CENTER FOR INSTITUTIONAL REFORM AND THE INFORMAL SECTOR

University of **Maryland at College Park**

Center Office: IRIS Center, 2105 Morrill Hall, College Park, MD 20742
Telephone (301) 405-3110 • Fax (301) 405-3020

WILL GOVERNMENT POLICY MAGNIFY CAPITAL FLOW VOLATILITY?

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Giuseppe Bertola and Allan Drazen

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Authors: Guiseppe Bertola (Princeton University) and Allan Drazen (University of Maryland)

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by

Giuseppe Bertola, Princeton University, CEPR and NBER

and

Allan Drazen, University of Maryland and NBER'

ABSTRACT

In some less-developed countries or regions, we observe periods of very large capital inflows alternating with periods of very large capital outflows. What accounts for this volatility? We develop a model based on the interaction of persistent, stochastic swings in the profitability of local investment on the one hand, and of forward-looking investment behavior (due to irreversibilities) on the other. We suggest that government policy responses may well magnify the effect of technological uncertainty and thus be responsible for the wide observed swings of capital accounts in regions such as Latin America.

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IRIS Summary **Working Paper No. 104**

Will Government Policy Magnify Capital Flow Volatility?

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In the past year there has been a significant change in capital inflows into Latin America. In the mid 1980s capital flows into the ten countries that make up Latin America averaged 8 billion dollars a year; they rose to **20** billion dollars in **1990, and to 40 billion dollars in 1331. Furthermore, capital** inflow into Latin America has been highly volatile over this period. what lies behind these recent changes?

One line of argument relates recent capital inflows into Latin America to what has been happening in the United States, specifically the sharp drop in interest rates and the sluggish level of economic activity. Though external factors are clearly important, factors internal to the region, such as the sharp change in the role of government and reliance on the free market, have played a role as well and perhaps a crucial one. In this paper we **consider this alternative point of view,** namely that the capital inflow represents the response to events within Latin America, rather than outside the region. More specifically, we suggest that variability of government policies may be responsible for the volatility of capital inflows. (In viewing the inflow as a regional phenomenon, we think of the "country" under consideration as a Latin American Aggregate, meaning that investment flows are highly correlated across neighboring countries in a region).

In this paper **we study investment behavior in a dynamic optimizing** model in which supply and demand shocks interact with government policies. Our **aim is to show not only that serially uncorrelated shocks can induce persistent effects on investment and** capital flows, but also that expected government policies and other "characteristics" of the economy can **magnify** the effects of these shocks.

We first show, in the context of a simple model in the absence of magnification effects from government policy, how the stochastic nature of production leads to variability in asset returns, asset prices and capital inflows. We then consider what determines the extent of fluctuations in private investment incentives and hence **fluctuations in asset prices and capital inflows.**

On the basis of these results, we then show how government policy responses to stochastic shocks can magnify the effects of those shocks. We consider a number of possible mechanisms for magnification of underlying shocks. First, the expectation that the government may "waffle" between the imposition and liberalization of capital account restrictions will mean that realizable returns to investment will similarly fluctuate. If capital controls are tightened in bad times and relaxed in good times, as would seem to characterize the policy of many Latin American governments, the effect of productivity shocks will be

magnified.

Second, there may be a positive feedback between capital movements and fiscal policy, a sort of "dynamic Laffer curve." Specifically, a given level of expenditure implies higher tax rates in bad times for a given tax base: these higher tax rates however discourage capital inflow, thus lowering the tax base and magnifying the tax consequences of an adverse shock.

Finally, government expenditures and transfers can also have a magnifying effect in at least two ways. First, public investment in infrastructure is often procyclical; to the extent that private investment and public infrastructure investment are complements in production, magnification of productivity shocks will result. Second, bad times may increase political pressure for redistribution of income flows towards domestic residents with no access to the international capital market. Such redistributive policies appear especially descriptive of many Latin American governments, and need to be financed by increased taxes on capital, the ex-ante internationally mobile factor of production.

I. Motivation and overview

In the past year there has been a significant change in capital inflows into Latin America. In the mid 1980s capital flows into the ten countries that make up South America averaged eight billion dollars a year; they rose to 20 billion dollars in 1990 and to 40 billion dollars in 1991. Furthermore, capital inflow into Latin America has been highly volatile over this period. What lies behind these recent changes?

One line of argument relates recent capital inflows into Latin America to what has been happening in the United States, specifically the sharp drop in interest rates and the sluggish level of economic activity. This point of view is well represented in a recent paper by Calvo, Leiderman, and Reinhart (1992). Taking the change in officially held foreign exchange reserves as a proxy for capital flows, they show, first of all, that the inflow was spread across several countries in Latin America. Using principal components analysis, they demonstrate that there has been a common factor in the inflow into all of these countries, and that the first principal component of various United States macroeconomic time series (including a measure of economic activity, various interest rates, and financial returns data) is correlated to Latin American capital inflows and real exchange rates. Put in simple terms, the drop in short-term interest rates in the U.S. since mid-1991 combined with the slowdown in economic activity led investors to shift their focus Southward.

Though this line of argument has much merit, two types of criticisms can be levellecl against it. First, given the nature of investment decisions, a perspective of longer than a year or two is needed. Second, external factors are clearly important, but factors internal to the

region (such as the sharp change in the government attitudes with increased reliance on free markets) have played a role as well, and perhaps a crucial one.

First, consider the nature of investment decisions. It is generally agreed that a long-run perspective is needed to understand investment dynamics in a macroeconomic context. Accumulation of physical capital and financial capital flows need to be analyzed in terms of their driving processes' stochastic properties rather than in terms of current events only. One must consider the interactions of stochastic shocks that exhibit persistence, as well as irreversibility of investment and adjustment costs that imply investment decisions should be forward-looking. **Such features should characterize any model of invcstmcnt, and suggest that** modeling fluctuations requires a view of longer term than a year or two.

In terms of capital flows, explaining the volatility of returns to country-specific investment is key to understanding the dynamic features of capital flows, leading one to ask what macroeconomic features may underlie such volatility. In so doing, we are motivated by recent Latin American experience. There is widespread agreement that the capital inflow is a regional phenomena, rather than being limited to a few countries. (The Calvo, Leiderman, and Reinhart **paper makes a strong case for this.) There is far less agreement, however, on the** view that economic developments in the United States were the primary motivating factor. There is mixed evidence on whether inflows of similar magnitude have taken place into other regions in the world, as the Calvo-Leiderman-Reinhart hypothesis would suggest. Moreover, if low U.S. interest rates were a key factor, why did we observe a similar massive inflow into Latin America in the late 1970's and early 1980's, when U.S. interest rates were very high? (We return below to a discussion of explaining these episodes in terms of interest rate

differentials.)

An alternative point of view is that the capital inflow represents the response to events within Latin America, rather than outside the region. More specifically, we suggest that variability of government policies may be responsible for the volatility of capital inflows. In viewing the inflow as a regional phenomenon, we think of the "country" under consideration as a Latin American aggregate, meaning that investment flows are highly correlated across neighboring countries in a region. There are a number of reasons why this is likely to be the case. Foremost in our minds is the view that outsiders perceive there to be unobserved shocks which are common to neighboring countries. That is, if there is a positive shock to economic activity and the profitability of investment in one country, it is believed there is a component to the shock which is common to the region, though not to countries outside the region. Secondly, there will be spillovers of observed activity across borders, both on the supply and the demand side. Finally, competition for funds in the world capital markets will lead countries to adopt similar policies with respect to foreign investment. That is, in order to remain attractive to foreign investors who believe there are regional factors, a country will be led to liberalize when its neighbors do.

We are currently involved in a research project whose aim it is to study investment behavior in a dynamic optimizing model in which supply and demand shocks interact with government policies. In a framework where primitive productivity shocks can induce persistent effects on investment and capital flows, we argue that expected government policies and other institutional characteristics of the economy can magnify the effects of these shocks. The mathematical development of these points is somewhat complex. We eschew formalities

in this paper, and simply outline some of our perspective's main insights in a non-technical, but nonetheless rigorous way.

When technological productivity shocks are the primary cause of volatility, they may of course be magnified by market structure and increasing returns at the local level (due to strategic complementarities, infrastructure, thick markets, threshold effects, etc.) Such effects are not unique to Latin America, however, and technological shocks, even when magnified by these effects, may not explain why the volatility of capital flows is so high in Latin America relative to other regions.

The focus of our research is therefore on how government policy can magnify the effects of technology shocks. There are a number of possible mechanisms. First, the expectation that the government may "waffle" between the imposition and liberalization of capital account restrictions will mean that realizable returns to investment will similarly fluctuate. If capital controls are tightened in bad times and relaxed in good times, as would seem to characterize the policy of many Latin American governments, the effect of productivity shocks will be magnified. Second, there may be a positive feedback between capital movements and fiscal policy, a sort of "dynamic Laffer curve." Specifically, a given level of expenditure implies higher tax rates in bad times for a given tax base; these higher tax rates however discourage capital inflow, thus lowering the tax base and magnifying the tax consequences of an adverse shock. Finally, government expenditures and transfers can also have a magnifying effect in at least two ways. On the one hand, public investment in infrastructure is often procyclical; to the extent that private investment and public infrastructure investment are complements in production, magnification of productivity shocks

will result. On the other hand, bad times may increase political pressure for redistribution of income flows towards domestic residents with no access to the international capital market. Such redistributive policies appear especially descriptive of many Latin American governments, and need to be financed by increased taxes on capital, the ex-ante internationally mobile factor of production.

The plan of the paper is as follows. In the next section we discuss our basic approach, which is focussed on a stochastic production structure (but with no "magnification" effects from government policy), and illustrate it with a simple model. We show how the stochastic nature of production leads to variability in asset returns, asset prices, and capital inflows. In the third section, we consider what determines the extent of fluctuations in private investment incentives and hence fluctuations in asset prices and capital inflows. We then proceed to sketch ways in which such volatility might be endogenous to the country's economic structure. In the following section, we consider the mechanisms set out above by which government policy will *magnify* fluctuations due to stochastic productivity shocks. The final section presents conclusions.

II. A Basic Model

Our goal is to show how fluctuations in underlying determinants of productivity (or of any other stochastic fundamental, such as demand conditions) can induce variability in patterns of investment and capital flows which looks quite different from the underlying driving process. Magnification of underlying variability through government intervention is our primary, though not our only interest. Our research strategy is to begin with a very basic

stochastic model. Of course, such a model should be viewed as representative of a much wider class of models. We analyze how capital flows into a country are affected by uncertainty as to local investment profitability. Our modelling of uncertainty is kept as simple as possible (a two-state Markov chain) to focus on the economics of the interaction between international supply of funds and local technological, market, and policy developments.

Consider an economy that produces a single good, where production is represented by a Cobb-Douglas production function,

$$Y(t) = A(t)L(t)^{\alpha}K(t)^{1-\alpha}, \tag{1}$$

where $Y(t)$ is output at time t; $A(t)$ is a productivity indicator; $L(t)$ denotes labor (or land), which is internationally immobile; and $K(t)$ is the installed stock of capital.

The economy's productivity grows exponentially (and exogenously) over time, but is also subject to equally exogenous fluctuations. Specifically, we write

$$A(t) = a(t)e^{\theta t}, \tag{2}$$

where the trend parameter θ indexes technological progress. To model stochastic productivity fluctuations, we let the scale parameter a follow a two-state Markov process: $a(t)$ = a, in a (country-specific) good state, but $a(t) = a_b < a_g$ in a (country-specific) bad state at time t, and transitions between the two states occur with constant probability intensity δ in continuous time.

The economy is open to international trade, but we abstract from issues of exchange rate determination by letting the single produced good be identical to what is produced

abroad. Thus, only intertemporal trade has a role in our model, and we focus on the consumption and investment choices of domestic and foreign residents. The production flow can be either consumed (locally or abroad), or invested. Physical investment translates one-to-one into an increase of the installed capital stock,' and is irreversible: when local business conditions deteriorate, the physical capital stock installed in the country cannot decrease. We assume perfect mohility of financial capital, however, and consider a simple *characterization* of capital-market equilibrium relationships.

Ruling out irrational bubbles, asset values depend on the current value and expected dynamics of dividends accruing to each unit of homogeneous capital, We denote by γ the share of the country's production which is paid as compensation for the services of the installed capital stock, and, for simplicity, we take it to be constant within each productivity state. Denoting capital's income share in good times and bad times by γ_g and γ_b respectively and employment by L_g and L_b, the dividend flow accruing to each unit of capital is

$$\gamma_i \frac{Y(t)}{K(t)} = \gamma_i e^{\theta t} a_i L_i^{\alpha} K(t)^{-\alpha} \tag{3}$$

in state i, $i = g,b$. To simplify notation, we define the profitability indicator

$$\eta_i(t) \equiv \gamma_i a_i L_i^{\alpha} , \tag{4}$$

and rewrite the dividends expression in (3) as

$$\gamma_i \frac{Y(t)}{K(t)} = \eta_i e^{\theta t} K(t)^{-\alpha} . \tag{5}$$

For the purpose of interpreting the results of this section, it may be useful to consider as a baseline the case of competitive decentralization (with no taxes or subsidies), and constant

employment. Under Cobb-Douglas production, the competitive factor share of capital would be state-independent and equal to $(1 - a)$. Thus, the dividends process responds one-for-one to changes in the productivity indicator in (2) and is a decreasing function of the installed capital stock with elasticity a. In (3), however, both capital's income share γ and employment L are indexed by state i. Inasmuch as they vary across states, the dynamics of the profitability index η in (5) differ from those of the primitive technological index a. In our working paper (1993), we consider how such state-dependency may magnify the volatility of capital income, and of capital-flows responses to the primitive shocks as indexed by a. We do not develop such insights formally in this paper, but simply diseuss the qualitative insights afforded by this and similar models.

To examine how stochastic productivity affects macroeconomic variables, we want to relate realizations of the profitability indices η_g and η_b to investment decisions, asset prices, and capital flows. To do so, consider the no-arbitrage relationships required by financial market equilibrium. They require that the asset value of capital in each state at each point in time (which we denote $q_g(t)$ and $q_b(t)$) must be such that current dividends and expected capital **gains per unit time: yield** a return r on the asset's value, where r is the rate of discount applied by welldiversified global investors to income flows from the country under consideration. (A formal, mathematical derivation of these equations, and of the results that follow, **can be found in our working paper.) These equations may be thought of as yielding** relations from the productivity indicators η_g and η_b to the asset prices in the two states and the stock of capital $K(t)$.

We assume that parameters **are** such that investment is positive in this country in good

times, that is, when profitability is indexed by η_g. Thus, the good-time value of capital is fixed at the unitary output and consumption price of investment in our single-output-good model, for any discrepancy between the value of installed capital and the unit cost of investment would allow arbitrage opportunities between installation of new capital on the one hand, and financial claims to the existing stock on the other. We further assume that investment is irreversible. Hence when bad times (as indexed by η_b) first hit, the irreversibility constraint is binding and the currently installed capital stock $K(t)$ will be constant.

These assumptions **imply the following characteristics of the paths, In bad times (that** is, times during which $\eta = \eta_b$) the irreversibility constraint may bite, to imply that the unit value of capital will be strictly less the current cost of installation ($q_b(t) \leq 1$). As dividends grow exponentially while the bad state persists, the unit value will not be constant over time, but will be rising monotonically to unity. If bad times persist long enough, productivity growth at rate θ will eventually make investment profitable even when $\eta = \eta_b$. Whenever there is positive investment, the value of installed capital must equal its installation cost ($q_b(t) \leq 1$).

In good times ($\eta = \eta_g$), the value of installed capital equals its installation cost ($q_g(t) = 1$), and capital grows exponentially. If the good state were perceived as permanent ($\delta = 0$), the equation determining the rate of growth of capital would reflect the equality of capital's current marginal revenue product to its user cost r. With $\delta > 0$ and $\eta_b < \eta_g$, investors realize that times will eventually turn bad, and that the downturn may in fact occur in the immediate future. With investment irreversilibyt, capital accumulation in good times must

then reflect the fact that if and when a negative productivity shock hits the economy it will be impossible to recoup the installation cost of existing units of capital.

III. Capital accumulation and capital flows

The solution of the model has a straightforward logical structure (see our working paper for derivations and details). The equations of the model determine $K(t)$ (and $q(t)=1$) when the irreversibility constraint *is* not binding, and determine $q(t)$ when binding irreversibility constraints yield a constant K. The top panel of Figure 1 displays a realization of the η Markov chain; the figure's other panels illustrate the dynamics of the capital stock, of output, of the unit value of the country's capital stock, and of realized returns on holdings of country-specific capital.

Whenever the irreversibility constraint is not binding, the country's capital stock increases so as to keep the value of capital at unity in the face of productivity growth: as in the steady state of a Solow (1956) model, capital grows at rate θ/α if θ is the *exponential rate* of growth of disembodied productivity and/or population. If the country is hit by a negative profitability shock, however, the value of installed capital drops below unity, the irreversibility constraint bites, and the stock of capital ceases to grow. If "bad times" persist long enough that $q_b(t)$ reaches unity, the irreversibility constraint ceases to bind and investment resumes, again at rate θ/α. As soon as profitability conditions are improved by the next Poisson shock, the capital level jumps to prevent q_g from exceeding unity, and investment proceeds at rate θ whether or not it was ongoing in the bad state. The "good" and "bad" times behavior of the various series plotted in the Figure is not as sharply

defined in real life as it is in the model, but the latter's implications appear qualitatively realistic. Output growth is slower when investment is not taking place, though positive within each state (explicit treatment of depreciation would of course imply slower and possibly negative output growth in bad times), When good news arrives and profitability improves, both output growth and investment spike upwards. The value of the country's installed capital stock, or its stock market's value, jumps upwards as the quantity of capital increases: a spike in the unit value of installed capital may or may not accompany the investment boom, depending on how long the previous depression lasted.

To discuss the *financial* capital-flow counterpart to the capital-accumulation dynamics, one can combine the essentially microeconomic aspects of our investment model with equally simple models of saving and consumption decisions in a small-open-economy setting. When individuals can borrow and lend at the world risk-free rate and the income stream is subject to stochastic fluctuations, consumption-saving decisions are not easy to model, since they will depend on the specific stochastic process followed by income. Some special cases, however, may provide some insight. Consider the extreme case in which domestic residents have no access to world capital markets, so that they would simply consume their current income at each point in time.[3] In this case, domestic consumption responds one-for-one to GNP. Since the investment model above is solved under the assumption that financial capital is internationally mobile, we should think of all claims to the installed capital stock as being owned by non-residents. Income flows from this capital, which would appear as a deficit item in the current account, would equal $\gamma Y(t)$. Periods of high investment would correspond to capital inflows and balance of payments surpluses, periods of low or zero investment as

balance of payments deficits.

However, standard residency-based definitions of capital flows may be quite misleading for interpreting accounting data from less-developed countries, and especially Latin American ones. When some or all capital flows take the form of unrecorded and often illegal "capital flight," official data measure only very imperfectly the amount and dynamics of local residents' net foreign assets. Even at a theoretical level, it is not quite clear that those Latin American citizens who hold much of their wealth in the U.S. are "resident" in any economic sense. It may then be useful to consider a less standard definition of capital flows, defined in terms of resource flows in and out of the country regardless of their owners' domestic of foreign residency. We can say that a country experiences positive capital inflows whenever the sum of domestic consumption and domestic investment exceeds domestic production in (1). We could then consider the dynamics of capital flows $F(t)$ defined by

$$F(t) = C(f) + \dot{K}(t) - Y(f) \quad . \tag{6}$$

In the extreme case where all local residents are liquidity constrained, domestic consumption coincides with GNP, and capital flows correspond to investment by foreigners. More realistically, in a typical Latin American country, some local residents may consume current income, while others smooth consumption through access to the world capital market. When the relevant transactions occur via overinvoicing of exports and other unofficial channels, recorded capital flows will reflect only imperfectly the investment decisions of local and foreign residents. They might instead be closely related to $F(t)$ in (G), with domestic consumption a weighted average of that of consumption "smoothers" and "rule-of-thumb" consumers. In any case, capital flows would be closely related to the capital accumulation

process illustrated in Figure 1.

The Figure also plots a series of realized returns on holdings of country-specific capital (returns per infinitesimal unit of time spike to plus or minus infinity upon a state transition, and the Figure plots their counterpart over finite intervals of time). It is important to note that the relationship between stock market rates of return and investment flows is consistent with the evidence in Calvo et al. (1992). First, the country is the recipient of ongoing positive capital flows in "good times," when the realized rate of return is inclusive of a "crash" premium which realizes upon state transition. Second, upon a transition from bad to good times there is a step capital inflow, and the return on the country's asset includes the realization of step capital gains on q. Such relationships follow immediately from the assumption of capital market equilibrium in a stochastic context, of course, and there is no sense in which high rates of return *cause* capital flows. The two phenomena are jointly and endogenously derived from underlying profitability dynamics.

The caution against taking high rate of return differentials as causing a capital inflow when both reflect underlying shocks is strengthened when one realizes that large flows of capital into the stock market may induce a run-up of stock prices. Such autonomous capital inflows would show up as a rate-of-return differential if rates of return are measured inclusive of realized capital gains, so that causation would run from capital flows to return differentials, not vice-versa. This may be descriptive of the Latin American experience in the late 1970's.

The above model illustrates the role of a primitive stochastic component in the production process in inducing fluctuations in key variables. We purposely kept the stochastic

specification as simple as possible, by focussing on a two-state process for the country's productivity and capital's profitability. The key characteristics of the model are: forward-looking behavior in physical investment (which we rationalize in terms of irreversibility but, of course, may reflect a variety of other realistic adjustment costs); and perfect flows of financial capital in the presence of local sources of uncertainty. Other features are admittedly simple, but more sophisticated modeling would not change the basic message.

The point that future expected business conditions matter for current investment is familiar from, e.g., Bernanke (1983), Dixit (1991), and much other recent work on investment dynamics under irreversibility. Of course, very similar if less dramatic insights could be obtained from any model where investment and disinvestment entail adjustment costs (with irreversibility representing the extreme case of prohibitive "adjustment" costs for disinvestment). An explicitly dynamic framework makes it possible to go beyond consideration of currently unconstrained investment decision, however. Quite clearly, the counterpart of restrained investment in good times is an excess of installed capital in bad times, when the irreversibility constraint bites. Rational investors behave so as to keep realized returns on country-specific investment as close as possible to the required rate of return (r in the model). A supernormal return in good times (and the attendant restrained investment, given decreasing returns to capital) has a counterpart *in lower-than-normal returns* in bad times, and irreversibility *per* se deters capital accumulation in an average sense. Rather, realistic irreversibilities and other adjustment costs affect the dynamics of capital accumulation, which are reflected in the dynamics of (unconstrained) flows of financial

capital.

The model could be extended in several ways. We could consider demand side shocks, for example in an analogous two-state framework. There could also be magnification from endogenous labor supply decisions or "thick-market" externalities. It would be hard, however, to argue that technological uncertainty or "thick-market phenomena" are especially important for capital profitability *in* specific countries, or indeed *in* less-developed countries as a whole. Even a simple look at the data make it apparent that Latin American countries feature much more drastic swings in savings, investment, and capital flows than East-Asian or sub-Saharan LDCs. Though the level of technological uncertainty, for example, may differ across countries, it is difficult to believe that it is sufficiently higher in Latin America than in the rest of the world to explain the high volatility of capital flows relative to other countries. One must therefore look at something other than primitive technological uncertainty to see what may distinguish Latin America from other regions in the world. As indicated in the introduction, our focus is on the role of government policy in magnifying technological shocks. In the next section, we go on to highlight the role of government policy variables, and argue that they should be regarded as crucial in the Latin American context.

IV. The role of government policy

Frequent changes in political regime and significant shifts in government policy are an often-noted characteristic of the economic policy making environment in Latin America. Argentina and Brazil, for example, are often given as examples of countries which have been hampered by frequent sharp policy shifts (for example in inflation stabilization or

balance-of-payments policy). The East Asian "dragons," by contrast, are notable for a high degree of policy stability (Larrain and Vergara [199 1]). The mid and late 1980's have witnessed another significant shift in policy in Latin America. Several countries in the region have moved sharply towards a much less interventionist stance and far greater reliance on the market; others have taken less drastic steps but have still moved along with the trend to free-market economics. The purpose of this section is to informally investigate the extent to which government policy decisions may help explain volatility of capital flows. More specifically, we are interested in how volatility in policy can *magnify the* volatility of fluctuations in investment profitability and investment, and we will discuss a number of possible mechanisms.

In arguing that variability in government policy may be what distinguishes Latin America from other regions in accounting for the variability of investment, we are *not* arguing that no other country exhibits similar instability of policy. The crucial point here is *magnification:* government policy can magnify the ups and downs due to technological shocks, but cannot induce a significant and sustained investment boom and capital inflow if the technological conditions are not right. That is, a region characterized by political instability need *not* experience volatility in investment opportunities and capital inflows if the underlying technological developments are uniformly unfavorable. As indicated in the introduction, our goal is to explain volatility of capital flows and not a uniformly low level. It is now well-known that expectations of future economic conditions become especially important in investment decisions when investment is irreversible (see, e.g., Bemanke, 1983). In the case of foreign investment, this especially means conditions under which profits may

be repatriated. Hence expectations of future restrictions are crucial. In countries with a history of capital controls, foreign investors will not automatically assume that the capital account will be open in the future simply because it is open today. (Van Wijnbergen [1985], Rodrik [1989], discuss how uncertainty about capital account policy will affect investment incentives from abroad. Drazen [1992] discusses how expectations of possible future trade restrictions induced how volatility in importation of consumer durables in Israel in the 1980's.) The link we see to primitive technological uncertainty is via the response of policy to economic conditions. Unlike East Asia, in Latin America a deterioration of economic conditions often leads lo a major change in the direction of economic policy (see, for example, Kiguel, 1989). The imposition of restrictions on both current and capital account transactions is a common response to the balance of payments problems that often accompany an economic slowdown. Hence, a drop in productivity could bring with it that capital account policy will soon become less favorable to foreign investment, especially if the lower Ievel of economic activity is expected to persist. Similarly, an increase of productivity may bring with it the expectation of liberalization if the high activity state is similarly viewed as persistent. This policy response would itself further dampen capital inflow when times turn bad and further increase capital inflow when times turn good. Hence the sort of endogenous trade policy response to economic fluctuations which often characterizes Latin American governments may magnify underlying volatility of production.

The second mechanism we consider concerns how the tax system may magnify the effect of technological shocks. Our basic idea is that fiscal systems in Latin America are often characterized by a positive feedback between the tax base and the tax rate. More specifically,

there is a positive feedback loop between capital inflows and the tax rate on capital. A technological shock which lowers the tax base will induce an increase in the tax rate on capital, thus reducing capital inflows and further eroding the tax base and inducing a further increase in the tax rate. We term this effect the "dynamic Laffer curve." For such a feedback loop to be present, shocks to productivity must be met by tax changes rather than by changes in government expenditure or by changes in the deficit (as a tax-smoothing model would suggest).[4]

The failure of governments to respond to supply shocks by cutting government expenditure so as to keep tax rates and the deficit unchanged is a realistic description of how the world works. Certain aspects of IMF stabilization programs may also work in this direction: their primary focus on restraining public-sector borrowing requirements may sometimes generate swings in tax rates of the type we consider. It certainly seems descriptive of many Latin American countries in which expenditure programs are extremely difficult to cut. The difficulty in cutting government expenditures when the size of the pie has decreased may reflect a war of attrition over how to divide the burden of the cut, as in Alesina and Drazen (1991).

It is harder to argue that supply shocks which are perceived as not being permanent are *not* fully absorbed in the deficit, that is, that full smoothing of tax rates does not occur. Latin American countries in general have been far from averse to deficits. One argument concerns the implications of tax smoothing in a stochastic framework. Since η is stochastic and could stay low or high for a long period of time, keeping tax rates constant and meeting fiscal requirements (higher expenditures or shrinkage of the tax base) by issuing debt would

require state-contingent instruments. In their absence, the intertemporal budget constraint would risk being violated by perfect smoothing of tax rates.

An empirically more relevant argument for the dynamic Laffer effect in Latin America may be the change in the composition of taxes in response to an adverse supply shock. An Alesina-Drazen type argument suggests that it may also be difficult to get agreement on changing *certain* types of taxes in an economy, namely those falling on domestic interest groups with significant political clout. This suggests that other types of taxes, those falling more heavily on nonresidents, would be disproportionately affected by a productivity shock. That is, if the political system is such that fiscal decisions heavily reflect interest group pressure, tax rates on foreign-source capital might be expected to rise sharply in response to a negative productivity shock, even when overall government spending is fixed over the cycle.

Finally, we consider how variable government expenditure and transfers can induce a similar magnification of primitive technological uncertainty to that discussed in the previous section. We discuss two specific mechanisms: public investment and redistribution of income towards domestic residents. The public investment channel is straightforward and flows from the provision of infrastructure discussed by Barro (1990), among others, leading to public and private investment being complementary. That the correlation between public and private investment is strong and positive is quite apparent from both Latin American and East Asian data. If publicly supplied infrastructure makes private investment more profitable, an increase in public investment will encourage capital inflow. The link to production volatility comes from the sensitivity of public investment expenditure to economic activity.

The possibility that income redistribution policies may magnify technological

uncertainty may be especially relevant to Latin America, where governments seem to be prone to intervene in the income distribution process. Intervention to smooth consumption of domestic residents over the cycle seems quite benign, but we will show it can have the effect of magnifying productivity shocks. To see why, suppose there exists a class of agents who do not have access to international capital markets and therefore simply consume a state-dependent fraction of domestic production. In the absence of redistributive activity, the consumption of "local" factors of production would he procyclical, responding one-for-one to technological shocks. If the government wishes to smooth the consumption of such factors' owners over the cycle, it will intervene with *countercyclical* transfers, financed by taxes *on* agents with access to international capital markets. Hence, to the extent that the tax-transfer program smooths consumption of the first class of agents, it must *unsmooth* income flows *of* the second class, that is, make its income flows more procyclical. In other words, it must magnify the effect of variability in a on capital's profitability as indexed by η.

V. Conclusions

The phenomenon of high volatility of capital flows into Latin America has rightfully generated a good deal of attention and interest. One line of explanation is that it reflects developments outside the region; a second, that it reflects developments within the region. We hold with those who favor the second line of argument. More specifically, we believe that the volatility of capital flows into Latin America reflect the vagaries of government policies. Moreover, we argue that the nature of investment decisions requires focusing on horizons of longer than a year, as some explanations of the recent Latin American experience

have done.

Our discussion of the specific application to Latin America was simply meant to support in a way we think is empirically relevant the basic argument that imperfect smoothing of taxes may generate magnifying effects of fiscal policy. We do not claim to have proved the crucial role of government policy. Instead, our methodology has been to examine a simple representative model in which stochastic swings in the underlying profitability of local investment interact with forward-looking investment behavior (due to irreversibilities) to yield volatility of capital inflows. We take the model to be representative in that any model of investment under uncertainty should have these two features, and any model with these two features will yield the basic patterns our model exhibited. Many substantive issues can be addressed by our formal model, and we have focused our analysis on realistic mechanisms by which government policy responses would *magnify* the effects of underlying technological uncertainty. All of these mechanisms need to be explored in greater detail. This paper is meant to suggest how fruitful such an exploration may possibly be in explaining the volatility of capital flows.

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ENDNOTES:

1. We disregard depreciation, but its role would be quite similar to that of technical progress, as indexed by θ.

2. A constant growth rate of labor supply could be included in the exponential term, since technical progress could be seen as labor augmenting.

3. Similar, though less extreme, assumptions are considered and rationalized by Gertler and Rogoff (1990) and by Barro, Mankiw, and Sala-i-Martin (1992).

4. It may seem strange that an income-based tax system would magnify rather than dampen **fluctuations, given the basic textbook story of the tax system as an automatic stabilizer. In** the automatic stabilizer story, tax rates stay constant (or even fall in a progressive tax system) in response to a shock, with the deficit taking up the slack. Here, if the deficit stays constant, tax rates must "take up the slack", with tax rates *moving countercyclically.*

Figure 1