real Exchange Rate", World Bank, Policy Research Working Paper 1800.

Baldi Anne-Laure and Nanno Mulder (2004). "The Impact of Exchange Rate Regimes on Real Exchange Rates in South America: 1990-2002", OECD Working Papers, No. 396.

Bordo Michael (2004). "Exchange Rate Regimes for the Twenty–First Century: An Historical Perspective", in Exchange Rate Regimes: Past, Present and Future, Oesterreichische Nationalbank, Working Paper 92, pp. 1-40.

Burstein Ariel, Martin Eichenbaum and Sergio Rebelo (2005). "Large Devaluations and the Real Exchange Rate", Journal of Political Economy, Vol. 113, Issue 4.

Calderón A., César (2002). "Real Exchange Rates in the Long and Short Run: A Panel Co-Integration Approach", Central Bank of Chile Working Papers No. 153.

Calvo A., Guillermo (1986). "Temporary Stabilization: Predetermined Exchange Rates", Journal of Political Economy, Vol. 94, No.6.

---------- and Frederic S. Mishkin (2003). "The Mirage of Exchange Rate Regimes for Emerging Market Countries", Journal of Economic Perspectives, Vol. 17, No. 4.

---------- and Carmen Reinhart (2000). "Fixing for Your Life", NBER Working Paper No. 8006.

---------- (2002). "Fear of Floating" Quarterly Journal of Economics, Vol. 117, No. 2.

---------- and Carlos A., Végh (1993). "Exchange Rate Based Stabilization under Imperfect Credibility", Reprint from Open-Economy Macroeconomics, Edited by Helmut Frisch and Andreas Worgotter, London MacMillan Press.

Catão A., V., Luis and Solomos M., Solomou (2005). "Effective Exchange Rates and the Classical Gold Standard Adjustment", American Economic Review, Vol. 95, No. 4.

Cavallo Michele, K. Kisselev, F. Perri, and N. Roubini (2005). "Exchange Rate Overshooting and the Costs of Floating", Federal Reserve Bank of San Francisco, Working Paper No. 2005-07.

Céspedes F., Luis, Roberto Chang and Andrés Velasco (2004). "Balance Sheets and Exchange Rate Policy", American Economic Review, Vol. 94, No. 4.

Chinn D., Menzie (2005). "A Primer on Real Effective Exchange Rates: Determinants, Overvaluation, Trade Flows and Competitive Devaluation", NBER WP No. 11521.

Collins M., Susan (1996). "On Becoming More Flexible: Exchange Rate Regimes in Latin America and the Caribbean", Journal of Development Economics, Vol. 51.

Coudert Virginie and Cécile Coharde (2002). "Exchange Rate Regimes and Sustainable Parities For CEECs in the Run-up to EMU Membership", CEPII Working Papers, No. 2002-15.

---------- (2008). "Currency Misalignments and Exchange Rate Regimes in Emerging

and Developing Countries" CEPII Working Papers, No. 2008-07.

Dornbusch Rudiger (2001). "Fewer Monies, Better Monies", NBER Working Paper No. 8324.

Driver L., Rebecca and Peter F., Westaway (2004). "Concepts of Equilibrium Exchange Rates", Bank of England, Working Paper 248.

Dufrenot J., Gilles and Etienne B. Yehoue (2005). "Real Exchange Rate Misalignment: A Panel Co-Integration and Common Factor Analysis", IMF WP/05/164.

Edwards Sebastian (1988). "Real and Monetary Determinants of Real Exchange Rate Behavior: Theory and Evidence from Developing Countries", NBER Working Paper No. 2721.

---------- (1989a). "Real Exchange Rates in Developing Countries: Concepts and Measurement", NBER Working Paper No. 2950.

---------- (1989b). "Exchange Controls, Devaluations, and Real Exchange Rates: The Latin American Experience", Economic Development and Cultural Change, Vol. 37, No. 3.

---------- and Miguel A., Savastano (1999). "Exchange Rates in Emerging Economies: What do We Know ? What do We Need to Know ?", NBER Working Paper No. 7228.

Frankel A., Jeffrey (1999). "No Single Currency Regime is Right for All Countries or at All Times", NBER Working Paper No. 7338.

---------- (2003). "Experience of and Lessons from Exchange Rate Regimes in Emerging Economies", NBER Working Paper No. 10032.

---------- (2005). "Contractionary Currency Crashes in Developing Countries", NBER Working Paper No. 11508.

Galstyan Vahagn and Philip, R., Lane (2008). "The Composition of Government Spending and the Real Exchange Rate", IIIS Discussion Paper No. 257.

Godfajn Ilan and Rodrigo O., Valdes (1999). "The Aftermath of Appreciations", The Quarterly Journal of Economics, Vol. 114, No. 1.

Guidotti E. Pablo and Carlos A., Vegh (1999). "Losing Credibility: The Stabilization Blues", International Economic Review, Vol. 40, No. 1.

Hinkle E., Lawrence and Peter J., Montiel (1999). "Exchange Rate Misalignment: Concepts and Measurement for Developing Countries", Oxford University Press.

Isard Peter (2007). "Equilibrium Exchange Rates: Assessment Methodologies", IMF Working Paper, WP/07/296.

Kao Chihwa and Min-Hsien Chiang (2000). "On the Estimation and Inference of a Cointegrated Regression in Panel Data", in *Advances in Econometrics*, 15, Edited by Baltagi H. Badi and C., Kao (2000), Elsevier Science.

Kempa Bernd and Michael Nelles (1999). "Misalignment of Real Exchange Rates and the Credibility of Nominal Currency Bands", Weltwirtschaftliches Archiv, Vol. 135, Issue 4.

Levy-Yeyati Eduardo and Federico Sturzenegger (2005). "Classifying Exchange Rate Regimes: Deeds vs. Words", European Economic Review 49.

Lothian R., James and Cornelia H. McCarthy (2002). "Real Exchange-Rate Behaviour under Fixed and Floating Exchange Rate Regimes", Manchester School, Vol. 70, Issue 2.

Mark C., Nelson and Donggyu Sul (2003). "Cointegration Vector Estimation by Panel DOLS and

Long-run Money Demand", Oxford Bulletin of Economics and Statistics, vol. 65(5).

McCoskey Suzanne and Chihwa Kao (1999). "Comparing Panel Data Cointegration Tests with an Application to the Twin Deficits Problem", *http://faculty.maxwell.syr.edu/cdkao/working/w.html*.

Nabli Mustapha, Jennifer Keller and Marie-Ange Veganzones (2004). "Exchange Rate Management within the Middle East and North Africa Region: The Cost to Manufacturing Competitiveness", American University of Beirut, Institute of Financial Economics, Lecture and Working Paper Series 2004, No. 01.

Obstfeld Maurice (1996). "Models of currency crises with self-fulfilling features", European Economic Review 40.

---------- (2004). "External Adjustment", NBER Working Paper 10843.

---------- and Kenneth Rogoff (1995). "The Mirage of Fixed Exchange Rates", Journal of Economic Perspectives, Vol. 9, No. 4.

Parsley C., David and Helen A., Popper (2001). "Official Exchange Rate Arrangements and Real Exchange Rate Behavior", Journal of Money, Credit and Banking, Vol. 33, No.4.

Pedroni Peter (1999). "Critical values for cointegration tests in heterogeneous panels with multiple regressors", Forthcoming Oxford Bulletin of Economics and Statistics.

---------- (2000). "Fully Modified OLS for Heterogeneous Cointegrated Panels", in *Advances in Econometrics*, 15, Edited by Baltagi H. Badi and C., Kao (2000), Elsevier Science.

---------- (2001). "Purchasing Power Parity Tests in Cointegrated Panels", The Review of Economics and Statistics, Vol. 83, No.4.

---------- (2004). "Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis", Econometric Theory, 20.

Razin Ofair and Susan M. Collins, (1997). "Real Exchange Rate Misalignments and Growth", NBER Working Paper No. 6174.

Reinhart Carmen and Kenneth Rogoff (2003). "The Modern History of Exchange Rate Arrangements: A Reinterpretation", *www.puaf.umd.edu/faculty/reinhart/Revised-March3-03.pdf*.

Ricci L., Antonio, Gian M., Milesi-Ferretti and Jaewoo Lee (2008). "Real Exchange Rates and Fundamentals: A Cross-Country Perspective", IMF WP/08/13.

Rogoff Kenneth, Aasim M. Husain, A. Mody, R. Brooks, and N. Oomes (2004). "Evolution and Performance of Exchange Rate Regimes", IMF, Occasional Paper 229.

Sarno Lucio, Giorgio Valente and Mark, E., Wohar (2003). "Monetary Fundamentals and Exchange Rate Dynamics Under Different Nominal Regimes", CEPR Discussion Paper No. 3983.

Sazanami Yoko and Seiji Yoshimura (1999). "Restructuring East Asian exchange rate regimes", Journal of Asian Economics 10.

Soto Raimundo and Ibrahim A., Elbadawi (2008). "Theory and Empirics of Real Exchange Rates in Developing Countries", Pontificia Universidad Catolica de Chile, Instituto de Economia, Documento de Trabajo No. 324.

Appendix 1 : Figures

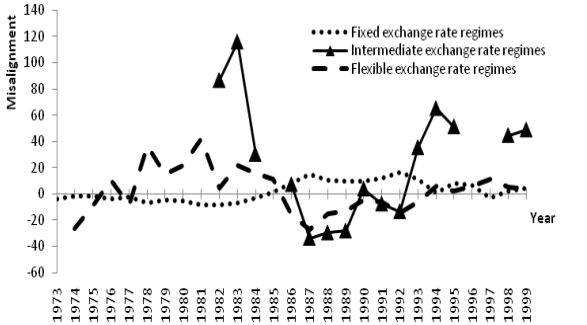

Figure 1: Misalignment in *de jure* exchange rate regimes - Low income countries

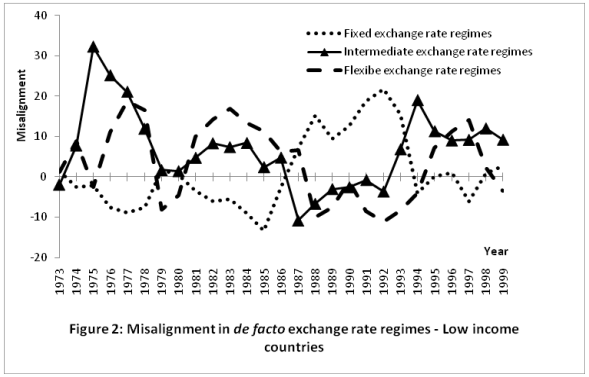

Figure 2: Misalignment in *de facto* exchange rate regimes - Low income countries

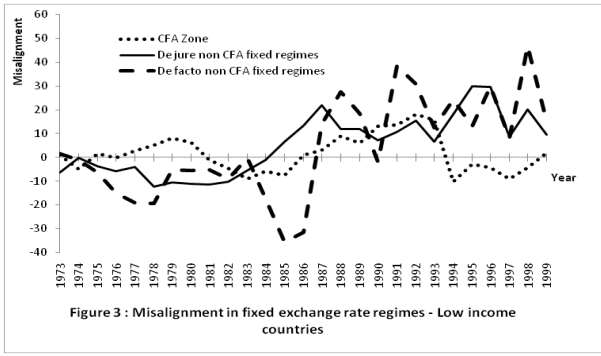

Figure 3 : Misalignment in fixed exchange rate regimes - Low income countries

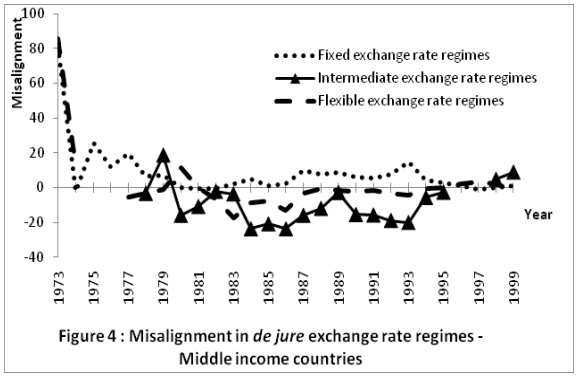

Figure 4 : Misalignment in *de jure* exchange rate regimes - Middle income countries

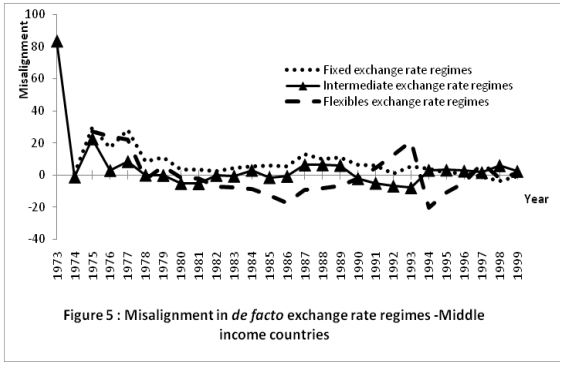

Figure 5 : Misalignment in *de facto* exchange rate regimes -Middle income countries

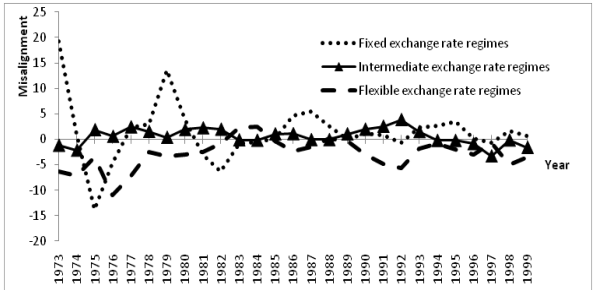

Figure 7 : Misalignment in *de facto* exchange rate regimes - High income countries

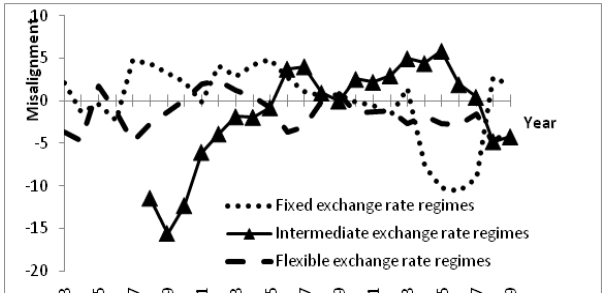

Figure 6 : Misalignment in *de jure* exchange rate regimes - High income countries

Appendix 2: List of countries

Low income countries: Bangladesh, Benin, Burkina Faso,Burundi, Cameroon, Central African Republic, Republic of Congo, Comoros, Côte d'Ivoire, Ghana, Gambia, Guinea-Bissau, Haiti, Indonesia, India, Kenya, Lesotho, Madagascar, Mali, Mozambique, Mauritania, Malawi, Niger, Nigeria, Nicaragua, Pakistan, Papua New Guinea, Rwanda, Senegal, Sierra Leone, Chad, Togo, Tanzania, Uganda, Zambia, Zimbabwe, Sudan, Guinea.

Middle income countries: Argentina, Antigua and Barbuda, Bolivia, Brazil, Botswana, Chile, Colombia, Cape Verde, Costa Rica, Dominica, Dominican Republic, Algeria, Ecuador, Egypt, Fiji, Gabon, Guatemala, Guyana, Honduras, Iran, Jordan, St. Kitts and Nevis, Sri Lanka, Morocco, Mexico, Mauritius, Malaysia, Panama, Peru, Philippines, Paraguay, El Salvador, Suriname, Swaziland, Seychelles, Syrian Arab Republic, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uruguay, St. Vincent and Grenadines, Venezuela, Vanuatu, South Africa.

High income countries: Australia, Austria, Belgium, Canada, Switzerland, Cyprus, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Ireland, Italy, Japan, Korea, Kuwait, Netherlands, Norway, New Zealand, Portugal, Sweden, United States.

CFA franc zone countries: The exchange parity of the CFA franc is fixed at 1 euro for 655,955 CFA franc. The CFA franc zone is composed of two groups of countries. The west African bloc includes Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo. Guinea-Bissau has joined the CFA zone on may 2nd, 1997. Mali exit the zone on July 1962 and re-integrated it on June 1st, 1984. The central African group includes Cameroon, Central African Republic, Chad, Republic of Congo, Gabon and Equatorial Guinea. Equatorial Guinea has joined the zone on august 27, 1984. Madagascar and Mauritania exit the zone in 1973.

Appendix 3: Data

Variable	**Definition**	**Source**
Real exchange rate (logRER)	See text	CERDI
Devaluation (Deval)	See text	Idem
Terms of trade (logTOT)	(Log) exports as capacity to import, constant local currency.	WDI 2003 and 2005
External financial flows (FF)	(Log) gross private capital flows as % of GDP in middle and high income countries. In low income countries, ratio of the sum of net income from abroad (in current US dollars) and aid (in current US dollars) to GDP (in current US dollars), in %.	Idem
Productivity growth (PROD)	Growth rate (in %) of constant US dollars GDP per labour unit. The data of economically active population is taken from the series "*labor force, total"*.	Idem
Trade openness (logTrade)	(Log) ratio of the sum of exports and imports to GDP, in %.	Idem
Government consumption (logGC)	(Log) Government consumption spending as % of GDP.	Idem
Monetary policy (*MP*)	Model 1: Excess growth rate of money stock (M1) in current local currency over the previous year's growth rate of current local currency GDP, in %.	Idem
	Model 2: Growth rate of domestic credit provided by the banking sector over GDP, in %	Idem
Inflation (π)	Deviation of the inflation rate from its sample yearly average.	Idem

Table 1: **Results of Hadri's unit root test**

Variables	Low income countries (N = 38)		Middle income countries (N = 45)		High income countries (N = 24)	
	P-value of Z-stat	P-value of Het Z-stat	P-value of Z-stat	P-value of Het Z-stat	P-value of Z-stat	P-value of Het Z-stat
LogRER	0.00	0.00	0.00	0.00	0 .00	0.00
First difference of LogRER	1.00	0.82	1.00	0.91	0.74	0.57
LogTOT	0.00	0.00	0.00	0.00	0.00	0.00
First difference of LogTOT	0.59	0.20	0.56	0.48	0.00	0.00
Second difference of LogTOT					1.00	1.00
LogTrade	0.00	0.00	0.00	0.00	0.00	0.00
First difference of LogTrade	1.00	0.98	0.99	0.99	0.95	0.98
PROD	0.00	0.00	0.00	0.00	0.00	0.00
First difference of PROD	1.00	1.00	1.00	1.00	1.00	1.00
LogGC	0.00	0.00	0.00	0.00	0.00	0.00
First difference of logGC	1.00	0.99	1.00	0.97	0.77	0.00
Second difference of LogGC					1.00	1.00
FF	0.00	0.00	0.00	0.00	0.00	0.00
First difference of FF	1.00	0.99	1.00	1.00	1.00	1.00
Monet	0.97	0.00	0.73	0.00	0.16	0.00
First difference of Monet	1.00	1.00	1.00	1.00	1.00	1.00
gcredit	0.97	0.00	0.40	0.01	0.00	0.00
First difference of gcredit	1.00	1.00	1.00	1.00	1.00	1.00
Deval	0.00	0.00	0.00	0.00	0.00	0.00
First difference of Deval	1.00	1.00	1.00	1.00	1.00	1.00

Note: Z-stat and Het Z-stat are the Hadri's test statistics; the latter is robust to heteroskedasticity. Individual fixed effects are included.

The null is the stationary hypothesis.

Table 2: **Results of Maddala and Wu's unit root test**

Variables	Low income countries (N = 38)			Middle income countries (N = 45)			High income countries (N = 24)		
	P-value of Fisher Chi-2			P-value of Fisher Chi-2			P-value of Fisher Chi-2		
LogRER	0.98	0.06	0.00	0.38	0.07	0.06	0.00	0.00	0.93
First difference of LogRER	0.00	0.00		0.00	0.00	0.00			0.00
LotTOT	0.00	0.00	1.00	0.81	0.00	1.00	1.00	0.27	1.00
First difference of LotTOT			0.00	0.00		0.00	0.00	0.00	0.00
LogTrade	0.00	0.00	1.00	0.04	0.00	1.00	0.03	0.00	1.00
First difference of LogTrade			0.00	0.00		0.00	0.00		0.00
PROD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LogGC	0.00	0.00	0.97	0.00	0.01	1.00	0.02	0.06	1.00
First difference of LogGC	0.00		0.00	0.00	0.00	0.00	0.00		0.00
FF	0.00	0.00	0.00	0.00	0.00	0.95	0.41	0.00	1.00
First difference of FF				0.00		0.00	0.00		0.00
Monet	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gcredit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Deval	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: The null is non stationarity. In the first sub-column, individual fixed effects are added; in the second one, individual fixed effects and individual linear trends are included; the third sub-column includes no individual fixed effects or individual linear trends.

Table 3 : Results of Pedroni's cointegration tests

Test statistics	Low income countries (N = 38)		Middle income countries (N = 45)		High income countries (N = 24)	
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
panel v-stat	-12.96	-12.96	-14.10	-14.10	-2.42	-2.49
panel rho-stat	15.51	16.15	13.94	17.48	6.03	6.11
panel pp-stat	21.72	31.16	-2.72	25.61	3.35	3.39
panel adf-stat	30.13	26.39	15.84	29.23	4.89	5.15
group rho-stat	8.57	8.44	10.74	11.08	7.81	7.83
group pp-stat	3.00	3.13	3.68	4.58	4.48	4.28
group adf-stat	4.84	4.49	5.34	5.24	5.51	5.55

Note: The critical values of the test statistics are 2.57 at 1%, 1.96 at 5% and 1.64 at 10%.

The null hypothesis is the absence of cointegration.

In model 1, monetary policy is measured by the excess growth of the money stock (M1) over the previous year's GDP growth rate. In model 2, it is measured by the growth rate of the domestic credit provided by the banking sector.

Table 4: Misalignment and overvaluation regressions, low income countries

	Dependent variable in regressions 1 to 4 : Misalignment				Dependent variable in regressions 5 to 8 : Overvaluation			
COEFFICIENT	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
de jure Fix	4.94**				0.45**			
	(1.98)				(2.56)			
de jure Interm	16.03*	15.99*			0.35	0.35		
	(1.82)	(1.82)			(0.76)	(0.76)		
inflation	41.05**	42.44**	49.73***	53.45***	0.6	0.57	0.61	0.69
	(2.50)	(2.53)	(2.67)	(2.75)	(1.13)	(1.04)	(0.94)	(0.99)
$\tilde{\Delta}$ *logTOT*	32.25**	32.29**	41.57**	40.95**	0.99*	0.99*	1.44**	1.40**
	(2.39)	(2.39)	(2.52)	(2.51)	(1.80)	(1.80)	(2.25)	(2.19)
$\tilde{\Delta}$ *logTrade*	-91.31***	-91.41***	-105.08***	-104.93***	-2.79***	-2.79***	-3.29***	-3.29***
	(-3.57)	(-3.57)	(-3.50)	(-3.52)	(-3.50)	(-3.50)	(-3.63)	(-3.63)
$\tilde{\Delta}$ *logGC*	1.72	1.61	6.98	6.05	-0.2	-0.2	0.11	0.01
	(0.15)	(0.14)	(0.53)	(0.46)	(-0.27)	(-0.27)	(0.14)	(0.016)
CFA		6.01**		5.94*		0.43**		0.14
		(2.27)		(1.88)		(2.10)		(0.60)
de jure NonCFA		4.14				0.46**		
		(1.55)				(2.43)		
de facto Fix			3.77				0.14	
			(1.35)				(0.71)	
de facto Interm			7.789***	8.00**			0.26	0.16
			(2.71)	(2.53)			(1.16)	(0.66)
de facto NonCFA				-1.79				-0.50*
				(-0.42)				(-1.91)
Observations	842	842	704	704	842	842	704	704
Number of countries	35	35	29	29				
Overall R2 / Pseudo R2	0.15	0.15	0.15	0.16	0.02	0.02	0.02	0.03
Within R2	0.16	0.16	0.15	0.15				
Between R2	0.13	0.14	0.17	0.23				
Wald chi2	39.37	39.35	28.04	29.37	23.90	23.94	19.28	25.30
Prob > chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
All regimes = 0	6.92	8.27	8.01	10.15	6.57	6.62	1.35	7.39
	[0.03]	[0.04]	[0.02]	[0.02]	[0.04]	[0.08]	[0.51]	[0.06]
Fix = Interm	1.51		3.48		0.04		0.37	
	[0.22]		[0.06]		[0.84]		[0.54]	
CFA = NonCFA		1.00		4.29		0.04		6.46
		[0.32]		[0.04]		[0.83]		[0.01]
All regimes equal		2.49		6.52		0.09		7.37
		[0.29]		[0.04]		[0.96]		[0.02]

Note: Robust z statistics in parentheses; p-values in square brackets. *** p<0.01, ** p<0.05, * p<0.1. All regressions contain a constant and time dummies for the 1980 and 1990 decades.

Table 5: **Misalignment and overvaluation regressions, middle income countries**

	Dependent variable in regressions 1 to 4 : Misalignment				Dependent variable in regressions 5 to 8 : Overvaluation			
COEFFICIENT	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
de jure Fix	5.66**	6.36***			0.63***	0.68***		
	(2.54)	(2.84)			(3.84)	(4.05)		
de jure Interm	-5.12**	-4.91*			-0.22	-0.2		
	(-1.97)	(-1.90)			(-0.80)	(-0.75)		
inflation	-5.82	-4.74	-4.46	-3.5	-0.65	-0.58	0.04	0.09
	(-0.70)	(-0.57)	(-0.54)	(-0.42)	(-1.35)	(-1.21)	(0.073)	(0.17)
$\tilde{\Delta}$ *logTOT*	-1.09	1.39	-7.1	-5.39	0.11	0.42	-0.46	-0.22
	(-0.11)	(0.13)	(-0.63)	(-0.46)	(0.12)	(0.43)	(-0.48)	(-0.22)
$\tilde{\Delta}$ *logTrade*	-54.39***	-54.89***	-49.41**	-49.31**	-4.12***	-4.33***	-3.38***	-3.53***
	(-2.97)	(-2.97)	(-2.51)	(-2.47)	(-3.57)	(-3.67)	(-2.85)	(-2.91)
$\tilde{\Delta}$ *logGC*	9.28	12.46	11.69	15.35	-0.47	-0.19	-0.01	0.31
	(0.85)	(1.15)	(0.97)	(1.27)	(-0.48)	(-0.19)	0.01	(0.30)
de facto Fix			6.61**	7.25**			0.90***	0.92***
			(2.23)	(2.46)			(3.69)	(3.76)
de facto Interm			2.41	2.46			0.39*	0.39*
			(0.86)	(0.88)			(1.81)	(1.79)
Observations	917	895	849	827	917	895	849	827
Number of countries	45	44	40	39				
Overall R2 / Pseudo R2	0.09	0.09	0.08	0.08	0.06	0.06	0.06	0.06
Within R2	0.12	0.12	0.10	0.10				
Between R2	0.01	0	0.06	0.04				
Wald chi2	74.01	74.38	61.37	63.63	71.97	71.04	63.91	60.95
Prob > chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
All regimes = 0	12.83	14.35	9.22	11.95	18.89	20.61	15.25	15.76
	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0]	[0.00]	[0.00]
Fix = Interm	12.35	13.48	7.45	9.89	9.74	10.44	8.58	9.19
	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]

Note: see table 4.

Table 6: Misalignment and overvaluation regressions, high income countries

	Dependent variable in regressions 1 to 4 : Misalignment				Dependent variable in regressions 5 to 8 : Overvaluation			
COEFFICIENT	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
de jure Fix	3.07***	3.25***			1.04***	1.06***		
	(3.74)	(3.92)			(4.36)	(4.48)		
de jure Interm	2.59***	2.42***			0.79***	0.74***		
	(3.67)	(3.35)			(3.47)	(3.30)		
inflation	-37.20***		-44.09***		-8.51**		-10.16***	
	(-2.74)		(-3.28)		(-2.54)		(-3.12)	
$\tilde{\Delta}$ *logTOT*	21.51*	23.84*	22.85**	25.36**	3.53	3.92	3.74	4.3
	(1.86)	(1.95)	(1.99)	(2.06)	(1.30)	(1.39)	(1.33)	(1.48)
$\tilde{\Delta}$ *logTrade*	-66.25***	-64.84***	-66.72***	-64.90***	-17.82***	-17.03***	-17.81***	-16.94***
	(-6.87)	(-6.68)	(-6.98)	(-6.67)	(-5.89)	(-5.74)	(-5.88)	(-5.65)
$\tilde{\Delta}$ *logGC*	1.41	2.59	0.2	2.06	-0.99	-0.63	-1.21	-0.7
	(0.066)	(0.12)	(0.0096)	(0.096)	(-0.23)	(-0.14)	(-0.28)	(-0.16)
de facto Fix			3.95***	3.96***			1.16***	1.14***
			(4.61)	(4.64)			(4.37)	(4.39)
de facto Interm			3.89***	3.43***			0.95***	0.84***
			(5.24)	(4.58)			(4.46)	(4.02)
Observations	553	553	553	553	553	553	553	553
Number of countries	23	23	23	23				
Overall R2 / Pseudo R2	0.16	0.14	0.18	0.15	0.11	0.10	0.11	0.10
Within R2	0.18	0.15	0.2	0.17				
Between R2	0.1	0.1	0.1	0.05				
Wald chi2	84.79	79.97	115.27	95.24	56.22	55.25	63.29	54.58
Prob > chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
All regimes = 0	18.35	18.29	33.50	28.50	23.83	24.28	26.77	24.53
	[0.00]	[0.00]	[0.00]	[0]	[0]	[0]	[0]	[0]
Fix = Interm	0.39	1.07	0.01	0.44	0.83	1.41	0.66	1.45
	[0.53]	[0.30]	[0.94]	[0.51]	[0.36]	[0.23]	[0.42]	[0.23]

Note: See table 4.

Table 7: Misalignment, overvaluation and deviations of *de facto* from *de jure* regimes, low income countries

COEFFICIENT	(1)	(2)	(3)	(4)
FF	1.57		0.32	
	(0.55)		(1.63)	
FN	3.51	1.5	0.63***	0.36*
	(1.04)	(0.53)	(2.78)	(1.68)
NF	-15.53***	-15.97***	-0.66	-0.79
	(-3.89)	(-3.95)	(-0.88)	(-1.05)
inflation	45.49**	48.28***	0.59	0.61
	(2.50)	(2.60)	(0.97)	(0.96)
$\tilde{\Delta}$ *logTOT*	41.79**	40.95**	1.51**	1.42**
	(2.55)	(2.52)	(2.31)	(2.20)
$\tilde{\Delta}$ *logTrade*	-107.14***	-106.65***	-3.36***	-3.31***
	(-3.60)	(-3.60)	(-3.63)	(-3.61)
$\tilde{\Delta}$ *logGC*	4.7	3.1	0.13	-0.02
	(0.35)	(0.24)	(0.17)	(-0.021)
CFA		2.5		0.17
		(1.01)		(0.87)
NonCFANonCFA		-6.46		-0.45
		(-1.58)		(-1.64)
Observations	700	700	700	700
Number of countries	29	29		
Overall R2 / Pseudo R2	0.16	0.17	0.03	0.03
Within R2	0.17	0.17		
Between R2	0.11	0.18		
Wald chi2	30.50	34.80	26.76	29.00
Prob > chi2	0.00	0.00	0.00	0.00
All regimes = 0	19.05	23.30	9.14	11.52
	[0.00]	[0.00]	[0.03]	[0.02]
FF = FN	0.60		2.28	
	[0.44]		[0.13]	
FF = NF	15.57		1.71	
	[0.00]		[0.19]	
CFA = NonCFANonCFA		5.96		5.57
		[0.01]		[0.02]
CFA = FN		0.15		0.65
		[0.70]		[0.42]
NonCFA NonCFA = FN		3.78		8.58
		[0.06]		[0.00]
All *de jure* Fix equal		5.97		9.00
		[0.05]		[0.01]
CFA = NF		17.74		1.62
		[0.00]		[0.20]
NonCFANonCFA=NF		3.10		0.19
		[0.08]		[0.66]
All *de facto* Fix equal		21.74		6.79
		[0.00]		[0.03]
All regimes equal	17.78	22.62	4.40	10.70
	[0.00]	[0.00]	[0.11]	[0.01]

Note: See table 4. The dependent variable is Misalignment in regressions 1 and 2. The dependent variable is Overvaluation in regressions 3 and 4.

Table 8: **Misalignment, overvaluation and deviations of *de facto* from *de jure* regimes, middle income countries**

COEFFICIENT	(1)	(2)	(3)	(4)
FF	8.18***	9.21***	0.81***	0.87***
	(3.78)	(4.30)	(4.11)	(4.26)
FN	6.28**	6.78**	0.49**	0.52***
	(2.05)	(2.21)	(2.57)	(2.72)
NF	8.43**	8.32**	1.24***	1.23***
	(1.98)	(1.96)	(2.70)	(2.68)
inflation	-3.85	-2.6	-0.22	-0.13
	(-0.47)	(-0.32)	(-0.44)	(-0.28)
$\tilde{\Delta}$ *logTOT*	-3.2	-0.79	0.08	0.39
	(-0.28)	(-0.067)	(0.081)	(0.38)
$\tilde{\Delta}$ *logTrade*	-52.12***	-52.48***	-3.65***	-3.85***
	(-2.67)	(-2.65)	(-3.06)	(-3.16)
$\tilde{\Delta}$ *logGC*	10.74	14.34	-0.05	0.26
	(0.90)	(1.21)	(-0.046)	-0.25
Observations	841	819	841	819
Number of countries	40	39		
Overall R2 / Pseudo R2	0.09	0.09	0.07	0.07
Within R2	0.12	0.13		
Between R2	0.06	0.03		
Wald chi2	81.97	87.15	76.36	74.37
Prob > chi2	0.00	0.00	0.00	0.00
All regimes = 0	16.27	20.75	21.46	22.80
	[0.00]	[0.00]	[0.00]	[0.00]
FF = FN	0.74	1.24	2.47	2.72
	[0.39]	[0.27]	[0.12]	[0.10]
FF = NF	0.00	0.04	0.85	0.60
	[0.95]	[0.84]	[0.36]	[0.44]
All regimes equal	0.75	1.27	4.02	4.02
	[0.69]	[0.53]	[0.13]	[0.13]

Note: See table 4. The dependent variable is Misalignment in regressions 1 and 2. The dependent variable is Overvaluation in regressions 3 and 4.

Table 9: Misalignment, overvaluation and deviations of *de facto* from *de jure*, high income countries

COEFFICIENT	(1)	(2)	(3)	(4)
FF	2.37*	2.51**	0.66*	0.69**
	(1.88)	(1.99)	(1.90)	(1.99)
FN	2.61***	2.91***	1.02***	1.08***
	(2.89)	(3.16)	(3.96)	(4.12)
NF	2.18***	2.55***	0.93***	0.98***
	(3.21)	(3.93)	(3.16)	(3.39)
inflation	-32.60**		-6.71**	
	(-2.43)		(-2.03)	
$\tilde{\Delta}$ *logTOT*	22.29*	24.31**	3.74	4.1
	(1.91)	(1.99)	(1.35)	(1.44)
$\tilde{\Delta}$ *logTrade*	-66.88***	-65.66***	-18.03***	-17.42***
	(-6.87)	(-6.73)	(-5.99)	(-5.90)
$\tilde{\Delta}$ *logGC*	2.42	3.33	-0.72	-0.42
	(0.11)	(0.15)	(-0.17)	(-0.095)
Observations	553	553	553	553
Number of countries	23	23		
Overall R2 / Pseudo R2	0.15	0.14	0.11	0.10
Within R2	0.16	0.13		
Between R2	0.21	0.24		
Wald chi2	88.19	85.97	60.57	61.26
Prob > chi2	0.00	0.00	0.00	0.00
All regimes = 0	16.13	21.53	23.77	26.41
	[0.00]	[0.00]	[0.00]	[0.00]
FF = FN	0.03	0.07	0.86	1.01
	[0.87]	[0.79]	[0.35]	[0.31]
FF = NF	0.02	0.00	0.39	0.51
	[0.88]	[0.98]	[0.53	[0.48]
All regimes equal	0.19	0.14	0.87	1.04
	[0.91]	[0.93]	[0.65]	[0.59]

Note: See table 4. The dependent variable is Misalignment in regressions 1 and 2. The dependent variable is Overvaluation in regressions 3 and 4.