CAPITAL FLOWS, EXCHANGE RATES AND GROWTH: EVIDENCE FROM DEVELOPING COUNTRIES

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ABSTRACT

The economic distress caused by recent financial crashes in developing economies has increased the concern about the optimal exchange rate policy. Yet, empirical work addressing the links between developments in the capital account and output growth under alternative policy regimes is very limited. In the present work, I assess the performance of fixed and flexible regimes in 53 developing countries for the 1978-2000 period. In particular, I explore the potential asymmetries that may arise when developing countries face swings in the capital account under different exchange rate arrangements. I confirm previous results that associate fixed regimes with higher output volatility. Moreover, I find that capital outflows are more sensitive to the choice of regime than capital inflows and that the effects of the former are delayed one year under fixed exchange rates resulting in a bigger once-and-for-all output loss.

Introduction

Several developing countries – mainly in East Asia and Latin America – have recently experienced financial crises following capital inflows and their subsequent reversals. Not surprisingly, this revived the exchange rate debate in emerging-market economies.

In both academic and policy-making circles, the exchange rate debate is still an empirical issue. Since the choice of regime is usually associated with the nature of shocks, the latter is particularly true for the case of countries facing considerable capital account shocks, where the effects are likely to be both nominal and real (Calvo and Reinhart, 1999). The absence of unambiguous results calls for further research on the subject, particularly regarding the combined effects on growth of capital flows and different exchange rate regimes

The paper is organized as follows: First, I review the literature around the exchange rate debate, the role of capital flows on economic performance and the use of alternative policy regimes. I then proceed to outline the empirical model and describe the data and methodology used, including a brief discussion regarding exchange rate regime classification. In the following section I report the paper's main results. Finally, I conclude and suggest some further research.

The Exchange Rate Debate

Advocates of both fixed and flexible regimes have re-stated old arguments and introduced new ones to show the costs and benefits of both in terms of stability, short-run shock absorption and long term growth. Yet, consensus has not been reached.

Arguments for exchange rate flexibility were put forth initially by Friedman (1953): '*If prices move slowly, it is both faster and less costly to move the nominal exchange rate in response to a shock that requires an adjustment in the real exchange rate*'.[1] This is particularly true in the case of negative shocks, (e.g. capital reversals) where prices must fall.[2] If the real exchange rate fails to adjust, the cost in terms of output may be considerable

Arguably, the use of monetary policy to provide liquidity and stimulate demand and boost growth, in times where funds are becoming short and liabilities are collected is an advantage of flexible regimes that policy makers may want to embrace (Khan, 2003). This adds to the evidence suggesting that most pegged rates, while successful for price-stabilization programs in the past, have not helped emerging economies to cope with external shocks, mainly of the Balance of Payments nature (Broda, 2001; Sachs, 1998).

On the other hand, floating regimes' 'original sin', as formalized in Dornbusch's overshooting (1976), is their inherent and sometimes excessive volatility that provides a good deal of uncertainty to both financial and real sectors. Adding to this, Calvo and Reinhart (2000) argue that, due to credibility problems and considerable liability dollarization, some developing countries may be correctly reluctant to truly engage on a floating regime ('Fear of Floating').

Frakel (1999) persuasively argues that, the more integrated neighbor countries become with one another, the less able they are to pursue independent monetary policy and that in any case; *'Developing countries have been unable to make good use of whatever monetary independency they posses'.*[3]

Finally, one has the old question of contractionry effects of devaluations, intimately linked to flexible exchange rates and which can be traced back to, at least, Diaz-Alejandro (1963) and Krugman and Taylor (1978).[4]

In addition to all these, both fixed and flexible regimes are subject to credibility issues, specially after the exchange rate crisis of the East Asian and Argentine type, as suggested by recent literature (Krugman, 1991; Agénor, 1994; Reinhart, 2000; Edwards, 2002).

The points presented above briefly illustrate the fact that the exchange rate debate is as active as it was at the demise of the gold standard. Two issues are in the center of the discussion nowadays. First, there is the now-conventional view that intermediate regimes are (or should be) fading away which has been called by some as the 'missing middle' (Frankel, 1999; Levi-Yeyati and Sturzenegger, 2005; Baldwin and Martin, 1999). Intermediate arrangements have been questioned, as they seem less transparent, less credible, and harder to understand, which ultimately may prevent convergence on private agent's expectations (Khan, 2003; Larrain and Velasco, 2001).

Chart I illustrates the fact that flexible arrangements have gained popularity in the last two decades and are now as widely used as fixed ones. Moreover, Chart I shows that indeed, intermediate regimes are fading: by the year 2000, the number of countries

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[1] Larrain, Felipe and Andres Velasco. 2001. "Exchange Rate Arrangements for Emerging Market Economies". *Essays in International Economics, No. 224.* Princeton University: Princeton, New Jersey.

[2] As Buffie *et al* (2004: p.149) recall: *'Few macroeconomists have trouble with the notion that prices are sticky downward'.*

[3] Frankel, Jeffrey A. 1999. "No Single Currency Regime is Right for all Countries or at All Times". *Essays in International Finance, No. 215.* Princeton University: Princeton, New Jersey.

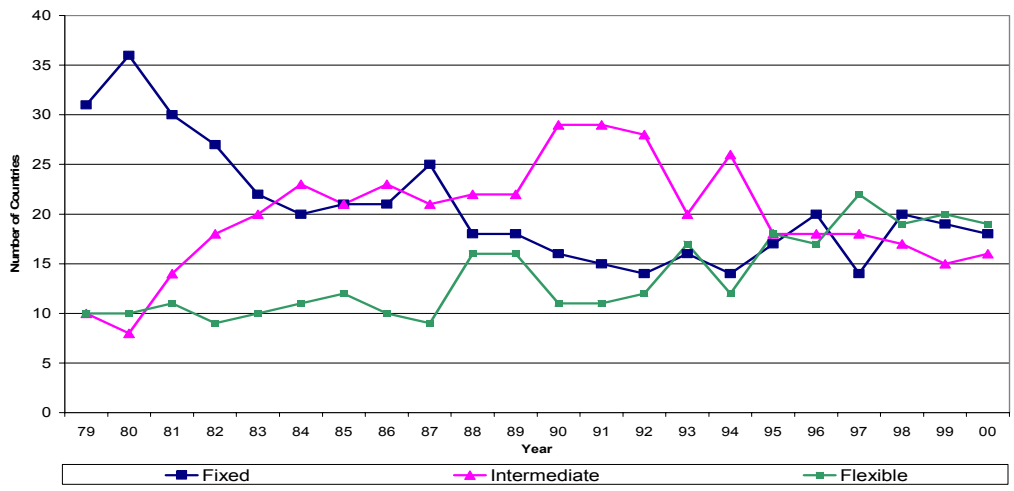
[4] Cited in Agénor and Montiel (1999).

running a *de facto* intermediate regime (crawls and baskets) was about half of the figure it was in the early 1990's when this was, by far, the most popular exchange rate arrangement.[5]

The second relevant issue in the debate is the 'two corner' or 'bipolar' view (Fischer, 2001; Williamson, 2001), which has gained adepts in a world where the impossible trinity seems to be more binding than ever. Since 'optimum currency areas' are hardly feasible in the near future for most developing economies[6]; *'hard pegs and floats are the only true options'*.[7] However, it is well known that, no peg, as hard as it might be, is irreversible. As pointed by Obstfeld (1996) this less-than-perfectly-credible feature of most pegs, opens the door to multiple equilibria which include, eventually, a collapse of the regime.[8]

As a result of this theoretical debate, there has been a considerable development of the empirical literature. Broda (2000) and Edwards and Levy-Yeyati (2003) are good examples of the evidence regarding the role of the exchange rate regime in isolating the economy from terms of trade shocks that ultimately support Friedman's proposition.[9] Ghosh *et al* (1997) on the other hand, have studied the direct effects on inflation and growth of the choice of regime, finding an an inverse relationship between exchange rate flexibility and output volatility.[10]

Chart I: Evolution of Exchange Rate Regimes 1978-2000



[5] However, the statement that they are 'hollowing out' is more evident for the case of *de jure* than it is for *de facto* regimes. The fading away result is less evident when one uses purely *de facto* instead of a mix of *de facto* and *de jure* classifications as Broda (2000) does.

[6] See Frankel (1999) for a non-technical presentation of Optimum Currency Area and a discussion around its possible application to country cases, specially Argentina.

[7] Larrain and Velasco (2001); pp. 9.

[8] Modeled as Reserve commitment that varies on degree, though it is sufficient with the perception that the commitment is less than full or may change with exogenous circumstances.

[9] Broda (2000) derives an optimization framework and uses a Panel VAR for a post-Bretton Woods sample of 74 developing countries for the period 1974-1996. Edwards and Levy-Yeyati (2003) use a growth equation *a la* Barro and Sala-I-Martin (1995) and estimate an ECM model by FGLS for a cross country (panel) dataset.

[10] However, the links between the choice of regime and output growth are, according to the authors, weak, reflecting the combination of higher productivity and trade growth under flexible regimes with higher investment ratios under pegged ones. Unfortunately, the paper misses the period following 1990 which is associated both with more flexible regimes implementation in developing countries and the occurrence of several exchange rate crises.

This last result that fixed regimes add to output volatility is noteworthy in its own right. Output volatility has concerned macroeconomists in recent times after the emergence of real business cycle theory and endogenous growth theory in the 1980s that suggest links between volatility and long-run growth (Bernanke, 1983; Pindyck, 1991; Stiglitz, 1993).

The arguments briefly presented above show that the debate around the choice of exchange rate regimes is rich and growing. Research on the subject is more active than ever, though the results are still mixed. Consensus will presumably require both new theoretical developments and more empirical analysis.

Capital Flows: Shocks and Growth

Research on shocks to the capital account and their effects on economic performance has seen considerable theoretical and empirical improvements. They include work mainly around three subjects. First, authors like Calvo *et al* (1993) have emphasized the role of external factors in the behavior of capital flows to developing countries and the risk of a capital reversal that this may represent. Along similar lines, Agénor and Montiel (1999) have summarized a set of 'push' and 'pull' factors that made capital flows come back to developing countries in the 1990s.

Second, Edwards (1998) provide evidence on the link between capital flows and the real exchange rate (RER) for the case of Latin America (including Granger-causality tests). Some of this coupled (inverse) movement is due to the nominal exchange rate, while the remainder is explained by the price-absorption effects of the capital surge *a la* Obstfeld (1986), specially in countries with rigid exchange rate arrangements. In latter work (Edwards, 2000), he has studied the role of capital controls in preventing financial crises. In cases like Chile, he argues that capital controls have been successful in changing the maturity profile of capital inflows and, therefore, reducing the potential risk of capital reversals.

Finally, there is now some research regarding the 'boom-and-bust' cycle of capital flows. Contributions like that by McKinnon and Pill (1997) and Fratzscher and Bussiere (2004) are important in that both try to explain how capital inflows that result from liberalization processes have positive and considerable effects on growth in the short and medium run, but may have no effects or even negative ones in the long-run[11].

Following these developments, the literature around the last phase of the cycle has exploded in recent years. Because capital inflow episodes lack the spectacularity of Capital Reversals and Sudden Stops, these phenomena have concentrated most of the attention.

The main theory lessons linking output distress with capital reversals can be summarized in two channels. The first is the 'Keynesian' channel, that is, a collapse in credit which in turn reduces aggregate demand and causes a fall in output. The second is the 'Fisherian' channel; currency crises that hit the financial sector and result in debt deflation and real contraction.

[11] The former uses a Fisher two-period model of borrowing and investing for the aftermath of capital account liberalization, and explains the logic of the 'boom-and-bust' cycle. The second finds empirical support for the McKinnon and Pill hypothesis, using a 1980-2002 sample of 45 developing and developed countries in a 'standard growth model' framework.

Additionally, as suggested by Calvo (1998) and Calvo *et al* (2004), RER depreciation that usually accompanies a Sudden Stop causes bankruptcies in the real sector. This in turn, causes further credit contraction and uncertainty about the solvency of the banking system, leading to bunk runs, bank bankruptcies and crisis in the payments system that finally results in output disruption.

On a notable empirical work, Hutchison and Noy (2002) study the direct effects of negative capital account shocks specially for the case of 'Sudden Stops Crises'. Estimating a growth equation for a panel covering 24 emerging-market economies in the 1975-1997 period, they find large and sometimes lasting negative effects on output of these negative capital account shocks.

Capital Flows and Alternative Policy Regimes

The stylized facts that help to explain why the exchange rate regime may matter when countries face shocks to the capital account are best understood under the complete cycle of capital flows usually associated with developing countries.

The first and obvious case is that of an economy that, either because of financial liberalization or high investment returns (very common phenomena in developing countries), experiences a large surge of capital inflows. If, as in Sachs (1998) and Obstfeld (1986), this results in higher absorption, the equilibrium price ratio of traded to nontraded goods, sometimes called the RER, is likely to change. Under a fixed exchange rate regime, this would happen *via* an increase in the prices in the nontraded sector. This poses a problem. When capital flows reverse, the RER must change again and, under a fixed regime, an economy with (downward) nominal price rigidities would suffer a painful adjustment that would include a considerable output loss.

In the worst-case scenario, the case presented above may result in a major crisis when expectations of devaluation force large and constant central bank intervention in the Forex market to defend the exchange rate. This in turn seriously compromises the Lender of Last Resort (LLR) functions of the central bank and usually ends up in a 'creditor panic' as in Sachs (1998). A flexible exchange rate arrangement, however, would give room for real appreciation *via* the *nominal* exchange rate in the inflows phase, which is much easier to adjust when capitals come to a stop or reverse.

Exchange rate flexibility has its own problems, however, particularly in the final phase of the cycle. When capital comes to a reversal after a phase of inflows, a flexible exchange rate regime is likely to allow a good deal of nominal depreciation. Large devaluations may in turn result in balance sheet problems for the real sector, as formalized by Krugman (1999). This 'open economy Bernanke-Gertler' story explains that due to considerable foreign currency denominated liabilities, devaluations hit the balance sheet of firms in the real sector (frequently leverage-constrained by their own net worth), and end up in an investment collapse and output loss. This type of argument gives an intuitive explanation for the IMF's support to defend the 'peg' in countries facing a reverse in the flows of foreign capital (e.g. Asia 1997-98, Argentina 2001).

The balance sheet story is sometimes objected to by the possibility that, in fact, exchange rate flexibility would prevent such a level of foreign currency indebtedness in the first place, by making foreign firms account for volatility risk. Again, some authors like Calvo

and Reinhart (1999) explain that most developing countries start from a situation of, at least, partial dollarization (i.e., they don't have that much of a choice!) and in any case, exchange rate risk is rarely ignored even in hard-peg economies.

Arguments go back and forth (some well founded, some not so) but again, a solid consensus has not been reached. This inconclusiveness, in turn, is a good starting point to carry on with empirical analyses.

The Empirical Exercise

The model used here for the empirical exercise exploits the direct links between exchange rate regimes, capital flows, and output growth[12]. I follow the now standard literature (Barro (1997), Sachs and Warner (1995)) on growth and specify the (proportional) change in (per capita) output $(\dot{y})$ as a function of: structural changes to the economy, captured by changes in investment *(inv)* and the degree of openness *(open);* domestic policy shocks, captured by changes in domestic credit *(credit)* and government expenditure *(gov)*; changes in the international environment, captured by the growth of the G-7 economies (y_{G-7}); and exogenous shocks which are expressed in terms of shocks to the capital account.[13] Later, I introduce the exchange rate regime as an additional explanatory variable.

Given the limited availability of reliable data on capital flows for developing countries, I exploit here, as Calvo *et al* (1993:115, 116) and Edwards (1998: 52, 81), the close link between capital flows and central banks' foreign exchange reserves. Therefore, shocks to the capital account are proxied by changes in this variable *(R)*.[14] The model to be estimated, with the disturbance term becomes then:[15]

$$\Delta \log y_{it} = \Delta \log y_{it-1} + \alpha_1\, open_{it} + \alpha_2 \Delta inv_{it} + \beta_1 \Delta \log credit_{it} + \beta_2 \Delta\, gov_{it} + \delta\, \Delta \log y_{G-7t} + \psi\, \Delta \log R_{it} + \varepsilon_{it} \qquad \textbf{(1)}$$

The macroeconomic series used here come mainly from the IMF International Financial Statistics (IFS) and the Penn World Tables (also Summers-Heston data), and the model is to be estimated for a panel of 53 developing countries for the 1978-2000 period. The exchange rate regime classification is a slightly more complex matter to which I turn now.

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[12] It is very much in the lines of the work by Hutchison and Noy (2002), Edwards and Levy-Yeyati (2003), and Fratzscher and Bussiere (2004), in that I start from a conventional growth equation and proceed to asses the impact of exchange rate regimes and shocks.

[13] This is similar to the approach used by Edwards and Levy-Yeyati (2003) only that they do it for the case of terms of trade shocks. The assumption of capital flows exogeneity is made on the grounds of what Calvo et al (1993) describe as external factors and Agénor and Montiel (1999) call 'push' factors. The evidence provided by these two authors supports the view that a good deal of flows to developing countries is determined by factors outside these economies.

[14] It is worth mentioning, though, that these authors do this for specific regions and periods of time and it becomes somewhat risky to generalize this procedure, specially when dealing with floating exchange rate regimes.

[15] I include one period lag for every variable (except for the G-7 average growth) in order to allow for delays in the output response to macroeconomic developments

Exchange Rate Regime Classification

The current situation of exchange rate regimes around the world is still far from that of academic circles and the popular 'bipolar view' is not a practical reality. The academic literature recognizes the use of at least nine currency regimes: currency unions, currency boards, truly fixed exchange rates, adjustable pegs, crawling pegs, basket pegs, target zones (bands), managed floats and free floats (Frankel, 1999). However, using nine different regime classifications implies a degree of detail in both the estimation and interpretation of results that is hardly attainable. Therefore, classifying them appropriately for applied research becomes crucial.

Additionally, one has the mismatch between the official regime announced by governments and the effective one, i.e. the one supported by the facts. It is has been widely admitted (Williamson, 2000; Edwards, 2000; Calvo and Reinhart 2000), even by the Fund officials themselves (Fischer, 2001) that in particular developing countries tend to run a *de facto* regime that is not consistent with the *de jure* regime reported to the IMF. The 'fear of floating' and 'hidden pegs' phenomena are expressions of this 'identification' problem.

Fortunately, some progress has been made towards developing a more realistic and practical classification. Examples of such progress are the works by Reinhart and Rogoff (2004), Broda (2000) and Levy Yeyati and Sturzenegger (2005). The last of these is particularly useful since the authors provide a *de facto* classification of regimes after studying the behavior of the relevant variables for most of the IMF-reporting countries for the period 1974 – 2000.[16] The results from their research help greatly in solving the 'classification' and the 'identification' problems and for this reason, they are used in the present work as the main source of exchange rate classification.

Estimation Strategy

There are two main features of the model presented in **(1)** that motivated the specification and estimation procedure. First, autocorrelation and persistence in the data, which is particularly high in growth models, require a dynamic estimation like the one presented in equation **(1)**. The estimation of this sort of model is not trivial however, since it is subject to the complexities of estimating panels with lagged dependent variables (LDV). The latter issue will be addressed below in more detail.

Second, the nature of the data also suggests that the model is likely to be characterized by idiosyncratic differences between countries that are relatively constant through the time in the sample. In the context of panel data models a Breush-Pagan test is a formal way to asses the need for country specific effects. Where country specific effects are deemed unnecessary by the B-P test, the data are pooled and the models are estimated by a standard instrumental variable approach. When performed, the test suggested the need

[16] The authors use measures of exchange rate, reserves, and exchange rate volatility so that their classification is not entirely based on outcome (exchange rate) or policy (intervention), but uses both. Under a K-Means Cluster analysis (KMC), they treat each country-year as an independent observation and carefully engage in the difficult task of differentiating between non intervention that is caused by the absence of shocks with true float-non-intervention behavior.

for these effects. Failure to account for unobservable heterogeneity imposes invalid restrictions on the coefficients.

However, the now included LDV will be correlated with the disturbance, even if the disturbance itself is assumed not to be autocorrelated (Greene, 2003). Under these circumstances, least squares estimation, that is, OLS or LSDV in the context of Fixed Effects, results in estimates that are neither unbiased nor consistent (the finite sample bias does not disappear since in this context, the large-sample results are obtained with respect to the number of 'panels' growing, n, not the number of periods, t). The use of conventional instrumental variables (IV) and Generalized Method of Moments (GMM) estimators are alternatives to overcome this problem.

Among the options left, it is now well documented (Baltagi, 2005; Greene, 2003) that the Arellano-Bond (A-B) estimator is, in most applications, more efficient than other IV estimators such as the Hausman-Taylor, and Anderson-Hsiao procedures.[17] Moreover, this estimator has been shown to perform well in macro panels of the type studied here (Judson and Owen, 1999).[18]

For the reasons presented above, I use the one-step GMM estimator suggested by Arellano and Bond (1991) to estimate the model in **(1)**.[19] Briefly, the procedure consists in taking first-differences from the dynamic model regression equation in order to remove unobserved time-invariant country-specific effects, and then instrument the right hand side variables in first-differenced equations using levels of the series, lagged two periods or more. This is done, however, *'under the assumption that time-varying disturbances in the original levels equations are not serially correlated'* (Bond et al, 2001).

The panel used is unbalanced in the sense that consecutive observations on individual units are available, but the number of time periods available may vary from unit to unit.[20] As pointed by Arellano and Bond (1991), the econometric methods suffer no fundamental change, provided a minimal number of continuous time periods are available for each unit. Accordingly, the condition to include a country in the sample was the availability of data (and regime classification) for at least 10 consecutive years. That was the only selection criteria applied to the sample.

Results of the Exercise

Equation **(1)** is estimated as the 'benchmark' regression reflecting the effect of capital flows in growth. Afterwards, new explanatory variables are added including: the exchange rate regime at work; the interaction between the regime at work and the capital flows variable and separate terms for negative and positive capital flows with their respective interactive terms. The alternative specifications become respectively:

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[17] Using some examples, Arellano and Bond (1991) report that the standard deviation of the GMM estimator is around four times smaller than the mentioned Anderson-Hsiao estimator.

[18] From the papers mentioned above, Fratzscher and Bussiere (2004) use the A-B GMM as their main estimator, while Hutchison and Noy (2002) use it in the robustness section of their exercise as an alternative to the HT-IV. Edwards and Levy-Yeyati (2003) use the Feasible Generalized Least Squares with panel corrected standard errors procedure suggested by Beck and Katz (1995), but they point out that the A-B would be an alternative.

[19] These authors suggest interpreting the results from the one-step GMM estimator instead of the two-step one which may produce downward-biased standard error estimates.

[20] The use of unbalanced panels allows to exploit a much larger sample which in turn may reduce the impact of self selection of units in the sample.

$$\Delta \log y_{it} = \lambda \Delta \log y_{it-1} + \alpha_1 \, open_{it} + \alpha_2 \Delta inv_{it} + \beta_1 \Delta \log credit_{it} + \beta_2 \Delta \, gov_{it} + \delta \, \Delta \log y_{G-7t} + \psi \, \Delta \log R_{it} + \phi \, fixed_{it} + \varepsilon_{it}, \quad \textbf{(2)}$$

$$\Delta \log y_{it} = \lambda \Delta \log y_{it-1} + \alpha_1 \, open_{it} + \alpha_2 \Delta inv_{it} + \beta_1 \Delta \log credit_{it} + \beta_2 \Delta \, gov_{it} + \delta \, \Delta \log y_{G-7t} + \psi \, \Delta \log R_{it} + \phi \, fixed_{it} + \gamma \, \Delta \log R_{it} \cdot fixed_{it} + \varepsilon_{it}, \quad \textbf{(3)}$$

$$\Delta \log y_{it} = \lambda \Delta \log y_{it-1} + \alpha_1 \, open_{it} + \alpha_2 \Delta inv_{it} + \beta_1 \Delta \log credit_{it} + \beta_2 \Delta \, gov_{it} + \delta \, \Delta \log y_{G-7t} + \psi_1 \, \Delta \log R_{it} \_ positive + \psi_2 \, \Delta \log R_{it} \_ negative + \phi \, fixed_{it} + \pi_1 \log R_{it} \_ positive \cdot fixed \varepsilon_{it} + \pi_2 \log R_{it} \_ negative \cdot fixed \varepsilon_{it}, \quad \textbf{(4)}$$

Table I shows the results from this series of estimations. Since GMM estimation relies heavily upon the assumption that there exists no second-order autocorrelation (Baltagi, 2005: 141), and that the overidentifying restrictions posed by the use of instruments are valid, the respective tests are also presented in Table I.[21]

The results from estimating **(1)**, apart from the ambiguous significance of lagged growth and government expenditure, are fairly satisfactory.[22] They show that both contemporaneous and delayed effects of capital flows on growth are positive, though contemporaneous effects are somewhat small. After the second year of a once-and-for-all ten percentage points decrease on the reserves growth rate, the accumulated output loss accounts for about 0.2 percentage points on average. If the decrease is held for two consecutive years however, the output growth toll by the third year becomes 0.38 percentage points. The effects of capital flows on growth are therefore substantial.

Estimation of **(2)** results in the assessment of the direct effects of the choice of regime on growth. Under this specification, the variable $fixed_{it}$ takes the value of 1 if the country *i* ran a *de facto* fixed exchange rate on year *t* and zero otherwise.[23]

The outcome shows that a fixed exchange rate regime has positive contemporaneous effects but negative lagged effects on growth. Choosing a fixed regime in year *t* entails a transitory output growth gain of 0.51 percentage points but a loss in year *t+1* of about 0.55 percentage points. The latter effect is not mitigated by the transitory growth gain if the economy decides to abandon the fixed regime (i.e., to run a float in *t+1*). This result suggests that there exist costs to abandoning these type of regimes as pointed out by Edwards (2000) and gives support to the 'exiting strategies' view.

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[21] The test for no second-order autocorrelation is the Arellano-Bond test that average autocovariance in the residuals of order 2 is 0 and the test for overidentifying restrictions uses the Sargan chi-squared statistic. It is known, however, that this test tends to over-reject the null that the restrictions are valid when the homoskedasticity assumption is violated. Therefore, if the null is not rejected in the homoskedastic case, it is expected that the restrictions are valid under the heteroscedastic case as well. Following this reasoning, the test is presented along with the estimation results.

[22] Full interpretation of all the coefficients is available upon request in the thesis version of this research.

[23] Since capital flows seem to have delayed effects on growth, the previous year's regime classification $(fixed_{it-1})$ was included in the regression.

I estimated equation **(3)** in order to account for the joint effects of capital flows and alternative exchange rate regimes. Interestingly, the estimates for contemporaneous and lagged interactive terms are of opposite sign. They suggest that on the same year the outflow happens, the growth consequences are close to zero. Nonetheless, in the following year, output growth would fall by 0.25 percentage points. On the other hand, running a flexible regime would result in a contemporaneous growth loss of 0.11 percentage points, plus a smaller loss (w.r.t. a fixed regime) in the following year of 0.15 percentage points, on average. Overall, the cumulative effect on output growth after two years is not different, but growth becomes much more volatile when a country decides to operate under a *de facto* fixed exchange rate regime.

After estimating equation **(4)**, one looks into the asymmetric effects that capital inflows and outflows may have. Following the outcome, capital flows seem to have only lagged effects on growth and, interestingly enough, they do not depend on the choice of regime. Capital flight on the other hand does depend on it. Under a fixed regime, a reduction of the same amount in the growth rate of reserves entails almost no effect on output growth. In the following year, though, the capital flight causes an average fall in output growth of 0.39 percentage points. This is a considerably larger effect than the one found before differentiating between negative and positive shocks. Again, the cumulative effect under a flexible regime after two years is not very different, showing 0.41 percentage points loss in growth. However, the effects on each year are quite different with an average loss of 0.27 p.p. in the first year and 0.14 in the following.

The series of estimations carried out above provide some insights into growth behavior under changing capital flows and outline the role of the exchange rate regime. On a cumulative growth basis there seems to be little difference in the choice of either exchange rate arrangement. However, impact and short-run dynamics are substantially different.

Robustness and Limitations

In addition to these regressions, a robustness analysis was performed. First, the sample was split into regions: Asia, Latin America and Africa, but the results were very similar to the main ones reported here. Second, a different exchange rate regime classification was used: instead of taking 'crawling pegs', 'baskets' and 'managed floats' as flexible arrangements, I included 'crawling pegs' in the 'fixed' category since they are sometimes argued not to have the flexibility required to allow smooth adjustments in the real exchange rate. After doing this, the outcome changed greatly as the choice of regime did not seem to help in explaining growth dynamics anymore. This suggests therefore that crawling pegs have played a role in the last two decades in helping developing countries to stabilize output and cope with capital account shocks.[24]

Finally, one has to explore which objections may apply to the exercise. The first limitation is that the use of Reserves as proxy for capital flows may be problematic. Though it has been used to some extent in previous research, it is

[24] This is not equivalent, however, as to say that they help developing economies to successfully manage oil, debt or confidence crises. This issue requires further research taking detailed account of the occurrence of these episodes and their interaction with alternative exchange rate regimes.

somewhat risky to generalize the procedure to a broad sample like the one used here. The second ones is the use of a purely *de facto* regime classification which has been criticized to be essentially backward looking (Ghosh *et al.* 1997, 2002). In other words, the results can be contaminated by what I call the exchange rate 'surprise' (as in the money surprise), i.e. the difference between the expected exchange rate regime and the actual one that results when the authorities do not hold to their commitments. Lastly there is a remark to be made concerning the choice of estimator. Bond *et al* (2001) state that when time series are persistent (output is a highly persistent series) and the number of observations are small, the first-differenced GMM estimator is poorly behaved. Although this is a potential caveat to the exercise carried out here, the period considered is rather long (17 years on average), relative to common panel data studies where the number of periods are around 5, as exemplified by Bond *et al* (2001) themselves.

Conclusion

The present paper has carried out an empirical exercise that accounts for the output growth response of capital flows and different exchange rate regimes on a cross-country basis. The results suggest that fixed exchange rate regimes are associated with more volatile output growth, an issue that has concerned macroeconomists for long. They also highlight that the effects of capital outflows are more persistent than those of capital inflows and that the former are sensitive to the choice of regime while the latter are not. Last but not least, the outcome illustrates the fact that fixed regimes delay the impact of capital outflows but result in a greater growth loss one year after they take place.

These results are suggestive and recall that the occurrence of international crises involving large swings in the capital account should be an incentive for academics and policy makers to look into the role of exchange rate regimes in dealing with this type of event. Further research on the subject may well investigate these issues with more accurate data or methods if available, or for a more recent period (i.e. 2000-2005). Moreover, new work around the subject could explore the endogeneity of the choice of regime, a sharp issue that deals with the simultaneity of the relevant variables.

Table I – Estimation Results

Dependent variable real GDP growth ($\Delta log\ y$)

Regressor	Benchmark (1)	XR Regime (2)	Combined FX (3)	Asymmetric FX (4)
Real GDP growth *(t-1)*	0.0736 (0.046763)	0.07341 (0.04699)	0.077102* (0.04721)	0.073166 (0.04724)
Openness				
(t)	-0.00102*** (0.0002)	-0.00103*** (0.0002)	-0.0010*** (0.0002)	-0.00103*** (0.0002)
(t-1)	0.00098*** (0.0002)	0.00097*** (0.0002)	0.00098*** (0.0002)	0.00098*** (0.0002)
Change in Investment				
(t)	0.00134** (0.00040)	0.00134** (0.00068)	0.001368** (0.0007)	0.001364** (0.00066)
(t-1)	0.00172*** (0.00034)	0.00179*** (0.00034)	0.001792***(0.00033)	0.00178*** (0.00034)
Change Govnt. Expenditure *(t)*	-0.001054 (0.0007)	-0.001031 (0.00067)	-0.000998 (0.00067)	-0.001021 (0.00067)
Growth of Reserves				
(t)	0.00647* (0.0035)	0.00655** (0.00341)	0.011908***(0.00335)	
(t-1)	0.01408*** (0.0032)	0.01361*** (0.00307)	0.014989***(0.00314)	
Credit Growth				
(t)	-0.005779** (0.0026)	-0.005151** (0.00259)	-0.005250**(0.00260)	-0.00504** (0.00253)
(t-1)	-0.005154** (0.0026)	-0.003987 (0.00261)	-0.004210 (0.00276)	-0.00447 (0.00279)
G-7 real GDP Growth *(t)*	0.278518*** (0.0980)	0.27852*** (0.09801)	0.305350**(0.09618)	0.29853*** (0.09511)
Exchange Rate Regime				
(t)		0.00511** (0.00205)	0.00588***(0.00215)	0.003662* (0.0023)
(t-1)		-0.00546***(0.00196)	-0.00635***(0.00209)	-0.004564** (0.0024)
Regime xReserves Growth				
(t)			-0.01326***(0.00396)	
(t-1)			0.00960** (0.00505)	
Negative Reserves Growth[1]				0.026555*** (0.0067)
(t)				0.014482** (0.0650)
(t-1)				
Positive Reserves Growth				
(t)				0.0047614 (0.0057)
(t-1)				0.012595*** (0.0372)
Positive Reserves Growth x Regime				-0.005392 (0.00857) 0.006238 (0.00951)
Negative Reserves Growth x Regime				-0.0280*** (0.00969) 0.0244*** (0.00951)
Sargan test for the homoskedasticity case	chi2(438) = 381.56 Prob > chi2=0.9757	chi2(438) = 382.68 Prob > chi2=0.9733	chi2(438) = 385.52 Prob > chi2=0.9661	chi2(438) = 396.55 Prob > chi2=0.9229
Arellano-Bond test that average autocovariance in residuals of order 2 is 0 (H_0: no second order autocorrelation):	z = -0.70 Pr. > z = 0. 4843	z = -0.63 Pr. > z = 0. 5268	z = -0.56 Pr. > z = 0.5765	z = -0.68 Pr. > z = 0.4945
Number of Observations	939	939	939	939
Number of Countries	53	53	53	53
Average observations per country	17.71	17.71	17.71	17.71

***, ** and * mean significant at the 1%, 5% and 10% confidence level respectively. Heteroskedasticity corrected standard errors in brackets. The Sargan test corresponds the same regression without heteroskedastic standard errors. The null hypothesis for this test is that the overidentifying restrictions posed by the use of instruments are valid.

References

Agénor, Pierre-Richard and Peter Montiel. 1999. *Development Macroeconomics*, Second Edition. Princeton.

Agénor, Pierre-Richard. 1994. "Credibility and Exchange Rate Management in Developing Countries". *Journal of Development Economics (vol. 45):* 1-16.

Arellano, Manuel and Stephen Bond. 1991. "Some Tests of Specification for Panel Data: Mote Carlo Evidence and an Application to Employment Equations". *Review of Economic Studies (58):* 277-297.

Baldwin, Richard and Philippe Martin. 1999. "Two Waves of Globalization: Superficial Similarities Fundamental Differences". *NBER Working Paper no. 6904*. National Bureau of Economic Research, Cambridge, MA.

Baltagi, Badi H. 2005. *Econometric Analysis of Panel Data*, third edition. John Wiley & Sons, Chichester, UK.

Barro, R. 1997. *Determinants of Economic Growth*. MIT Press, Cambridge, MA.

Bernanke, Ben S. 1983. "Irreversibility, Uncertainty, and Cyclical Investment." *Quarterly Journal of Economics (98):* 85-106.

Bond, Stephen; Anke Hoeffler and Jonathan Temple. 2001. "GMM Estimation of Empirical Growth Models". *Economic Paper 2001-W21*, Economics Group, Nuffield College, University of Oxford.

Broda, Christian. 2001. "Coping with Terms of Trade Shocks: Pegs versus Floats". *American Economic Review (vol. 91):* 376-380.

Broda, Christian. 2000. "Terms of Trade and Exchange Rate Regimes in Developing Countries". Massachusetts Institute of Technology, Cambridge, MA.

Buffie, Edward; Christopher Adam; Stephen O'conell & Catherine Pattillo. 2004. "Exchange Rate Policy and the Management of Official and Private Capital Flows in Africa". *IMF Working Paper 04/216*, International Monetary Fund.

Calvo, Guillermo and Carmen Reinhart. 2000. "Fear of Floating". University of Maryland.

Calvo, Guillermo and Carmen Reinhart. 1999. "Capital Flow Reversals, the Exchange Rate Debate and Dollarization". *Finance and Development*, Vol. 36, No. 3: 13-15

Edwards, Sebastian. 2000. "Exchange Rate Regimes, Capital Flows and Crisis Prevention". *UCLA draft for conference presentation*.

Edwards, Sebastian. 1998. "Capital Flows, Real Exchange Rates and Capital Controls: Some Latin American Experience". *NBER Working Paper 6800*. National Bureau of Economic Research, Cambridge, MA.

Edwards, Sebastian. 2002. "The Great Exchange Rate Debate after Argentina". *Journal of Economics and Finance (13*): 237-252.

Fischer, Stanley. 2001. "Exchange Rate Regimes: Is the Bipolar View Correct?" *Journal of Economic Perspectives (vol. 15):* 3-24.

Fratzscher, Mrcel and Matthieu Bussiere. 2004. "Financial Openness and Growth: Shor-Run Gain, Long-Run Pain?" *ECB Working Papers No. 348*. European Central Bank.

Frankel, Jeffrey A. 1999. "No Single Currency Regime is Right for all Countries or at All Times". *Essays in International Finance, No. 215*. Princeton University: Princeton, New Jersey.

Friedman, Milton. 1953. "The Case For Flexible Exchange Rates", in: *Essays in Positive Economics*. The University of Chicago Press: 157-204.

Ghosh, Atish R., Anne-Marie Gulde, Jonathan D. Ostry and Holger C. Wolf. 2002. *Echange Rate Regimes: Choices and Consequences*. MIT press, Cambridge, MA.

Ghosh, Atish R., Anne-Marie Gulde, Jonathan D. Ostry and Holger C. Wolf. 1997. "Does the Nominal Exchange Rate Regime Matter?". *NBER Working Paper No. 5874*. National Bureau of Economic Research, Cambridge, MA.

Greene, William H. 2003. *Econometric Analysis*, fifth edition. Pearson Education.

Heston, Alan, Robert Summers and Bettina Aten. 2002. Penn World Table Version 6.1, *Center for International Comparisons at the University of Pennsylvania (CICUP)*

Hutchison, Michael and Ilan Noy. 2002. "Sudden Stops and the Mexican Wave: Currency Crises, Capital Flows Reversals and Output Loss in Emerging Markets". *Economic Policy*

Research Unit Working Paper 2002-12. Institute of Economics, University of Copenhagen, Denmark.
International Monetary Fund. 2005. International Financial Statistics (IFS) website: http://ifs.apdi.net/imf/ .
Judson, R.A. and Owen, A.L. 1999. "Estimating Dynamic Panel Data Models: A Guide For Macroeconomists". *Economics Letters 65(1);* 9-15
Khan, Mohsin S. 2003. "Current Issues in Design and Conduct Monetary Policy". *IMF Working Papers*. IMF Institute.
Krugman, Paul. 1999, "Balance Sheets, Financial Crises, and the Transfer Problem" available at http://web.mit.edu/krugman/www/FLOOD.pdf
Larrain, Felipe and Andres Velasco. 2001. "Exchange Rate Arrangements for Emerging Market Economies". *Essays in International Economics, No. 224*. Princeton University: Princeton, New Jersey.
Levy-Yeyati, Eduardo and Federico Sturzenegger. 2005. "Classifying Exchange Rate Regimes: Deeds vs. Words". *European Economic Review (49):* 1603-1635.
McKinnon, Ronald and Huw Pill. 1997. "Credible Economic Liberalizations and Overborrowing". *American Economic Review (87):* 189-193.
Obstfeld, Maurice. 1996. "Models of Currency Crises with Self-fulfilling Features". *European Economic Review (40):* 1037-47.
Obstfeld, Maurice. 1986. "Capital Flows, the Current Account and the Real Exchange Rate: Consequences of Stabilization and Liberalization" in: *Economic Adjustment and Exchange Rates in Developing Countries*. Edited by Sebastian Edwards and Liaquat Ahamed.
Pindyck, Robert. 1991. "Irreversibility, Uncertainty, and Investment." *Journal of Economic Literature (29):* 1110-1148.
Reinhart, Carmen. 2000. "The Mirage of Floating Exchange Rates". *American Economic Review (vol. 90):* 65-70.
Sachs, Jeffrey. 1998. "Creditor Panics: Causes and Remedies". *Harvard Institute for International Development*. Cambridge, Massachusetts.
Sachs, Jeffrey D. and Andrew Warner. 1995. Economic Reform and the Process of Global Integration. *Brooking Papers in Economic Activity* vol, 1995, issue 1:1-118.
Stiglitz, Joseph E. (1993). "Endogenous Growth and Cycles." NBER Working Paper No.4286.
Williamson, John. 2001. "From Bretton Woods to Bipolarity: The Evolution of Thought on Exchange Rate Regimes, 1971-2001". Institute for International Economics.

Appendix A: Description of the Data

A1. Variable Definitions and Sources

The series of estimations carried out in the main text use the following variables and sources:

y_{it} = Real GDP per capita at current prices from the Penn World Tables version 6.1.

$open_{it}$ = Degree of openness of the economy measured as exports plus imports divided by GDP (in %), from the Penn World Tables version 6.1.

inv_{it} = Investment at current prices as share of GDP, from the Penn World Tables version 6.1.

$credit_{it}$ = Domestic Credit at current prices from the International Financial Statistics (IFS) at the IMF.

gov_{it} = Government expenditure at current prices as share of GDP, from the Penn World Tables version 6.1.

R_{it} = Central Bank's total Reserves minus gold from the IFS at the IMF.

$fixed_{it}$ = Exchange rate regime classification in *fixed* or *flexible* from Levy-Yeyati and Sturzenegger (2005).