

# The New Wave of Private Capital Inflows

## Push or Pull?

*Eduardo Fernandez-Arias*

In most cases, push. Lower international interest rates are a key factor in the new wave of capital inflows to developing countries. Whether that wave is sustainable depends on the economic performance of industrial countries. This makes developing countries vulnerable — but a soft landing is feasible.



## Summary findings

Widespread private capital inflows to middle-income countries have surged over the past three years. At the same time, Brady-type debt reduction operations and domestic policy reform took place, indicators of country creditworthiness improved dramatically, and international interest rates plummeted. Which factors most fully explain the wave of capital inflows? How sustainable is it?

Some see this new wave of voluntary capital inflows as being mostly "pulled" by attractive domestic conditions, which open new and profitable investment opportunities in the domestic economy and improve country creditworthiness. Under this interpretation, if successful domestic policies are maintained, capital inflows will be sustained.

Others see these inflows as being mostly "pushed" by conditions (especially low interest rates) in industrial countries. Under this interpretation, capital inflows would diminish and possibly turn to outflows if international real interest rates returned to the higher levels of the 1980s.

Fernandez-Arias presents an analytical model of international portfolio investment in developing countries based on non-arbitrage conditions between external returns and domestic returns adjusted by country risk. He uses the model to explain why the new wave of private capital inflows is mostly a middle-income country phenomenon. To analyze the issue of private

capital inflows, he applies the model to data for a representative panel of middle-income countries.

The main empirical result is that (except in Argentina, the Republic of Korea, and notably, Mexico), the surge of capital inflows appears to be driven more by low returns in industrial countries than by domestic factors. So recent levels of capital inflows would be unsustainable if global interest rates returned soon to higher levels and cautious policies should be followed.

Two other important conclusions are obtained. First, depressed returns in industrial countries caused the improved creditworthiness in indebted countries through their effect on discount rates. Country creditworthiness was an important transmission mechanism for external shocks and is the key to reconciling the push and pull interpretations of market data.

Second, a soft landing appears feasible. Stock adjustment does not appear to be a significant component of the adjustment mechanism manifested in the surge of capital inflows. In other words, the evidence so far suggests that a gradual increase in international interest rates would result in less capital inflow, or moderate capital outflows in some countries, rather than massive capital outflows that quickly bring down the stock of foreign liabilities. By and large, if there are capital outflows, they are unlikely to match past inflows unless the reversal in external conditions coincides with a worsening of domestic conditions.

---

This paper — a product of the Debt and International Finance Division, International Economics Department — is part of a larger effort in the department to analyze foreign investment in emerging markets. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Ronald Tutt, room S8-040, extension 31047 (20 pages). June 1994.

*The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be used and cited accordingly. The findings, interpretations, and conclusions are the authors' own and should not be attributed to the World Bank, its Executive Board of Directors, or any of its member countries.*

## Appendix 1 - Data.

$$PF_{4,t} = \left( \frac{PF_{it}}{(GNP_{i,1988})(CPI_{US,t})} \right) \times 4$$

$$RFDEV_{4,t} = (RF_{it} - \overline{RF}_{1,89})$$

$$RDEV_{it} = (LR_{it} - \overline{LR}_{1,89})$$

$PDEV_{it}$

$$\overline{RF}_{1,89} = \text{Average of RF over 1989}$$

$$\overline{LR}_{1,89} = \text{Average of LR over 1989}$$

$$\overline{P}_{1,89} = \text{Average of RF over 1989}$$

$$PF_{it} = \text{Total Portfolio Flows. Source: IECDI staff estimates}$$

$$RF_{it} = \text{US 10 year government bond yield - Source: line 61 IMF International Financial Statistics. The monthly interest rate was taken and the quarterly annualized average was calculated.}$$

$$P_{it} = \text{Log of secondary market price of Commerical Bank debt. Two weekly data was taken and the quarterly average was calculated. Source: Salomon Brothers.}$$

$$VP_{88} = \text{Gross National product - Source - IMF International Financial Statistics}$$

$$CPI_{US} = \text{Consumer price index for the US - Source: IMF International Financial Statistics.}$$

## SUMMARY

Widespread private capital inflows to middle-income countries have surged over the last three years. At the same time, Brady-type debt reduction operations and domestic policy reform took place, country creditworthiness indicators dramatically improved, and international interest rates plummeted. Which factors are most important in explaining this wave of capital inflows and, consequently, how sustainable is it? This is a subject of debate with important implications for policy as well as positive analysis.

Some see this new wave of voluntary capital inflows as being mostly "pulled" by attractive domestic conditions, which open new and profitable investment opportunities in the domestic economy and improve country creditworthiness. Under this interpretation, successful domestic policies are the key and, if maintained, capital inflows would be sustained. Others, however, see these inflows as being mostly "pushed" by conditions in industrial countries, especially the low interest rates prevailing there. In this interpretation, capital inflows would not be sustained if international real interest rates returned to the higher levels of the 1980s.

This paper presents an analytical model of international portfolio investment in developing countries based on non-arbitrage conditions between external returns and domestic returns adjusted by country risk. This model is used to explain why the new wave of private capital inflows is mostly a middle-income country phenomenon. To analyze the issue at hand, the model is operationalized and a tractable estimating equation is obtained and used for a representative panel of middle-income countries. The main empirical result is that, with a few exceptions, most notably Mexico, the surge of capital inflows appears to be largely driven by low returns in industrial countries, as opposed to domestic factors. Consequently, recent levels of capital inflows will prove to be unsustainable if global interest rates soon return to higher levels.

The structural analysis of this process yields two important insights. First, it is shown both theoretically and empirically that depressed returns in industrial countries cause the improvement of creditworthiness in indebted countries through their effect on discount rates, which supports the view that country creditworthiness has been an important transmission mechanism of external shocks and provides the key for reconciling the "push" and "pull" interpretations of similar data.

Second, soft landing appears feasible. The dynamic observed behavior of capital inflows does not appear to have a significant component of stock adjustment. Therefore, prevailing conditions determine capital inflows irrespective of their accumulated stock. This implies that sudden capital outflows rapidly reversing past inflows are not to be expected unless the reversal in external conditions is coupled with a concurrent worsening in domestic conditions.

## INTRODUCTION

Widespread private capital inflows to middle-income countries have surged over the last three years. At the same time, Brady-type debt reduction operations and domestic policy reform took place, country creditworthiness indicators dramatically improved, and international interest rates plummeted. Which factors are most important in explaining this wave of capital inflows and, consequently, how sustainable is it? Policy designed to deal with capital inflows and their consequences requires a clear understanding of these issues.

The surge in voluntary private capital inflows over the last few years to several developing countries, including many of the classical Latin American debt crisis examples, has reminded both analysts and policymakers that reluctant foreign investment and capital rationing is not an unavoidable, sad fact of life and that international capital markets could again be a significant source of finance. Unfortunately, economists are not yet ready to answer whether these capital flows are being "pushed" by low interest rates in industrial countries or "pulled" by higher returns in developing countries, nor to assess the sustainability of these capital inflows.

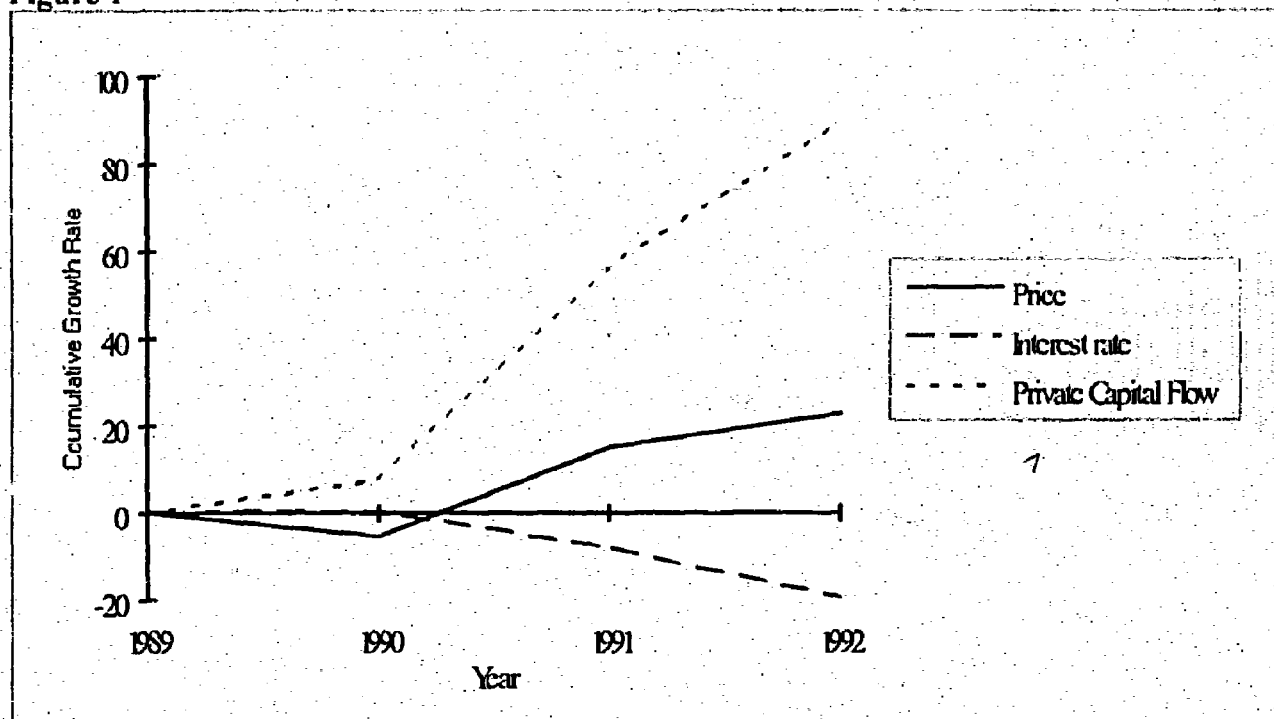
Some see this new wave of voluntary capital inflows and rapidly improving creditworthiness as the evidence that debt strategies have worked and domestic policies are on the right track. In this view, domestic factors are more important than external factors in explaining these inflows. This is the "pull" story (see Chuhan, Claessens and Mamingi, 1993). It leads to the optimistic view that the sustainability of these flows is to a large extent a function of domestic policies which are under the control of developing countries. Under this interpretation, successful domestic policies are the key and, if maintained, capital inflows would be sustained. By contrast, for others (Calvo, Leiderman and Reinhart (1993)) the surge in capital inflows is the result of factors external to developing countries, such as the fall in international interest rates. This "push" story leads to the concern that these flows are highly volatile because they are subject to factors beyond the control of policymaker and calls for cautious policies. In this interpretation,

capital inflows would not be sustained if international interest rates returned to the higher levels of the 1980s.

The "pull" story in Chohan et al. is partly based on the observation that country creditworthiness appears to play a very substantial role in explaining the inflows compared to that of international interest rates. However, the critical and seemingly obvious assumption that country creditworthiness indicators reflect domestic factors as opposed to external factors, is unwarranted. In this paper I show, both theoretically and empirically, that external factors have a substantial impact on country creditworthiness, a channel through which domestic economies are exposed to exogenous shocks. Therefore country creditworthiness is not a good proxy for domestic factors. For this conceptual reason, as well as other more technical reasons, this paper radically differs in its interpretation and reaches very different conclusions despite broadly similar data.

In this paper, I find clear support for the "push" story. With very few exceptions, most notably Mexico, external factors appear to be the most important in explaining the recent surge in capital inflows. Consequently, recent levels of capital inflows will prove to be transitory if global interest rates soon return to the higher levels of the 1980s. Nevertheless, soft landing may be possible. The dynamic behavior of capital inflows does not appear to have a significant component of stock adjustment. Capital inflows appear to be responding only to contemporaneous conditions irrespective of their accumulated stocks. Therefore, they should not be seen as a way of accomplishing stock levels in line with prevailing conditions, a result that could be obtained depending on the relative importance of the channels through which inflows affect returns, as later explained. This implies that sudden capital outflows rapidly reversing past inflows, that is negative stock adjustments, are not to be expected unless reversal in external conditions is coupled with a concurrent worsening in domestic conditions.

Figure 1



Private Capital Flows Foreign Direct Investment plus Total Portfolio flows to all Developing countries.

Source: World Debt Tables and IECDI staff estimates.

Interest rate 10 year US Govt. bond yield.

Price: Overall Annual average of secondary market prices.

Source: Salomon Brothers.

This paper develops a structural model of international portfolio allocation in which the importance of country creditworthiness is made explicit and its determinants analyzed. This structural analysis is able to overcome some of the limitations of the "push" story in Calvo et al. where capital inflows in Latin America are proxied by changes in international reserves<sup>1</sup> and inferences are based only on the statistical analysis of common factors. First, quarterly portfolio capital inflows are measured directly for a comprehensive panel of middle-income developing countries. Second, the underlying linkages and channels are addressed both analytically and empirically. Third, the findings in Calvo et al. appear hard to reconcile with the traditional portfolio model where the key

<sup>1</sup> Chohan et. al (1993) show that change in reserves is a poor proxy of capital inflows.



determinant of flows is return differentials. In such a model equal changes in domestic and foreign returns should have effects on flows equal in size. Since significant changes in domestic returns have systematically failed to cause large capital inflows over the last several years, the effects of international interest rates in Calvo et al. would be implausibly large compared to that of domestic returns. Furthermore, the absence of voluntary private inflows to entire regions, such as Sub-Saharan Africa, contradicts the presumption of widespread inflows across countries (as found in Latin America) which is the basis for the conclusions in their paper. The model here is, by contrast, consistent with all the evidence.

This paper is organized as follows. Section I sketches a simplified international portfolio allocation model focusing on the role of country creditworthiness and its determinants. In particular, it provides the analytical framework for the key issues discussed later in the paper: the nature of the factors underlying the increased inflows, the channels through which they operate, and their volatility and dynamic implications. Section II operationalizes the model in section I by considering a suitable burden-sharing model of country risk and treating improvements in the domestic economic climate as an underlying unobserved variable. Section III contains the empirical statistical analysis of such a model in connection with the issues discussed above and Section IV concludes. Appendixes with statistical information follow.

## **I. A SIMPLE INTERNATIONAL PORTFOLIO ALLOCATION MODEL**

### ***The Model***

The key reason why the financial evaluation of foreign investment differs from domestic investment is that the first requires the analysis of relevant "country" factors, such as future exchange rates, balance of payments difficulties and controls, and, more generally, the various ways in which foreign investors can be taxed implicitly or explicitly.

Returns to investment abroad can be thought as coming from two sources: the individual "project" and global "country" factors. The first source is common with domestic investors of the recipient country. The second source is specific to foreign investors.<sup>2</sup>

This second source of returns is particularly relevant and cannot be ignored by foreign investors investing in developing countries. Its main components are "volatility" (for example, future exchange rates may be subject to great uncertainty) and "default risk." While the first type of factors would only affect the variability of returns but not its expected mean, the presence of "default risk" does reduce mean returns (as well as further increasing return variability). The combination of these country factors results in the need for adjusting "project" returns: expected mean returns should be revised downwards and variability should be increased.<sup>3</sup>

In developing countries with substantial default risk and low creditworthiness the effect of shocks on mean returns is likely to be relatively more significant, and therefore dominate the effect on variability. For these countries, first moments, as opposed to second moments, are likely to be a sufficiently good approximation to describe changes in foreign investors' choices between investing in these developing countries or elsewhere. The standard mean-variance portfolio models based on the trade-offs between first and second moments facing risk-averse investors is less relevant when default risk is not negligible and country creditworthiness is low. First, shocks to country creditworthiness can be expected to be relatively more significant when it is low and therefore more sensitive to the realization of uncertain developments. Hence, in developing countries these shocks are likely to be a more important factor in determining capital inflows. Second, once country creditworthiness is too low, capital is rationed and the resulting involuntary flows emerging from negotiations are largely independent of the specific

---

<sup>2</sup>This abstracts from "country" factors affecting domestic investors, which may lead to capital flight.

<sup>3</sup>Except under unlikely negative correlation conditions between project returns and country risk.

characteristics of the return profiles. Therefore first moments are also the key for the characterization of these "corner" solutions where lack of creditworthiness segments markets *de facto*.

This simplified model of private international portfolio allocation is based on non-arbitrage conditions for mean returns for the various types of flows, indexed by  $s$ , which hold dynamically in discrete periods indexed by  $t$ . The three key variables are: domestic "project" expected return  $D_{st}$ , country creditworthiness adjustment factor  $C_{st}$  (1 for a developed country), and the opportunity cost represented by the return in developed countries  $R_{st}$ . In this context,  $D_{st}$  is the contractual return adjusted by idiosyncratic factors. From the point of view of foreign investors of type  $s$ , the overall return of investing abroad (the adjusted domestic return) is  $D_{st}C_{st}$  and the alternative return (the foreign return) is  $R_{st}$ . The marginal equilibrium condition for voluntary private flows is the equality between adjusted domestic and foreign returns:

$$D_{st}C_{st} = R_{st} \text{ for } s \text{ voluntary}^4 \quad [1]$$

Let  $F_t$  denote the vector of net flows  $f_{st}$  across types  $s$  in period  $t$ . Let  $S_t$  denote the vector of end-of-period stocks. While  $R_{st}$  can be assumed to be exogenous given the relative unimportance of developing countries in world financial markets, both factors underlying domestic returns,  $D_{st}$  and  $C_{st}$ , can be assumed to negatively depend on these vectors. Domestic project returns decline as foreign capital inflows increase because the quality of the pool of available investment opportunities in the domestic economy decline as a result of diminishing returns and adjustment costs. As discussed later in the context of burdensharing, country creditworthiness can be assumed to decrease as the stock of

---

<sup>4</sup>In the case of involuntary flows such as commercial bank debt in countries where payments result from ex-post bargaining given the constraints on enforcing international contracts, this condition would hold as an inequality (smaller than).

foreign liabilities increase. Therefore:

$$D_{st} = D_s(d_t, F_t), \quad D_1 > 0 \text{ and } D_2 < 0 \quad [2]$$

$$C_{st} = C_s(c_t, S_t), \quad C_1 > 0 \text{ and } C_2 < 0 \quad [3]$$

where  $d_t$  and  $c_t$  are shift parameters reflecting the underlying economic climate concerning the investment returns and the country's ability to pay respectively.

For voluntary private flows, say  $s=1$  to  $v$ , the  $v$  non-arbitrage equilibrium conditions in [1] hold. For them, flows  $f_{st}$  are endogenously determined based on the exogenous variables  $c_t$ ,  $d_t$  and  $R_{st}$ , and their initial stocks (as well as stocks and flows of other types of flows). If country creditworthiness is extremely low, these interior equilibrium conditions may call for outflows that exceed the country's payment limit. In that case, capital rationing and involuntary flows reflecting the country's payment ceiling would result instead (such as the case of the involuntary restructuring of commercial bank debt). Involuntary flows ( $s > v$ ) are the result of a "corner" solution rather than the interior solution yielded by the non-arbitrage conditions [1], which would hold as inequalities<sup>5</sup>. To make the model interesting as an explanation for the surge of capital inflows, I will assume that the set of flow types that are voluntary, whose level is determined by the non-arbitrage conditions, is large and certainly not empty. It should be kept in mind, however, that if  $v=0$  the above-mentioned non-arbitrage conditions have no bite and all capital inflows would be exogenous to the model and therefore not affected by its parameters. Arguably, this corner solution is a good representation of countries with very severe creditworthiness problems, such as Sub-Saharan Africa.

---

<sup>5</sup>This paper focuses on voluntary flows. For an analysis of how involuntary flows are determined in a bargaining framework see Eduardo Fernandez-Arias (1991).

In this model, under general regularity conditions and assuming that external returns  $R_{st}$  are positive functions of  $R_t$ , a shift parameter reflecting the underlying external investment climate, in equilibrium voluntary flows co-move in the sense that shocks to the underlying parameters  $c_t$ ,  $d_t$ , and  $R_t$  cause them to move in the same direction. This condition would therefore qualitatively validate partial equilibrium analysis. In particular, for all voluntary private flows  $s=1$  to  $v$ , it holds true that  $\Delta f_s > 0$  when  $\Delta c > 0$  or  $\Delta d > 0$  or  $\Delta R < 0$ .<sup>6</sup> Instead of attempting to specify further the general equilibrium conditions that would determine the precise quantitative impact on each type of flow, here we simply assume that the above equation [1] holds for voluntary private flows in the aggregate. Let  $F_t$  and  $S_t$  denote these aggregate flows and stocks. For simplicity, let the parameters  $d_t$  and  $c_t$  subsume, respectively, the flows and stocks of types other than private voluntary (say commercial bank debt inclusive of Brady bonds and official debt). We then arrive at the non-arbitrage condition:

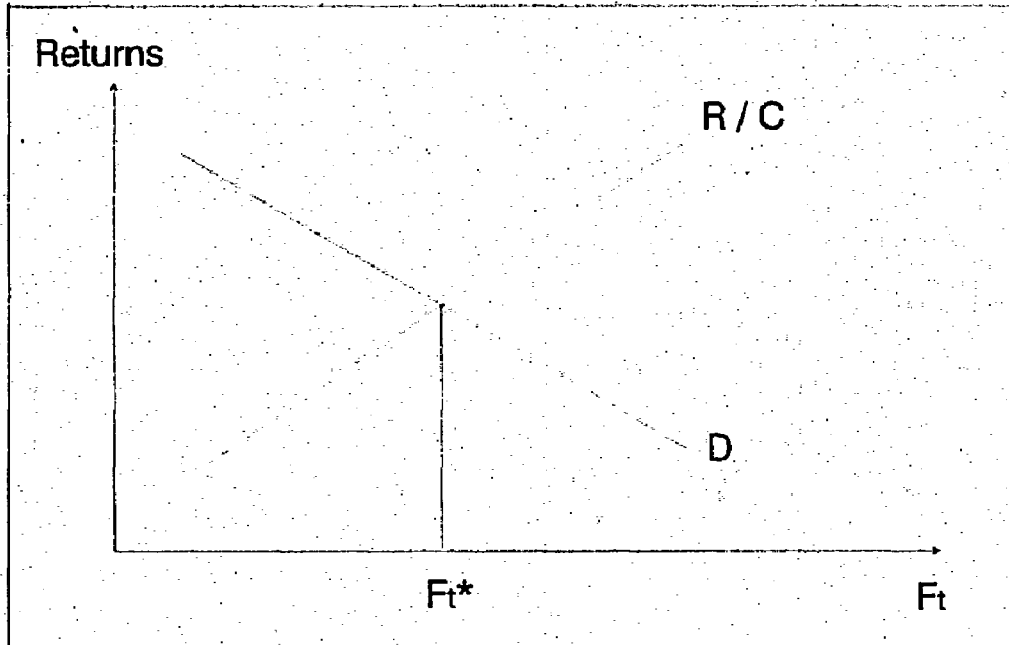
$$D(d_t, F_t) = R_t / C(c_t, S_t) \quad [4]$$

This non-arbitrage condition equates domestic returns  $D$  to foreign returns  $R$  multiplied by  $1/C$ , which can be interpreted as the country risk premium factor. Substituting  $S_t = S_{t-1} + F_t$  allows to obtain both terms of [4] as functions of  $F_t$ , which are graphically depicted in Figure 2:

---

<sup>6</sup>Empirically, the discrimination between equity and debt flows in the context of an earlier draft confirms this theoretical presumption.

Figure 2



The comparative statics of private voluntary flows  $F_t$  can be easily derived by totally differentiating [4] (substituting  $S_t$  and using the sign restrictions in [2] and [3]) and confirmed by inspecting Figure 2. The reduced-form solution is such that

$$F_t = F(d_t, c_t, R_t, S_{t-1}) \quad [5]$$

The slopes of the curves in Figure 2, and therefore the size of the comparative statics derivatives, depend on the sensitivity of the functions  $D$  and  $C$  to the equilibrating flows as measured by  $D_F$  and  $C_S$  (since given the predetermined  $S_{t-1}$ ,  $C_S = C_F$ ). The impact of various shocks and policies can be traced through their impact on those slopes. For example, the policy of counteracting capital inflows with international reserves accumulation makes the  $D$  curve flatter. To the extent that domestic project returns  $D$  are depressed by net capital inflows (reserves accumulation amounts to investing abroad), this policy requires larger inflows to have a given effect on  $D$ . In this model such a policy

magnifies the effects of the underlying shocks, resulting in larger capital inflows from abroad and increased volatility. To the extent that country creditworthiness depends on gross foreign liabilities and therefore gross capital inflows, capital inflows are to some extent limited at the cost of creditworthiness.

### *Stock Adjustment and Dynamics*

Voluntary capital flows  $F$  equilibrate shocks to the system through two channels: "project" return  $D$  (flow adjustment) and creditworthiness  $C$  (stock adjustment). The relative contribution of these channels to the equilibrating adjustment depends on their relative impact on overall adjusted domestic returns  $DC$ . On the margin this is measured by their relative elasticities with respect to flows, that is  $(F/D)D_F$  relative to  $(F/C)C_S$  (since  $C_S=C_F$ ). Since  $C_S$  and  $D_F$  relate to slopes in Figure 2, this can also be grasped graphically. The key parameter summarizing the relative contribution of stock adjustment is the relative elasticity  $\lambda=(C_S/C)/(D_F/D + C_S/C)$ , which under the assumptions made in [2] and [3] ranges between 0 and 1. Two polar cases are interesting:

i) Stock adjustment is ineffective ( $\lambda=0$ ). In this case  $C_S=0$ , which implies a horizontal  $R/C$  curve in Figure 2. Here all the adjustment takes place through  $D$  and the resulting flow  $F_t$  from [4] does not depend on the initial stock  $S_{t-1}$ . Then:

$$F_t = F(d_t, c_t, R_t) \quad [5i]$$

ii) Flow adjustment is ineffective ( $\lambda=1$ ). In this case  $D_F=0$ , which implies a horizontal  $D$  curve in Figure 2. Here all the adjustment takes place through  $C$  and the solution to [4] can be rewritten in terms of stocks only:

$$S_t = S(d_t, c_t, R_t) \quad [5ii]$$

These two polar cases have quite different dynamic implications. To see this, consider the case where at some point in time  $T$  the underlying parameters return to their initial levels at time 0 (that is,  $(d_T, c_T, R_T) = (d_0, c_0, R_0)$ ). In case (i),  $F_T = F_0$ . If in the interim period flows were larger than initially, flows will decline to reach the initial level but outflows would not undo the accumulated inflows in the interim period. In case (ii),  $S_T = S_0$ . Here flows would not only decline but would abruptly turn to outflows immediately undoing all the cumulative gains in increased flows.

Sharper insights can be obtained by explicitly solving a linearized version of [5]. Notice that by differentiating [4] it can be easily checked that  $dF_t/dS_{t-1} = -\lambda$ , which provides an alternative interpretation of the parameter  $\lambda$ . A linear solution is formally obtained in the next section in equation [14]. For our purposes here it is enough to write:

$$F_t = K_t - \lambda S_{t-1} \quad [6]$$

where the constant  $K_t$  depends on the underlying parameters  $(d_t, c_t, R_t)$  and the coefficient of  $S_{t-1}$  is  $-\lambda$  as discussed above. It is clear that flows crucially depend on the contemporaneous conditions reflected in  $K_t$  and that the worsening of those conditions would lead to flow reduction. For any given  $K_t$ , inflows are smaller the larger the accumulated stock and the parameter  $\lambda$  as measured by  $\lambda S_{t-1}$ .<sup>7</sup> The ratio  $\lambda^* = K_t/S_{t-1}$  defines a threshold level for  $\lambda$ : if  $\lambda > \lambda^*$ , a condition that large accumulated stocks make more likely, outflows would result. More generally, the contemporaneous inflow level associated with fixing the condition  $K$  to a certain level (for a given accumulated stock) is larger the smaller the parameter  $\lambda$ . In particular, the immediate inflow reduction

<sup>7</sup> In graphic terms, increasing stocks make the curve  $R/C$  to shift upwards over time. Ceteris paribus, this leads to lower equilibrium flows. The magnitude of this reduction depends on the slopes of both curves in such a way that it is proportional to  $\lambda$ .



associated with setting  $K$  to a low level would be minimized when  $\lambda=0$ . In that case,  $F_t=K_t$  and outflows would result only when they are required by the underlying parameters as measured by  $K_t < 0$ .<sup>8</sup>

As noted above, if  $\lambda=0$  then the dynamics of  $F_t$  collapses into a static equation. If  $\lambda$  is not zero<sup>9</sup>, however, flows exhibit interesting dynamics. Rewriting [6] as a difference equation in stocks, letting  $S$  be initial stock in the relevant period ( $t=0$ ) and assuming for simplicity that over that period  $K_t$  takes the constant value  $K$ <sup>10</sup>, the solution is:

$$S_t = K/\lambda + (S - K/\lambda)(1-\lambda)^t \quad [7]$$

This solution is stable and converges to the long-run equilibrium stock  $K/\lambda$ . Convergence is monotonic (increasing or decreasing depending on whether the initial stock  $S$  is below or above the long-run equilibrium), where the speed of convergence to equilibrium increases with  $\lambda$  (and is infinite when  $\lambda=1$ ). Notice that during an expansive phase ( $S < K/\lambda$ ) there is a trade-off between the level of the long-run equilibrium and the how fast that level is approached: for given  $K$  (and given initial stock  $S$  assumed to be non-negative), the larger  $\lambda$ , the faster the adjustment to the equilibrium stock but the lower such equilibrium. It can be easily shown that this second factor prevails by differentiating [7] to obtain  $dS_t/d\lambda < 0$  for all  $t > 0$  under the assumptions. In other words, the smaller  $\lambda$  the faster stocks accumulate. Stocks accumulate the fastest when  $\lambda=0$ , in which case  $S_t = S + Kt$ .

---

<sup>8</sup> Always under the maintained assumption that a solvency crisis does not develop. Otherwise the basic non-arbitrage condition would not hold and forced repayments would occur.

<sup>9</sup> The previous static case for  $\lambda=0$  can also be obtained as a limiting case as  $\lambda$  approaches 0.

<sup>10</sup> Smooth growth of  $K$  can be easily modelled. Another way to interpret this simple formulation is that  $K$  is a constant fraction of the economy's GDP and that flows and stocks are measured as ratios to GDP.

The dynamics of a reversal of conditions as reflected in  $K$  can be analyzed using [7]. Let  $K$  be the less favorable conditions and  $S$  the accumulated stock when the reversal takes place. The bulk of the adjustment takes place up-front, as can be checked by taking time differences in [7] to obtain:  $F_t = (K - \lambda S)(1 - \lambda)^{t-1}$ . Whether the new stock levels entail outflows depends on whether the initial stock  $S$  is larger than the long-run equilibrium  $K/\lambda$ . Permanent (as opposed to simply short-run) outflows would result if  $\lambda > \lambda^*$  (despite decreasing stocks), and, conversely, permanent inflows if  $\lambda < \lambda^*$ . Regarding the cumulative adjustment as measured by  $S - S_t$ , if  $K$  is not negative (the reversal is not catastrophic), then the adjustment is uniformly more severe the larger the parameter  $\lambda$  and is therefore minimized when  $\lambda = 0$ . The swiftness of the flow reduction and possible outflows if favorable underlying conditions reversed depends on  $\lambda$  and is minimized when  $\lambda$  is zero. Where the parameter  $\lambda$  lies is ultimately an empirical question, which is addressed as such in section III.<sup>11</sup>

### *The Role of Country Creditworthiness*

The creditworthiness channel corresponds to curve  $C(c_t, S_t)$  in Figure 2. First, it plays a role as part of the adjustment mechanism through stock adjustments as long as  $C_S < 0$  as discussed above. Its effect is to dampen the flow adjustment needed to restore equilibrium (a consequence of the positive slope of the  $R/C$  curve in Figure 2) and magnify the dynamic adjustment as discussed above. Second, it plays a role as a channel for transmitting shocks on the country's ability to pay ( $c_t$ ), either exogenous or policy

---

<sup>11</sup>For completeness, it may be interesting to analyze the case where  $\lambda < 0$ . This case would require that ceteris paribus, given  $K$ , foreign investors be more willing to invest the larger their collective exposure. The opposite assumption is made in this paper on the grounds that country creditworthiness would decline in that case, and therefore  $\lambda < 0$  is ruled out by assumption. While this appears to be a very reasonable assumption, the herd behavior implicit in  $\lambda < 0$  is not inconceivable, perhaps as a rational response in the context of imperfect information. In that case, the solution in [7] is explosive: stocks would increase (decrease) without bound as long as  $S$  is bigger (smaller) than  $K/\lambda$ .

determined such as the level of debt outstanding.<sup>12</sup>

Shocks improving country creditworthiness would move downwards the curve  $R/C$  and cause capital inflows as an equilibrium response. If effects on  $C$  are negligible, the creditworthiness channel would not be important for the transmission of shocks. If, further, stock adjustment is not significant, then  $C$  is constant and the model collapses to the traditional model where only returns  $R_t$  and  $D_t$  matter. In fact, in this case [5] collapses to  $F_t = F(d_t, R_t)$ . Otherwise this channel would be important for the determination of voluntary capital inflows.

Since the adjustment factor  $C$  is at most one, when country creditworthiness is not an important concern, such as in developed countries, this factor is approximately equal to the constant one and therefore largely insensitive to shocks and stock accumulation. In that case, this channel is not important and the traditional model is applicable. By contrast, when country creditworthiness is low this channel is potentially important.<sup>13</sup> The factors underlying country creditworthiness in that case, many of which are subject to significant variations, are analyzed in what follows.

### *Disentangling External and Domestic Factors*

Whether capital inflows are caused by external or domestic factors depends on the ultimate nature of the shocks underlying the adjustment, rather than the channels through which they operate. While foreign return  $R_t$  is clearly external and the domestic investment climate parameter  $d_t$  is clearly domestic, the factors underlying country creditworthiness and the country's ability to pay index  $c_t$  are less clear. To the extent that

---

<sup>12</sup>The effect of debt reduction can also be analyzed along the lines of this model. I leave this for another paper.

<sup>13</sup>As discussed above, when creditworthiness is extremely low, however, even if sensitive to shocks and stocks of liabilities, country creditworthiness may be irrelevant because capital is rationed and the solution for capital flows collapses to a constant corner solution determined outside the model, as opposed to the interior solution depicted in Figure 2.

the country creditworthiness channel is important, the assessment of the role of external and domestic factors requires the analysis of the nature of the factors underlying country creditworthiness.

The parameter  $c_t$  depends on both external and domestic factors. Conceptually, this parameter can be thought as reflecting the expected present value of the resources available for external payments. On the one hand, its present value nature implies that it is sensitive to the investors' discount rate, which is of course an external factor. This is a generally overlooked powerful channel of external influence. On the other hand, the stream of resources being discounted is possibly related to resource bases such as export earning capacity or public revenue capacity, which in turn result from a combination of domestic and external factors (such as world growth or terms of trade).

The key elements relevant for this analysis can be represented in the following simple model of country's ability to pay measured by  $c$  (subindex  $t$  dropped for simplicity):

$$c = W/(i-g) \quad [8]$$

where the discount rate in the present value calculation is  $i$  and the relevant wealth base from which resources available for payment in each period are obtained is assumed to grow at the rate  $g$  starting from the value  $W$ .

The appropriate (average) discount rate in this present value calculation is some medium or long-term risk-free international interest rate in the currency in question. Similarly, the (average) growth rate  $g$  is some expected medium or long-term growth rate. Under these simplifying assumptions, the elasticity of  $c$  with respect to international interest rates is minus  $1/(1-g/i)$ . Even if external influences underlying  $W$  and  $g$  are left aside, an interest rate elasticity of minus one (or possibly larger in absolute value in a growing economy) amounts to a potentially powerful channel of external influence.

Falling international interest rates may easily account for sharp improvements in country creditworthiness.

## II. OPERATIONALIZING THE MODEL

In order to make the model empirically tractable it is required to relate the parameters and variables to observable statistics. I first analyze how to measure the country creditworthiness adjustment factor and returns, and then specify functional forms leading to a tractable closed-form solution for capital inflows.

### *Country Creditworthiness and Burden Sharing*

To the extent that the maximum recovery value of each type of foreign liability depends at least in part on common factors such as the factors underlying the country's ability to pay index  $c$ , shocks to these common factors will induce co-movement of those values. When those maximum recovery values are below contractual values, they are the market values of those claims and their ratio to contractual values implicitly defines market prices. In that case, shocks to the country's ability to pay translate into co-movement of implicit market prices.

This co-movement of implicit market prices allows to relate the default risk associated with voluntary stock  $S_t$  to the observable commercial bank debt secondary market price. Let  $P_t$  be the secondary market price of commercial bank debt stock  $B_t$  and  $Q_t$  be the (implicit) price of commercial voluntary stock  $S_t$ . Burdensharing among various creditor classes boils down to the rules that determine the repayment amounts that each class would be able to force the country to make in present value terms, which depends on contractual rights and bargaining powers. Here I assume a simple burdensharing model where the associated forced repayment capacities of both classes are given increasing

functions  $f_1$  and  $f_2$  of the capacity to pay index  $c$  (subindex  $t$  dropped for clarity).<sup>14</sup> Then  $P=f_1(c)/B$  and  $Q=f_2(c)/S=f(PB)/S$ , where  $f$  is  $f_2(f_1-1)$  and therefore  $f>0$ . Of course, the above assumes that the resulting prices  $P$  and  $Q$  are smaller than one, which in turns implies rationing of both types of financing. However, if  $f(PB)/S$  is sufficiently large, then the resulting  $Q>1$ . This is arguably the relevant case currently in the countries under review, where  $B$  is rationed but  $S$  is not. In that case,  $Q=1$  (in this simple burdensharing model  $P$  is unchanged). In order to focus on  $P$  and  $S$ , which show much more variability than  $B$ , I take  $B$  as constant. Consequently, I assume that the sharing of country risk is such that:

$$Q_t = \text{Min}(1, f(P_t)/S_t) \quad [9]$$

By definition, the country creditworthiness adjustment factor  $C$  is equal to expected  $Q$  next period:

$$C_t = E_t[Q_{t+1}] \quad [10]$$

Assuming that the pair  $(P_t, S_t)$  is a sufficient statistic for  $f(P_{t+1})/S_{t+1}$  (that it absorbs all the relevant information available at time  $t$  concerning that ratio), which is a reasonable assumption given that stocks move slowly and secondary market prices for debt incorporate expected zero profit conditions, then:

$$C_t = C(P_t, S_t) \quad [11]$$

---

<sup>14</sup>This is a particular case of the "creditor-specific collateral" model in Demirguc-Kunt and Fernandez-Arias (1992). See that paper for an elaboration on how it differs from the traditional "single collateral" model and why, contrary to the corporate case, it may be more applicable in the context of sovereign debt.

Of course, to the extent that the market value for commercial bank debt relates to the country's ability to pay index  $c_t$ , the interest rate sensitivity of that parameter discussed above will be transmitted to the market price  $P_t$ , and therefore to country creditworthiness  $C_t$  through [11].

### *Measuring International Returns*

Measuring returns  $R$  and  $i$  is difficult because unobservable expected (ex-ante) real returns are needed. The usual way out is to measure ex-post real returns and hope that some form of rational expectations will make this solution somehow reasonable. A complicating factor in this case is that the relevant returns, especially  $i$ , should refer to medium-term maturities which fall outside the observable time frame. Therefore this quite imperfect solution is not even feasible.<sup>15</sup>

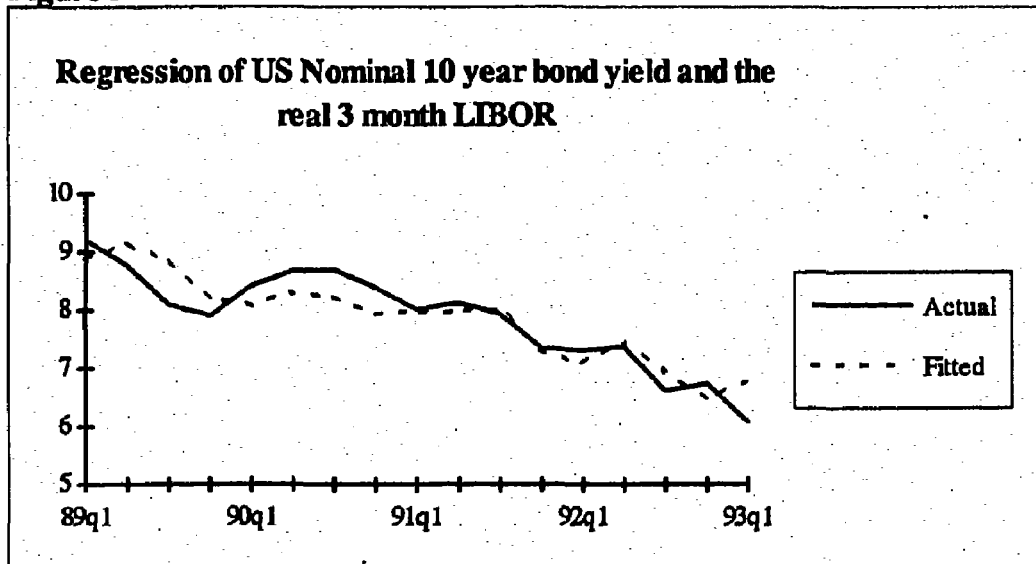
Within the feasible alternatives, the various choices do not seem to make substantial difference for the issue at hand. First, yields on various maturities exhibit a large degree of multicollinearity which makes unimportant the careful modeling of the term structure. Second, relevant nominal rates and observable ex-post real rates are also highly collinear. For example, long-term nominal yields (10-year US bonds) and ex-post short-term real rates (3-month US LIBOR deflated by the US GDP deflator) track one another extremely well over the relevant period (see Figure 3) and their regression yields an R-squared of 0.80.<sup>16</sup>

---

<sup>15</sup>Survey data on US inflation expectations could be very useful but to my knowledge there is no available information for recent years. Market information on inflation-indexed claims is not available to the best of my knowledge. I am not aware of successful forecasting models which could be used for this purpose.

<sup>16</sup>This surprisingly good fit also holds for longer periods of time.

Figure 3



To make the presentation cleaner I chose not to distinguish between the maturities of the two international returns  $R$  and  $i$  (they are both called  $R$ ). Since  $i$  should be medium-term as explained above, a ten-year maturity yield was used. Given the difficulties in estimating the unobservable ex-ante real rates, nominal rates were used instead as a proxy based on the assumption that inflation expectations over the medium term are slow-moving. As shown above, the use of other combination of maturities or ex-post short term real rates would not make much relevant difference.

#### *Capturing the domestic investment climate*

The measurement of returns within the domestic economy ( $D$ ) would be even harder than the measurement of international returns. The instability of the developing economies makes both nominal rates and ex-post real rates not very useful for proxying expected real returns. In particular, ex-post returns in domestic stock markets, a commonly used measure for those countries where it is available, may contain more noise than information.<sup>17</sup>

<sup>17</sup>In fact, apart from bubbles and speculative instability in general, changes in stock prices reflect the rents accruing



In any event, what needs to be captured is the domestic investment climate  $d_t$ , to which flows react, rather than the resulting returns  $D_t$ . That is not an easy task. One alternative to capture  $d_t$ , which can be interpreted as the availability of new investment opportunities, is to measure the resulting investment or savings volume. One difficulty with this approach is that it would require careful modeling of the investment and savings functions in order to control for other variables as well as endogeneity biases.<sup>18</sup> In summary, returns are not an appropriate proxy and domestic investment or savings may introduce more noise than information and yield misleading results. Ideally, the domestic economic environment and policies should be incorporated explicitly. In practice, this exercise is a difficult one in a country study and even more so in a cross-country study like this one.

Fortunately, while the explicit modeling of the underlying policies would be unavoidable if the issue at hand were the evaluation of policies, for the present purpose it is sufficient to consider the domestic climate parameter ( $d_t$ ) as an unobservable and estimate its effect indirectly as the residual capital flows which are not accounted for the other variables in the model. The assumptions needed to recover such latent variable are discussed in Section III.

### *Solving the Empirical Model*

A linearized model is obtained when the following functional forms are assumed as empirical counterparts of [2] and [3]:

---

to established firms due to investment rigidities in tapping new opportunities, which may have a tenuous relation with the return of those opportunities. Large stock market gains may be more the result of a rigid economy than of high-return investment opportunities, either realized or still untapped. The insignificance and sometimes wrongly signed estimates for the effect of this variable in Chuhan et al. (1993) confirms these problems.

<sup>18</sup>While this route appears worth exploring, the lack of improvement of low domestic savings rates in some of the Latin American countries that are seen as successful in this study strongly suggest that this approach would probably only contribute to an even stronger "push" case.

$$C_t = WP^X \exp(-YS_t) \quad [12]$$

$$D_t = d_t \exp(-ZF_t) \quad [13]$$

where  $W, X, Y$  and  $Z$  are positive constants. Rewriting the equilibrium condition [4] in logarithmic form ( $\log D + \log C = \log R$ ) and solving for  $F_t$  using [12] and [13] leads to the following linear empirical counterpart of [5] (that is an explicit form of [6]):

$$F_t = I_t - \beta r_t + \gamma p_t - \lambda S_{t-1} \quad [14]$$

where  $r$  and  $p$  are the logarithms of interest rates and prices  $R$  and  $P$  respectively, and  $F$  and  $S$  are voluntary capital flows and stocks respectively. Regarding the parameters,  $\beta = 1/(Y+Z)$ ,  $\gamma = X/(Y+Z)$ ,  $\lambda = Y/(Y+Z)$ , and the intercept is  $I_t = (\log(d_t) + \log(W))/(Y+Z)$ . The general sign assumptions on  $(X, Y, Z)$  imply that  $(\beta, \gamma)$  are positive and  $\lambda$  lies between zero and one (while the intercept  $I_t$  is not constrained). This is of course in agreement with the general solution [5], since  $(I_t, r_t, p_t)$  proxies (the logarithm of)  $(d_t, R_t, C_t)$ . Notice that the coefficient of  $S_{t-1}$  is  $\lambda = Y/(Z+Y)$  as derived in Section I and used in [6], where  $K_t = I_t - \beta r_t + \gamma p_t$ . Furthermore, the structural parameters  $(X, Y, Z)$  are identified in this model since they can be recovered from  $(\beta, \gamma, \lambda)$ . In particular, the elasticity of the (multiplicative) country risk premium  $(1/C)$  to secondary market prices, equal to  $-X$ , can be recovered as  $-\gamma/\beta$ .

### III. STATISTICAL ANALYSIS

#### *Sample and Statistical Assumptions*

The statistical analysis was conducted based on quarterly information for 1989-1992 and the first half of 1993, (indexed by  $t$ ) for a panel of thirteen middle-income developing countries receiving private portfolio flows in the period. Since country

creditworthiness plays a crucial role in the analysis, only countries with consistent creditworthiness information over time were included.<sup>19</sup> The resulting panel is still highly representative. In terms of portfolio flows in the period, it represents 85 percent of middle-income countries and 75 percent of all developing countries.<sup>20</sup>

Portfolio flows (both equity and debt<sup>21</sup>) were used in the analysis because high frequency (quarterly) data was available and the purely financial nature of these transactions could justify the assumption of no adjustment lags.<sup>22</sup> Portfolio flows were measured in dollars and deflated by the US CPI index to arrive at flows in real dollars. The stocks of portfolio liabilities were proxied by accumulating portfolio flows after 1988. The external return and country's capacity-to-pay parameters,  $R_t$  and  $c_t$  respectively, were proxied along the lines explained in the previous section. External returns were proxied by annualized 10-year US bond nominal yields. The country's capacity to pay index was proxied by the debt secondary market price except for Korea, Malaysia and Thailand where it is not available. An implicit unit price was assumed for these countries to reflect that they remained creditworthy throughout the period.<sup>23</sup> (For more details on the data see Appendix I.) For the reasons explained in the previous section, the domestic investment climate parameter  $d_t$  is indirectly measured as a residual.

The panel framework increases statistical efficiency by assuming that the relative effect on capital flows of changes in external returns and country creditworthiness is the

---

<sup>19</sup>The countries are Algeria, Argentina, Brazil, Chile, Korea, Malaysia, Mexico, Panama, Philippines, Poland, Thailand, Uruguay and Venezuela.

<sup>20</sup>Based on World Bank (1992) definitions and statistics.

<sup>21</sup>Portfolio debt flows include short-term flows except those trade related.

<sup>22</sup>Other voluntary private flows, namely foreign direct investment, are available only with annual frequency and are probably subject to adjustment lags. Preliminary analysis done in an earlier draft using annual data showed that the same qualitative conclusions apply to both portfolio and direct investment.

<sup>23</sup>The credit ratings in *Institutional Investor* further supports this assumption, since the ratings of these three countries are significantly above the ratings of the other ten.

same for all countries in the period. Relative effect is meant to be relative to the size of the country (and is defined as capital flows as a fraction of 1988 GNP).<sup>24</sup> This makes sense because these two explanatory variables are already standardized across countries: external returns are common and the country's ability to pay index is similar in magnitude. This relative measure can be expected to eliminate heteroscedasticity problems.<sup>25</sup> As usual, idiosyncratic differences across countries are accommodated in country-specific intercepts to relax the equality assumptions on marginal impacts.

The final problem to be dealt with is one of identification. Because the domestic climate variable is treated as a latent variable, the country specific intercepts would reflect not only structural country characteristics but also that variable. This confusion of both effects would not allow any attribution of capital flows to domestic climate through inter-country comparisons unless countries are assumed to be structurally identical. Even then, the common structural component would not be identified and therefore a complete decomposition of variable capital inflows, that is their non-structural portion due to changes in the domestic investment climate, could not be accomplished.

This identification problem was solved as follows. First, all variables (capital flows and stocks ratios, external returns and creditworthiness) are measured as deviations from their 1989 average level, which eliminates structural differences across countries. In other words, this model explains the increase in portfolio flows in terms of the changes in the explanatory variables taken 1989 as a benchmark. Second, it was assumed that there was a country-specific quantum change in the investment climate in each country after 1989. While this is an imperfect assumption, it reflects the notion that in many countries there

---

<sup>24</sup>When used, stocks are also standardized by quarterly GNP.

<sup>25</sup>It is worth noting that equal absolute effects on flows, an assumption sometimes used in similar studies, does not seem reasonable in a panel with very dissimilar countries. This misspecification error is likely to lead to non-robust estimations which, coupled with unchecked heteroscedasticity, would mostly reflect the larger countries in the sample, thus undermining the power of the panel approach.

was a policy sea change after the Brady Initiative (1989) that underlies the surge in inflows thereafter. Then the portion of the increase in portfolio flows due to improvements in the domestic economic investment climate in each country (for given country creditworthiness) is identified as the country specific intercept in such a model. (The same idea was also used when analyzing the increase in country creditworthiness.)

### *Econometric Estimation and Testing*

Following the derivation in the previous section, the basic estimating structural equation is:

$$y_{it} = \alpha_i - \beta r_t + \gamma p_{it} - \lambda s_{i,t-1} + u_{it} \quad [15]$$

where  $r$  and  $p$  are the logarithms of interest rates and prices  $R$  and  $P$  respectively,  $y$  is capital inflow as percentage points of GNP and  $s$  results from its accumulation over time. All the variables are expressed as deviations from their 1989 average level. The resulting sample size is therefore 182, resulting from 14 quarterly observations (1990.1 to 1993.2) over 13 countries indexed by  $i$ . The qualitative analysis conducted in the previous section indicates that the country-specific intercept  $\alpha_i$  is not restricted, and the common parameters  $\beta$ ,  $\gamma$  and  $\lambda$  are positive. In particular,  $\lambda$  is the fraction of the inflows that can be attributed to stock adjustment and lies between zero and one.

The consistency of OLS estimators crucially depends on the uncorrelation between regressors and contemporaneous error terms. It appears reasonable to assume that both  $r_t$  and  $p_{it}$  are uncorrelated with  $u_{it}$ : interest rates because they are exogenous and prices because under the burdensharing model developed in the previous section they do not depend on  $S_{it}$ . The absence of correlation between  $S_{i,t-1}$  and  $u_{it}$  is plausible as long as errors are serially uncorrelated. OLS estimation of equation [15] yields a slightly negative

point estimate for  $\lambda$  ( $\lambda=-0.08$ ) and a Durbin-Watson statistic in the no serial correlation range for usual confidence levels (2.17). This was interpreted as evidence that stock adjustment, and their dynamic implications discussed above, are not an important element in the present surge of capital inflows.

In order to make the rest of the discussion cleaner, it was assumed that  $\lambda=0$  and the explanatory variable  $s_{i,t-1}$  was neglected in the rest of the paper. Since in light of the theoretical discussion in Section I this parameter ranges between zero and one, this assumption is fully consistent with the empirical evidence. As discussed in Section I, this pure flow adjustment mechanism implies the lowest volatility in the case of a reversal. Consequently, the estimating equation finally selected is:

$$y_{it} = \alpha_i - \beta r_t + \gamma p_{it} + u_{it} \quad [16]$$

The estimation using OLS leads to the point estimates  $b=3.46$  and  $c=1.17$ . These estimates have the expected sign and are significantly different from zero at usual confidence levels. This implies that both opportunity costs and country creditworthiness are relevant considerations in investors' reactions. In particular, the elasticity of the country risk adjustment factor to secondary market prices can be estimated as  $c/b=0.34$ . The point estimates  $a_i$ , which reflect the impact of changes in the domestic conditions beyond their effect on creditworthiness after 1989, are mixed and certainly not consistently positive. Mexico is the outstanding good case, followed by Korea and Argentina. Worsening cases include Algeria and Philippines (and also Chile due to domestic policy restrictions to capital inflows and a successful 1989). (See Equation 1 in Appendix 2 for further details.)

These estimators are the preferred ones after a number of tests were run:

i) Alternative burdensharing models would lead to prices  $p$  dependent on stocks  $S$ .<sup>26</sup> The endogeneity of prices could induce correlation between  $p$  and  $u$ , especially after neglecting the stock adjustment mechanism, biasing the results. Instrumental variable regression where  $p_{it}$  was instrumented by lagged prices yielded less efficient point estimates not significantly different from the OLS estimators. This was interpreted as a validation of the OLS estimations and eliminated the need for a simultaneous equations approach where prices would be endogenous, because such system can be assumed to be recursive. In any event, if the IV estimators were used instead the same qualitative conclusions would emerge.

ii) Inconsistency due to non-stationarity does not appear to be a problem. The variables used can be presumed to be stationary either because of their nature (interest rates) or because they are bounded (ratios, prices). Nevertheless, the sample profile appears to be consistent with a non-stationary situation. The Dickey-Fuller cointegration test was run stacking vectors of within-country residual-based statistics and the no cointegration hypothesis was clearly rejected.

iii) Serial autocorrelation of the disturbance term does not appear to be a problem according to Durbin-Watson statistic. Zero autocorrelation is not rejected at usual confidence levels and therefore reported estimator standard errors are accepted.<sup>27</sup>

---

<sup>26</sup>Even then, this effect can be expected to be small as long as  $B/S$  is large.

<sup>27</sup>If anything, the evidence points to negative, rather than positive, serial autocorrelation, possibly due to the lumpiness of investment with quarterly frequency.

iv) A random effects specification, as opposed to the fixed effects specification implicit in the use of deterministic country dummies, would lead to more efficient estimators of common parameters if the country-specific random component is uncorrelated with prices (interest rates are not a problem because they are country invariant). The point estimates obtained with the error component model were extremely close to the ones obtained with fixed effects ( $b'=3.40$  and  $c'=1.23$ ), so that the use of this method would have made no difference for the conclusions. Although the Hausman test for the consistency of the random effects model would allow its use at high confidence levels, the discrepancies in the parameter point estimates were so small and the theoretical gains in accuracy under the null hypothesis of zero correlation so marginal that the simpler fixed effects model was selected. One of the clear advantages of this choice is that the orthogonality properties of the fixed effects model leads to exact factorial decompositions at the country level, which is exploited in the tables that follow.

v) Results are robust to the proxies used. As discussed in the previous section, the 10-year nominal interest rate used is very highly correlated with ex-post 3-month real LIBOR, which would have been an alternative regressor. As noted in Claessens, Diwan and Fernandez-Arias (1992), debt prices for instruments emerging from Brady operations do not accurately reflect country risk because of various enhancements. The use of stripped prices in the relevant countries and periods made essentially no difference ( $b'=3.46$  and  $c'=1.15$ ).

#### *Decomposing Capital Inflows into Proximate Causes*

A country-by-country decomposition of the increase in portfolio inflows (as a percentage of GNP) after 1989, measured as its average level relative to its 1989 level, is presented in Table 1. The decomposition is based on the average of each explanatory



variable (which are also measured in terms of deviations from their 1989 level) multiplied by its estimated coefficient. The resulting three-way decomposition is based on the following equality for each country  $i$ :

$$y_i = a_i - br_i + cp_i \quad [17]$$

where  $y_i$ ,  $r_i$  and  $p_i$  are averages across time. Therefore this decomposition based on first moments directly addresses the issue of what portion of the increase in flows is due to changes in the explanatory variables. Since the question is to assess the sources of the surge of flows in the period (rather than its variation in general for which second moment methods are designed), this method appears the most natural in this case.<sup>28</sup> Since interest rates fell in the period, their contribution is positive. Prices in most countries increased in the period, making also a positive contribution.

---

<sup>28</sup>This decomposition based on first moments is also invariant to the use of alternative explanatory variables collinear with the ones used, so that results do not depend on the particular proxies chosen. But unlike second moment methods, it is exhaustive (because each country's residuals add up to zero due to OLS orthogonality properties) and invariant to the order in which factors are analyzed. By contrast, to achieve this the traditional Analysis of Variance requires orthogonality among regressors (which does not hold in this case) or arbitrary assumptions, such as in decompositions based on standardized coefficients.

**Table 1: Decomposition of Increase in Portfolio Inflows after 1989**  
(percentage of GNP)

	Increase in Inflows	PROXIMATE FACTORS		
		Improving Domestic Investment Climate	Rising Country Creditworthiness	Falling International Returns
Algeria	-0.21	-0.77	0.13	0.43
Argentina	1.76	0.66	0.67	0.43
Brazil	0.64	0.23	-0.02	0.43
Chile	-0.15	-0.94	0.36	0.43
Malaysia	0.53	0.11	0.00	0.43
Korea	1.16	0.73	0.00	0.43
Mexico	3.19	2.37	0.39	0.43
Panama	0.47	-0.48	0.52	0.43
Philippines	-0.23	-0.75	0.10	0.43
Poland	0.00	0.07	-0.50	0.43
Thailand	0.47	0.05	0.00	0.43
Uruguay	0.72	0.16	0.14	0.43
Venezuela	0.59	-0.33	0.49	0.43
Average	0.69	0.09	0.18	0.43
	100%	12%	25%	62%

Note :May not Add up due to rounding errors

The average line reflects the decomposition for a country in the sample taken at random, that is a "typical" middle-income country creditworthy enough to receive portfolio flows. This average is the one that better reflects the qualitative features of this process from the point of view of these middle-income countries. By contrast, aggregate portfolio flows to all countries combined<sup>29</sup> are more sensitive to the situation in the larger countries and its analysis requires the calculation of a weighted average (using GNP as weight).

The effect of the domestic investment climate is mixed: in some countries improved and in some others deteriorated. Only in three countries of the thirteen, Argentina, Korea and Mexico, it appears to have had substantially positive effects. In the

<sup>29</sup> Arguably, to all developing countries because the sample is highly representative in aggregate terms.

typical middle-income country the improvement in domestic investment climate has not been significant and made only a marginal contribution to the attraction of portfolio flows (12%), which can be well accounted by the fall in international interest rates and the improvement in creditworthiness. Had the domestic investment climate in developing countries remained unchanged, we would have still witnessed a generalized surge in portfolio inflows across countries.<sup>30</sup>

Increased country creditworthiness played an important role in explaining capital inflows in many countries, but generally smaller than that of international interest rates (with the only clear exception of Argentina).<sup>31</sup> For the typical middle-income country improvements in country creditworthiness made less than half the contribution of interest rates (about 40%).<sup>32</sup> (In aggregate dollar terms over the developing world, the contribution of improvements in country creditworthiness relative to that of international interest rates appears to be about 30%)

The factor that clearly stands out is international interest rates, which *ceteris paribus* "pushed" portfolio flows in the amount of almost half a point of GNP to these countries over the period. This mass of flows amounts to most of the portfolio flows received by the typical country (63%).<sup>33</sup> Still, this appears to leave room for an important effect of "pull" factors. As analyzed before improvements in the domestic

---

<sup>30</sup> While almost half of the aggregate dollar amount in the developing world may be attributed to this factor, this is mainly the result of compositional effects due to larger countries doing better rather than a widespread and easily replicable feature of this phenomenon in middle-income countries.

<sup>31</sup> Korea, Malaysia and Thailand were assumed to have an implicit unit price in the period, and therefore in these countries changes in creditworthiness made zero contribution by assumption.

<sup>32</sup> The same qualitative conclusions were reached in an earlier draft based on annual observations of total private flows including foreign direct investment. Using standardized coefficients (the product of the absolute value of the coefficient times the standard deviation of the regressor) to measure the relative contribution of creditworthiness also leads to the same qualitative conclusions in this model. It should be noted that, if at it is customary, the regressors are considered in levels rather than increments, creditworthiness would appear more important than interest rates because the between-country variation of prices that the panel approach is designed to filter out would unduly inflate the variation of prices.

<sup>33</sup> This represents about 40% of aggregate portfolio flows.

investment climate in the typical country were not substantial, but if added to the contribution of improvements in creditworthiness (25%) they would amount to an unimpressive but still important contribution of 37%.<sup>34</sup> This would be a gross overestimation of the contribution of "pull" factors, however, because as explained above external factors have an important bearing on country creditworthiness. In what follows I tackle this issue empirically and give a final assessment of the contribution of external and domestic factors.

### *The Contribution of External (Push) and Domestic (Pull) Factors*

In this model, the analysis of the role of external and domestic factors and the assessment of their contribution requires the analysis of the determinants of secondary market prices. One non-structural approach would be to assume that co-movement of prices of different countries reflect external common factors and the rest of the variation corresponds to domestic factors. In order to make the point that international interest rates are the ultimate driving force in this "push" process of capital inflows, here a more structural approach is followed, where prices are explicitly explained by international interest rates based on the theory presented in previous sections. To make the analysis clean and simple, a constant price-interest rate elasticity across the 10 countries with creditworthiness problems (that is excluding Korea, Malaysia and Thailand)<sup>35</sup> is assumed:

$$p_{it} = \mu_i - \varepsilon_{it} + w_{it} \quad [18]$$

---

<sup>34</sup> It could be further argued that the relative inaccuracy with which  $\beta$  and  $\gamma$  are estimated and the negative correlation between  $b$  and  $c$  due to some degree of multicollinearity between the regressors does not allow to rule out the possibility that the contribution of creditworthiness is significantly higher than 25% (up to about 50% if interest rates are deleted from the regression).

<sup>35</sup> Since these countries are assumed to have unit prices the theory developed in Section II does not apply. For them interest rates have no effect on (implicit) prices.

The intercept  $\mu_i$  reflects the change in domestic factors leading to improvements in creditworthiness (as opposed to the domestic investment climate  $\alpha_i$ ). The parameter  $\epsilon$  is (the absolute value of) the interest rate elasticity and is expected to be positive. In this analysis, both domestic factors and external factors (conservatively restricted to international interest rates  $r_t$ ) act through two channels: i) directly affecting external and domestic returns ( $\beta r_t$  and  $\alpha_i$  respectively), and ii) indirectly through creditworthiness for those countries still having gains to be made as described in equation [18]. For these countries domestic and external factors are accounted for by  $\alpha_i'$  and  $\beta' r_t$  respectively according to the following expressions:

$$\begin{aligned}\alpha_i' &= \alpha_i + \gamma \mu_i \\ \beta' &= \beta + \gamma \epsilon\end{aligned}\quad [19]$$

The analysis of the relative contribution of domestic and external factors can be done along the lines of Table 1 using [19]. Considering estimates  $m_i$  and  $e$  in [18] such that  $p_i = m_i - e r_t$ , the nice features of the decomposition are preserved. (For Korea, Malaysia and Thailand [17] is not applicable and no change needs to be made.) In that case the resulting decomposition is:

$$y_i = (a_i + \delta_i c m_i) - (b + \delta_i c e) r_t \quad [20]$$

where  $\delta_i = 0$  for Korea, Malaysia and Thailand and  $\delta_i = 1$  for the rest of the countries in the sample.

The more sensitive prices to interest rates as measured by the elasticity  $e$ , the more important external factors compared to domestic factors. If  $e = 0$  there is no external linkage and it would be valid to fully attribute the contribution of creditworthiness to

domestic factors. In that case, the contribution of external factors to the increase in flows can be read directly from Table 1 (63% for the typical country) and the rest can be attributed to domestic factors, acting either directly or through improvements in creditworthiness. If  $e > 0$  as expected, however, not all of the improvement in creditworthiness is due to domestic factors and the contribution of external factors would be higher because of their beneficial effect on creditworthiness.

It is clear from [20] that the average contribution of external factors is a linear function of the elasticity parameter  $e$ . For example, taking the benchmark value  $e=1$  as the value of  $\epsilon$  in [18], which has been the (accepted) null hypothesis in some empirical studies (such as in Cohen and Portes (1990) and, more recently, Demirguc-Kunt and Fernandez-Arias (1992)), and external factors would account for as much as 78 percent of the increase in flows in the typical country.<sup>36</sup>

In what follows,  $\epsilon$  is estimated and the corresponding country by country decomposition presented. Since  $w_{it}$  and  $u_{it}$  are assumed to be uncorrelated (as explained and tested above), then the two-equation system formed by equations [16] and [18] is recursive and OLS in each equation is consistent and fully efficient under the usual assumptions. Running OLS on [18] leads to  $e=1.49$  with an estimated standard error of only 0.14 (see Equation 2 in Appendix 2 for more details). This elasticity is consistent with the theoretical presumption discussed in the previous section. Since  $e$  is a consistent estimator, [19] yields consistent estimates. Furthermore, since orthogonality conditions are preserved [20] can be applied to obtain Table 2:

---

<sup>36</sup>Other works also show that world interest rates are a central determinant of debt prices, such as Dooley and Stone (1993) and Bulow, Rogoff and Bevilacqua (1992).

**Table 2: Domestic and External Contributions to Increase in Portfolio Flows after 1989  
(percentage of GNP)**

	Increase in Inflows	Domestic Factors		External Factors	
		Total	of which through creditworthiness	Total	of which through creditworthiness
Algeria	-0.21	-0.86	-0.09	0.64	0.22
Argentina	1.76	1.11	0.46	0.64	0.22
Brazil	0.64	0.00	-0.24	0.64	0.22
Chile	-0.15	-0.80	0.14	0.64	0.22
Malaysia	0.53	0.11	0.00	0.43	0.00
Korea	1.16	0.73	0.00	0.43	0.00
Mexico	3.19	2.55	0.18	0.64	0.22
Panama	0.47	-0.17	0.31	0.64	0.22
Philippines	-0.23	-0.87	-0.12	0.64	0.22
Poland	0.00	-0.64	-0.71	0.64	0.22
Thailand	0.47	0.05	0.00	0.43	0.00
Uruguay	0.72	0.08	-0.08	0.64	0.22
Venezuela	0.59	-0.05	0.28	0.64	0.22
Average	0.69	0.10	0.01	0.59	0.17
	100%	14%		86%	

Note: May not Add up due to rounding errors.

The previous analysis lends support to the push story. International interest rates appear to be the driving force and domestic factors appear to have played a minor role in attracting capital inflows, with the exception of Argentina, Korea and Mexico. This finding would hold even if the direct effect of interest rates as measured by  $\beta$  is assumed to be substantially lower than the OLS estimate  $b$  due to the sizeable indirect effect of interest rates through country creditworthiness. For the typical country, the fall in international interest rates explain 86% of the increase in inflows. True, due to the fact that, overall, domestic factors have been more favorable in larger countries<sup>37</sup>, the contribution of external and domestic factors to aggregate inflows is roughly equal. Irrespective of whether this correlation between domestic factors and country size is coincidental or not, an issue which is not analyzed in this paper, this compositional effect should not obscure the "push" nature of the phenomenon. If the association is

<sup>37</sup> For example, Argentina, Korea and Mexico combined have 40% of total sample GNP.

coincidental, then the picture for the typical country is representative of all middle-income countries and is also a good estimate of their prospects in the aggregate. If such association is systematic, the analysis of the typical country would still be representative of middle-income countries with only some exceptions, and therefore applicable to most countries.

#### IV. CONCLUDING REMARKS

Sustainability of capital inflows is generally recognized as a key parameter for policy design. Unsustainable capital inflows call for policies aimed at leaning against the wind. This paper shows that the sustainability of capital inflows is vulnerable to external factors even when accompanied by improved country creditworthiness, but that soft landing is possible. Therefore it gives support to measured optimism if cautious policies are followed. Four main points support that conclusion:

i) In terms of proximate causes, improvements in country creditworthiness appear to be a significant variable to explain investors' behavior and the surge of capital inflows in middle-income developing countries. But, to a large extent, developing country creditworthiness has been in turn driven by external factors, especially international interest rates. The previous finding on the importance of improvements in country creditworthiness is best seen as a channel through which the underlying factors, external factors for the most part, induced capital inflows.

ii) In terms of causal underlying factors, the surge of capital inflows in most countries appears to have been largely pushed by low returns in developed countries, both directly or through the country creditworthiness channel, as opposed to being pulled by domestic



factors. Even if domestic conditions in middle-income countries had remained unchanged we would have witnessed a surge of capital inflows driven by lower international interest rates. There are important country exceptions, namely Argentina, Korea and, most notably, Mexico, but in most countries no surge in inflows would have taken place in the absence of the remarkable reduction in international interest rates. It can be further argued that for developing countries not receiving capital inflows, such as sub-Saharan African countries, such reduction was not large enough to eliminate credit rationing.

iii) Consequently, most developing countries are vulnerable to adverse exogenous developments that would render capital inflows unsustainable. Capital inflows in the typical country are largely dependent on favorable international interest rates and would not be sustained if they return to higher levels.

iv) But soft landing appears feasible. Stock adjustment does not appear to be a significant component of the adjustment mechanism manifested in the surge in inflows. In other words, the evidence so far suggests that a gradual increase in international interest rates would result in lower capital inflow levels, or moderate capital outflows in some countries, rather than massive capital outflows to quickly bring down the stock of foreign liabilities. By and large, if there are capital outflows, they are unlikely to match past inflows unless the reversal in external conditions is coupled with a concurrent worsening in domestic conditions.

### References

Bulow, J.; K Rogoff and A. Bevilaqua, 1992, "Official Creditor Seniority and Burden-Sharing in the Former Soviet Bloc," Brookings Papers on Economic Activity, 1: 1992.

Chuhan, P.; S. Claessens and N. Mamingi, 1993, "Equity and Bond Flows to Latin America and Asia: The Role of External and Domestic Factors," PRE Working Paper #1160, World Bank.

Calvo, G.; L. Leiderman and C. Reinhart, 1993, "Capital Inflows and The Real Exchange Rate Appreciation in Latin America: The Role of External Factors," IMF Staff Papers, March 1993, Vol 40, N. 1.

Claessens, S.; I. Diwan and E. Fernandez-Arias, 1992, "Recent Experience with Commercial Bank Debt Reduction" PRE Working Paper #995, World Bank.

Cohen, D. and R. Portes, 1990, "The Price of LDC Debt," CEPR Discussion Paper #459.

Demirguc-Kunt, A. and E. Fernandez-Arias, 1992, "Burden-sharing Among Official and Private Creditors," PRE Working Paper #943, World Bank.

Dooley, M. and M. Stone, 1993, "Endogenous Creditor Seniority and External Debt Values," IMF Staff Papers.

Fernandez-Arias, E., 1991, "A Dynamic Bargaining Model of Sovereign Debt," PRE Working Paper #778, World Bank.

## Appendix 1 - Data.

$$PF_{it} = \left( \frac{PF_{it}}{(GNP_{i,1988})(CPI_{US,t})} \right) \times 4$$

$$FDEV_{it} = (RF_{it} - \overline{RF}_{1989})$$

$$RDEV_{it} = (LR_{it} - \overline{LR}_{1989})$$

$PDEV_{it}$

$$\overline{F}_{1989} = \text{Average of RF over 1989}$$

$$\overline{R}_{1989} = \text{Average of LR over 1989}$$

$$\overline{P}_{1989} = \text{Average of RF over 1989}$$

$$PF_{it} = \text{Total Portfolio Flows. Source: IECDI staff estimates}$$

$$RF_{it} = \text{US 10 year government bond yield - Source: line 61 IMF International Financial Statistics. The monthly interest rate was taken and the quarterly annualized average was calculated.}$$

$$LR_{it} = \text{Log of secondary market price of Commercial Bank debt. Two weekly data was taken and the quarterly average was calculated. Source: Salomon Brothers.}$$

$$VP_{88} = \text{Gross National product - Source - IMF International Financial Statistics}$$

$$CPI_{US} = \text{Consumer price index for the US - Source: IMF International Financial Statistics.}$$

**Dummy Variables**

**ALG = Algeria**

**ARG = Argentina**

**BRA = Brazil**

**CHI = Chile**

**KOR = Korea**

**MAL =Malaysia**

**MEX = Mexico**

**PAN = Panama,**

**PHI = Philippines**

**POL = Poland**

**THA = Thailand**

**URG = Uruguay,**

**VEN = Venezuela**

## Appendix 2

### Equation 1

Dependent Variable: RFDEV4

	Estimated Coefficient	Standard Error
ALG	-0.77	0.36
ARG	0.66	0.42
BRA	0.23	0.36
CHI	-0.94	0.37
MAL	0.11	0.36
KOR	0.73	0.36
MEX	2.37	0.37
PAN	-0.48	0.39
PHI	-0.75	0.36
POL	0.07	0.45
THA	0.05	0.36
URG	0.16	0.36
VEN	-0.33	0.38
LRDEV	-3.46	0.97
LPDEV	1.17	0.50

R-squared 0.44

Durbin-Watson  
statistic 2.12

### Equation 2

Dependent Variable: LPDEV

	Estimated Coefficient	Standard Error
ALG	-0.0767	0.0583
ARG	0.391	0.0583
BRA	-0.201	0.0583
CHI	0.123	0.0583
MEX	0.152	0.0583

**Policy Research Working Paper Series**

<b>Title</b>	<b>Author</b>	<b>Date</b>	<b>Contact for paper</b>
WPS1292 Services as a Major Source of Growth in Russia and Other Former Soviet States	William Easterly Martha de Melo Gur Ofer	April 1994	C. Rollison 84768
WPS1293 Product Standards, Imperfect Competition, and Completion of the Market in the European Union	Glenn Harrison Thomas Rutherford David Tarr	April 1994	N. Artis 38010
WPS1294 Regulations, Institutions, and Economic Performance: The Political Economy of the Philippines' Telecommunications Sector	Hadi Salehi Esfahani	April 1994	B. Moore 35261
WPS1295 Why Higher Fiscal Spending Persists When a Boom in Primary Commodities Ends	Bruno Boccara	April 1994	M. Pfeiffenberger 34963
WPS1296 Earnings-Related Mandatory Pensions: Concepts for Design	Salvador Valdés-Prieto	April 1994	H. Rizkalla 84766
WPS1297 How Relative Prices Affect Fuel Use Patterns in Manufacturing: Plant-Level Evidence from Chile	Charles C. Guo James R. Tybout	May 1994	C. Jones 37699
WPS1298 Capital Goods Imports, the Real Exchange Rate, and the Current Account	Luis Serven	May 1994	E. Khine 37471
WPS1299 Fiscal Policy in Classical and Keynesian Open Economies	Klaus Schmidt-Hebbel Luis Serven	May 1994	E. Khine 37471
WPS1300 Dynamic Response to External Shocks in Classical and Keynesian Economies	Klaus Schmidt-Hebbel Luis Serven	May 1994	E. Khine 37471
WPS1301 Estimating the Health Effects of Air Pollutants: A Method with an Application to Jakarta	Bart Ostro	May 1994	C. Jones 37699
WPS1302 Sustainability: Ethical Foundations and Economic Properties	Geir B. Asheim	May 1994	C. Jones 37699
WPS1303 Conflict and Cooperation in Managing International Water Resources	Scott Barrett	May 1994	C. Jones 37699
WPS1304 Informal Gold Mining and Mercury Pollution in Brazil	Dan Biller	May 1994	D. Biller 37568
WPS1305 Information and Price Determination Under Mass Privatization	Nemat Shafik	June 1994	A. Yideru 36067

**Policy Research Working Paper Series**

	<b>Title</b>	<b>Author</b>	<b>Date</b>	<b>Contact for paper</b>
<b>WPS1306</b>	<b>Capital Flows and Long-Term Equilibrium Real Exchange Rates in Chile</b>	<b>Ibrahim A. Elbadawi Raimundo Soto</b>	<b>June 1994</b>	<b>R. Martin 39065</b>
<b>WPS1307</b>	<b>How Taxation Affects Foreign Direct Investment (Country Specific Evidence)</b>	<b>Joosung Jun</b>	<b>June 1994</b>	<b>S. King-Watson 31047</b>
<b>WPS1308</b>	<b>Ownership and Corporate Control in Poland: Why State Firms Defied the Odds</b>	<b>Brian Pinto Sweder van Wijnbergen</b>	<b>June 1994</b>	<b>M. Kam-Cheong 39618</b>
<b>WPS1309</b>	<b>Is Demand for Polluting Goods Manageable? An Econometric Study of Car Ownership and Use in Mexico</b>	<b>Gunnar S. Eskeland Tarhan N. Feyzioglu</b>	<b>June 1994</b>	<b>C. Jones 37699</b>
<b>WPS1310</b>	<b>China's Economic Reforms: Pointers for Other Economies in Transition</b>	<b>Justin Yifu Lin Fang Cai Zhou Li</b>	<b>June 1994</b>	<b>C. Spooner 30464</b>
<b>WPS1311</b>	<b>The Supply Response to Exchange Rate Reform in Sub-Saharan Africa (Empirical Evidence)</b>	<b>Mustapha Rouis Weshah Razzak Carlos Mollinedo</b>	<b>June 1994</b>	<b>J. Schwartz 32250</b>
<b>WPS1312</b>	<b>The New Wave of Private Capital Inflows: Push or Pull?</b>	<b>Eduardo Fernandez-Arias</b>	<b>June 1994</b>	<b>R. Tutt 31047</b>

