

Working Paper

INTERNATIONAL MONETARY FUND

IMF Working Paper

© 1997 International Monetary Fund

This is a *Working Paper* and the author(s) would welcome any comments on the present text. Citations should refer to a *Working Paper of the International Monetary Fund*. The views expressed are those of the author(s) and do not necessarily represent those of the Fund.

WP/97/148

INTERNATIONAL MONETARY FUND

Monetary and Exchange Affairs Department

**Policy Reform, Adjustment Costs, and Investment:
With Activity of Local Investors as a Signal**

Prepared by Omotunde E. G. Johnson¹

November 1997

Abstract

Adjustment assistance is provided to local investors responding to policy reform and facing adjustment costs, to facilitate their activity—a signal to foreign investors about the profitability of investing in the local economy. The government, in providing assistance, maximizes its utility subject to its budgetary constraint, taking into account the utility forgone in alternative uses of budgetary funds. Foreign investors use the signal to update beliefs about investors in the local economy and compute the expected return from investing in the country. The investment response of foreign investors depends on the expected return so computed relative to the expected returns in their alternative investments worldwide.

JEL Classification Numbers: F21, G14, O23

Author's E-Mail Address: OJohnson@IMF.org

¹Paper prepared while on sabbatical leave at the University of Oxford. The author remains solely responsible for the views expressed in the paper, while thanking for their comments William Alexander, David Andrews, Liam Ebril, Julio Escolano, and Robert Hauswald, of the IMF, and Francis Teal of the University of Oxford.

Table of Contents	Page
Summary	<u>3</u>
I. Introduction	<u>4</u>
II. Adjustment Costs and the Signal	<u>6</u>
III. The Model: Government Optimization	<u>8</u>
IV. Signaling and Foreign Investment	<u>11</u>
V. Some General Implications	<u>14</u>
VI. Concluding Remarks	<u>18</u>
References	<u>20</u>
Figure 1.	<u>12</u>

SUMMARY

Signaling to foreign investors, using the investment activity of local investors as the signal, occurs in the context of policy reform and local investors facing adjustment costs as they attempt to reallocate and expand their capital stock. In a simple model, the government provides adjustment assistance to local investors, to help defray their adjustment costs and boost investment activity. This assistance acts as a signal to foreign investors about the profitability of investing in the local economy. The government maximizes its utility subject to its budgetary constraint, taking into account the utility forgone in alternative uses of budgetary funds.

At the beginning of the period when the policy reform starts, the government chooses its policies, including its schedule for adjustment assistance. The rate of return to investing locally is then revealed to local investors, who choose their investment level in relation to GDP. At the end of this period, Foreign investors observe this investment together with other elements of the signal. They use the signal to update beliefs about investors in the local economy and to compute expected returns from investing in the country. The foreign investors then select their own investment for the ensuing period, depending on the returns so computed relative to expected returns from investing in other parts of the world.

Signaling has its costs for a country. It entails using resources with opportunity costs, and, in equilibrium, the rate of return demanded by foreign investors is higher than in a world of complete information with no need for a signal. Despite these costs, certain countries could benefit from the separating nature of the equilibrium. Countries classified as having predominantly sophisticated investors (whose signals induce significant positive response from foreign investors) will have a higher investment supply schedule (investment as a function of real rates of return) than countries classified as having predominantly unsophisticated investors.

I. INTRODUCTION

Even with rapid and resolute policy reform, including capital account liberalization, private capital accumulation and reallocation by investors can be slower than is pareto-optimal. For national investors as well as foreign investors in their capacity as reinvestors of profits earned locally and reallocators of capital already in the country—*both* to be identified simply as *local investors*—the underlying problem may be sizable *adjustment costs*, in expanding capital (see, e.g., Lucas, 1967) or in reallocating (capital) from the old sectors (from which exit is now optimal) to those where expansion of capital is now more profitable under the new regime (see, e.g., Dixit, 1989). Or investors could be frustrated by *capital market imperfections* particularly since the investors may not have established a track record of profitable operation in the expanding sectors.¹ Investors, for instance, could face exceptional financing costs (e.g., higher borrowing interest rate or very strict credit rationing than normal) because a firm has not had a long history of successful operation in a new environment or business. Then there is what has been called *structural uncertainty* (Zeira, 1987) that arises when a firm is uncertain about its profit function and must discover it through a process of search via experience gained from engaging in the investment activity, supplemented perhaps by some market research. Structural uncertainty could be especially severe during periods of structural reforms requiring major sectoral reallocation of capital.

All of the above assume that investors find the current government credible in its determination to persist with the reforms and that the policies contained in the government's program are sustainable in the socio-political environment of the country. In such a case, there would exist a high degree of confidence that current policies would not be reversed (either by the present or a future government)—unless real economic circumstances warrant a reversal, of course. When credibility of the government or the sustainability of policies makes significant the risk of policy reversal, investors may prefer to wait for greater assurances before committing themselves to capital accumulation or reallocation. The durability and irreversibility of much capital investment often render such a wait-and-see strategy optimal (see, e.g., Dixit and Pindyck, 1994).²

For *foreign investors*, apart from the above, incomplete information on additional facts may give rise to risks or uncertainties related to both the policy and the non-policy environment in a country, adversely affecting expected returns from investing in the country.

¹For the operation of such factors, see, for example, Stiglitz and Weiss (1981).

²Gains from waiting may also result from a cautious approach to policy by policy makers. The knowledge that the authorities may be uncertain about how far to go in their use of certain policy instruments, and prefer to make small changes and then observe the response of the private sector before making additional changes, can engender strategic situations, as investors also learn the authorities' behavior strategy rule(s) and use it (them) in formulating their own strategy (strategies). See, for example, Caplin and Leahy (1997).

These facts could include, most notably, the security situation; the availability and quality of basic infrastructural services; the efficiency and honesty of the government bureaucracy; the state of development, and of the efficiency, of labor and financial markets; and the political and social attitudes toward private capital. In all such areas, local investors would be normally better informed than foreign investors and often would, in addition, have devised privately efficient ways to address many difficulties of the environment.

Foreign investors will typically look for news or appropriate signals that would inform them about the wisdom of investing, or even investigating investment possibilities (via market research), in particular economies.³ Given the factors about which foreign investors are typically ill-informed, and given the informational advantage of local investors, information on the investment activity of local investors in the economy could be an appropriate signal to foreign investors for assessing the performance of an economy and how the foreign investors are likely to perform in that economy. In fact, we would conjecture that the investment activity of local investors would be a very strong signal, which could be also available at *relatively* low cost to foreign investors. The strength of the signal would tend to be greater the more widely known are the local investors, for example via their participation in international financial markets, and the more integrated are the local financial markets with other (especially major) financial markets. In addition, the signal would be stronger and more cheaply available, the more, in practice, foreigners invest jointly in enterprises with local investors, including enterprises owned predominantly by the local investors.

Government policies can abate directly, or else mitigate, the adverse effects of the above problems; some of these policies have already been discussed in the literature. For instance, to deal efficiently with adjustment cost and imperfect financial markets, some government financial assistance may be optimal, in addition to structural reforms that improve the functioning of financial markets and the markets for capital goods. To address credibility and policy sustainability, signaling with specific government policy instruments could work (see, e.g., Rodrik, 1989; Bartolini and Drazen, 1997). To tackle structural uncertainty, perhaps the provision of information and some direct adjustment finance to assist with market research could prove useful.

This paper, *inter alia*, addresses the issue of signaling to foreign investors, using the investment activity of local investors (to be denoted as L below) as the signal. The paper does so in the context of policy reform when local investors face any or all of the costs discussed above (adjustment costs, capital market imperfections, and structural uncertainty) as they attempt to reallocate and expand their capital stock as necessary. For ease of exposition, these costs will all simply be identified as *adjustment costs*. A model is developed in which the government provides adjustment assistance to local investors responding to policy reform, in

³The news and signals are used in conjunction with risk ratings of countries as will be discussed below. For some interesting issues related to risk ratings see, e.g., Haque, et al (1997).

order to boost L . This then acts as a signal to foreign investors about the profitability of investing in the local economy. The government maximizes its utility subject to its budgetary constraint, taking into account the utility foregone in alternative uses of budgetary funds. Foreign investors use the signal to update beliefs about investors in the local economy and to compute the expected return from investing in the country. The investment response of foreign investors depends on the expected returns so computed for the local economy relative to the expected returns in the foreign investors' alternative investment opportunities world-wide.

The rest of the paper is organized as follows. Section II contains further elaboration on the adjustment costs and the signal. Sections III and IV are the core of the paper. Section III looks at the model from the standpoint of the government, and the government's optimal behavior strategy is derived to maximize its utility. In section IV, the perspective shifts to that of foreign investors; their optimal behavior strategy is derived, to maximize the expected returns from their investments, world-wide, after adjusting for country risks. For simplicity, both the government and the foreign investors are treated as if they were each a single person. In Section V, some general remarks are made, mainly about the cost of using signals, the separating nature of the equilibrium, and about empirical implications and evidence. Section VI contains concluding remarks.

II. ADJUSTMENT COSTS AND THE SIGNAL

Although we aggregate several types of costs into one and call them all adjustment costs, it may be noted in passing that the costs arising from capital market imperfections and structural uncertainty are not costs that traditionally form elements of what most economist would think of when discussing *adjustment costs*. Rather, typically, these costs affecting supply response and/or reallocation of capital between sectors would include: (i) quasi-fixed factor costs (such as waiting time to order and set up new machinery and facilities); (ii) the loss from discarding obsolete machinery; (iii) costs of training old and new workers in using new equipment or in adapting to new unfamiliar work practices and production lines; and (iv) costs (most notably redundancy pay) of firing unwanted employees (with outdated skills). All these costs flow from technological, physical, and natural constraints to effecting major changes to, and relocation of, plant, equipment and production lines and techniques.⁴

To help defray adjustment costs to firms, we have stated that *adjustment assistance* could be given. A number of ways exist for giving this assistance—some in kind and others in general purchasing power. For concreteness, we think of the assistance as being given in general purchasing power. In this regard, tax rebates are a straightforward way to do so. It is outside the purview of this paper to discuss at length the various ways in which one could give

⁴See, e.g., Lucas (1967), Pindyck (1982), and Dixit (1989).

adjustment assistance to firms and the relative merits of the different approaches.⁵ At any rate, as long as the assistance supports genuine costs of adjustment by local investors in response to credible policy reforms, it does not engender differential net return between local and foreign investors (the case in which such assistance could lead to differential returns will be discussed later). In addition, the adjustment assistance is not meant to alter desired long-run adjustment, in response to the policy reform, only to speed up adjustment.⁶

The *investment activity of local investors (L)* in reality is concerned with information much wider than simply the quantity of investment. In particular, it will contain other pieces of information such as the particular sectors in which the local firms are expanding their investments; the domestic sectors that are contracting (relatively or absolutely); the state of technology and human capital in the expanding sectors; and the general sources and costs of funds available to, and being used by, the local investors.

Probably one of the main sources of value to foreign investors of using a signal, such as L, is helping to narrow the set of countries, and the field of investment opportunities within countries, for intensive market research to locate specific areas and projects for actual investment, a process that can otherwise be very costly especially for small firms. Thus the motivation for using a signal is similar to that often operating in determining participation by financial and other business firms in co-financing and co-investment arrangements. At the same time, a good signal makes possible a rational and refined approach to decision making that does not rely on news or broad generalizations about whole sets of countries—say in a region.

The particular signal being discussed in this paper is likely to be more useful for investors wanting to operate in the agricultural, manufacturing and service sectors than for those desiring to enter the mining sector of a country. For one thing, governments are generally least hostile to foreign mining companies, probably because the relative (to local investors') expertise is thought to be greatest in that sector or because the capital requirements are typically beyond the capabilities, to raise funds, of local enterprises. In addition, the quality of the output is generally more predictable for mining than for other sectors (once the exploratory work has been done of course), reducing structural risks for investors. Conceivably, this is because the relative capital intensity of mining vastly reduces the impact of local factors of production (particularly labor) on the quality of the output. Furthermore, the markets for minerals tend to be world-wide, and product specifications typically can be described in terminology and categories that are clear in the case of mining, while this can be much more difficult in the case of products of other sectors.

⁵In principle, the analysis involved would be similar, with appropriate modification, to that of assessing the advantages and disadvantages of different fiscal incentives for the promotion of investment in developing countries (see, e.g., Lent, 1971).

⁶The problem should be familiar from the flexible accelerator model of investment.

Countries serious about policy reform and desirous of attracting foreign capital could also benefit from the operation of a signal, such as the one discussed here, particularly when they are members of a set of countries with a reputation for antagonism to private (notably foreign) capital. In other words, the reform-minded countries would benefit from an approach that enables investors, in the computation of expected returns, to separate them from the other countries in the set.

The effectiveness of the L signal would be enhanced if supported by other signals that address issues of government credibility and sustainability of a policy reform program in general and of liberalization of capital movements in particular.⁷ Other things being equal, these other signals would reduce investment risks in the eyes of both local and foreign investors. In this paper, we abstract from government and policy credibility issues and assume that local investors find the government credible in its commitment to reform and feel only insignificant risk of policy reversal.

III. THE MODEL: GOVERNMENT OPTIMIZATION

We consider a situation in which total investment in the economy at time t is the sum of investment by local investors and foreign investors. Local investors are in close contact with the government and are not uncertain about government policy. Their problem is *adjustment cost* when the government changes policy. The foreign investors, in contrast, do not know the investment environment as well and are not in close touch with the government or as clear about government policy. Hence, the new investors judge whether or not they should invest (or augment their investment rate) and, indeed, the extent to which they should invest, by looking at the investment activity and performance of the local investors. In short, the local investors provide the signal to the foreign investors to guide the behavior of the latter. We consider only two periods—namely, period $t-1$ and t —and present the equilibrium for period t .

The model works as follows, for the two periods $t-1$ and t . At the beginning of period $t-1$, when the policy reforms begins, the government designs its program with clear expectations about the response that local investors will have in terms of their basic investment; this expected response depends, *inter alia*, on adjustment costs. In the complete program, the government includes a schedule for adjustment assistance. The government, given its expectations about the basic investment (which would result if there were no adjustment assistance), and the relationship between adjustment assistance and increased local investment, determines its adjustment assistance schedule to maximize its utility subject to its budget constraint. The local investors observe the schedule and select their total domestic investment. At the end of period $t-1$ foreign investors observe the activity (L) of local investors and, consistent with the signaling model (section IV below), select their (foreign) investment destined for the local economy in period t . The local and foreign investment

⁷See, e.g., Rodrik (1989) and Bartolini and Drazen (1997).

together make up total investment. In equilibrium, the total investment is consistent with government expectations; that is, at the point of utility maximization, the relationship between local and foreign investment, taken into account by the government, is the one consistent with the equilibrium behavior of the foreign investors in the investors' signaling model. In the equilibrium of the model, the variables determined are: (i) adjustment assistance; (ii) investment by local investors; and (iii) foreign investment. Total investment is thereby determined. The basic policies of the government as well as the basic investment of local investors (in response to the basic policies) are exogenously determined.

More concretely, the situation for period t (when the signal observed at the end of period $t-1$, associated with the policy reform program of period $t-1$, has its effect on foreign investment) can be depicted as follows. Let I^d and I^f represent investment in the domestic economy by local and foreign investors respectively. All investment variables are measured in relation to gross domestic product (GDP); investment itself will be considered as gross. Also, let r represent the rate of growth of investment by local investors (relative to GDP); r^0 , the rate of change of investment by local investors not induced by adjustment assistance (basic or exogenous investment); and A , adjustment assistance. Also, let α represent the ratio of the effective rate of growth of foreign investment to the rate of growth of local investment; that is,

$$(1) \quad \alpha_t = \frac{r_t^f}{r_t}$$

where r_t^f represents the rate of growth of foreign investment and r_t is, of course, the rate of growth of investment by local investors.

Equation (2) gives the investment equation consistent with the expectations of the government.

$$(2) \quad I_t = I_{t-1} + r_t^0 (1 + \alpha_t) I_{t-1}^d + I_{t-1}^d \int_{A_t} \frac{dr_t}{dA_t} dA_t$$

where $\alpha_t = \alpha_t [I_{t-1}^d (A_{t-1})]$. Note that dr/dA is a schedule. We are assuming in this paper that it exhibits diminishing returns, reflecting rising marginal adjustment cost as the rate of adjustment increases during any given time period. Note also that the signaling effect works on total investment whether exogenous investment or induced by adjustment assistance. The basic macroeconomic policies of the government (without adjustment assistance) will influence r_t^0 (the local investment rate of increase that occurs "exogenously"). Moreover, the signaling effect tends to work with a lag. Hence the value of α_t reflects the influence of I_{t-1} , which is part of the information contained in the signal L_t .

The government obtains utility from private investment in the economy because of the positive effects on GDP growth and employment. As a consequence, the government obtains utility from providing adjustment assistance which helps to support greater private investment than otherwise. But the government also obtains utility from its own expenditures on other

activities (whether of an investment or consumption nature). The government utility function therefore exhibits the standard properties of consumer utility functions, most notably diminishing marginal rates of substitution.

Thus, we specify the utility of the government as a function of adjustment assistance directed at boosting private investment and of expenditure on goods other than adjustment assistance. In this regard, as far as the government is concerned, whereas the increased rate of private investment induced by adjustment assistance gives positive utility, there is an opportunity “cost” to the spending on adjustment assistance in the form of the foregone utility derived from spending on alternative goods. That is,

$$(3) \quad U_t = U[(\bar{G}_t - A_t), I_t(A_t)]$$

where \bar{G}_t represents the amount of government funds available to be spent in period t (the budget constraint), and U signifies utility. It is assumed throughout that the budget constraint is determined exogenously and not influenced by the amount of adjustment assistance given; in other words there is no special tax levied for investment adjustment assistance, which constitutes only a very small part of total government expenditure. To maximize government utility, set dU/dA in (3) equal to zero and obtain

$$(4) \quad U_1 = U_2 \frac{dI_t}{dA_t}, \text{ or } \frac{U_1}{U_2} = \frac{dI_t}{dA_t} = \frac{dr_t}{dA_t} I_t^d$$

where a numbered subscript of U denotes a partial derivative with respect to the relevant variable.

Equations (2) and (4) determine the equilibrium values of A_t (say A_t^*) and I_t (say I_t^*)—and hence dA_t^* —for given values of α_t , r_t^0 , I_{t-1}^d and the given dr_t/dA_t schedule. An equilibrium r_t for local investors, say r_t^* , is also obtained.⁸

A graphical illustration is given in Figure 1. The I^0I^0 schedule represents the transformation of adjustment assistance into investment, and the U^0U^0 schedule reflects the

⁸An important optimization problem tackled simultaneously by the government, but not discussed explicitly in this paper, is the design of the adjustment assistance mechanism. Although this issue will not be addressed in this paper, the objective of an optimal mechanism will be to minimize the adjustment assistance given for any increase in investment by local investors, subject to the condition that the last increase in investment receives marginal adjustment assistance greater than or equal to the marginal adjustment cost. The mechanism will involve a schedule that allows the government to pay no more than the minimum necessary to induce each additional investment, while taking into account increasing marginal adjustment costs. We implicitly assume throughout this paper that such an optimal mechanism is put in place as part of the adjustment assistance program.

preferences (marginal rate of substitution) of the government between investment adjustment assistance and other uses of budgetary funds. The point I_t^a , the intercept of the I^oI^o schedule, indicates the level of investment that would occur in the absence of adjustment assistance in period t (that is exogenous investment). The ratio U_1/U_2 is the slope of the U^oU^o schedule, while the slope of the I^oI^o schedule is given by the expression on the right hand side of equation (4). The slope of the first schedule reflects diminishing marginal utility; the slope of the second reflects diminishing marginal returns to adjustment funds in bringing about additional private investment (increasing marginal cost of adjustment).

IV. SIGNALING AND FOREIGN INVESTMENT

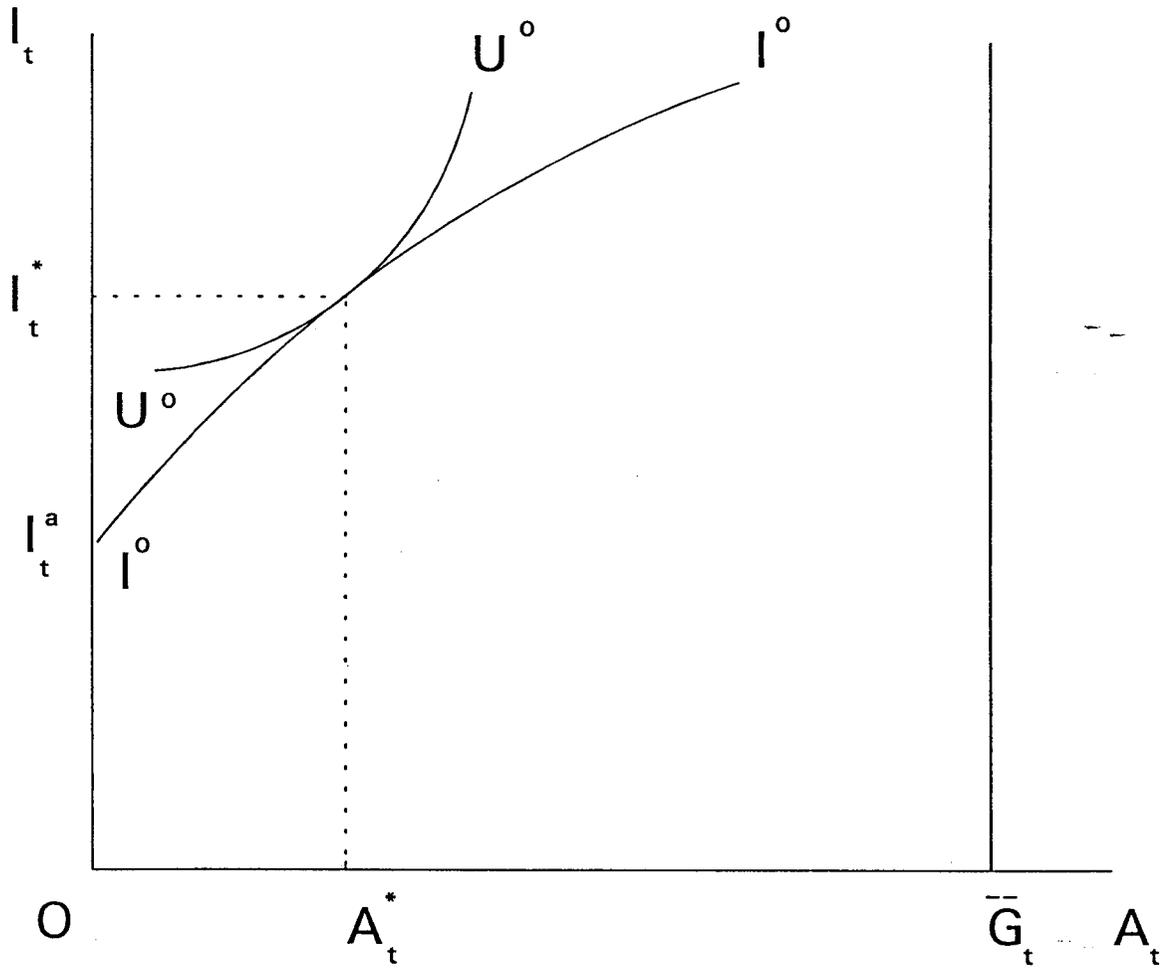
The paper now turns to the second aspect of the signaling model: the specification of the equilibrium behavior of the foreign investors. Define ρ as the real rate of return on investment, and μ as the country risk factor. Let superscripts d and w represent the domestic (local) economy and the world, respectively. For simplicity, and without loss of generality, we assume that the three parties (the government, the local investors, and the foreign investors) all have the same time horizon as regards ρ .

We present the signaling model as follows. At the beginning of period t-1, when the policy reform begins, the government chooses its policies, including its schedule for adjustment assistance. ρ^d is then revealed to local investors, who proceed to choose I_{t-1}^d . At the end of period t-1, this I_{t-1}^d is revealed to foreign investors, together with other elements of L. We identify the signal given at the end of period t-1 as L_t . The foreign investors then select I_t^f as a function of L_t . Thus I_t gets determined, as shown by equation (2).

Now when foreigners observe I^d , they decide on I^f (which determines the α) on the basis of the expected real return on their investment, duly adjusted for country risk, μ^d . The foreigners have their own assessment of country risk but they have incomplete information about ρ^d , one reason why they avail themselves of the L signal. The foreign investors also have incomplete information of the risk adjustment factor that local investors are using in their investment decision making. Hence, once the foreign investors receive the signal they must (for a number of reasons) assess it. Foreigners are also interested in maximizing their utility which increases with the rate of return on their investment after adjusting for risk.

The foreign investors are assumed to classify local investors into two types, namely, *sophisticated* (s) and *unsophisticated* (u); this is assumed a classification they use world-wide. The s-type investor always demands a minimum real rate of return (ρ_m^d) equal to the world risk-free rate of return (ρ^w) adjusted for some world-wide index of country risk (μ^d). That is, for the s investor the following minimum condition is satisfied:

Figure 1



$$(5) \quad \rho_m^d = (1 + \rho^w)(1 + \mu^d) - 1$$

In contrast, the unsophisticated investor is believed to have a significantly positive probability of being willing to accept a rate of return of less than that given in equation (5) —although not less than the risk-free world interest rate—to induce domestic investment on its part. In addition, under normal circumstances, sophisticated investors will want to invest mainly in certain activities and make use of certain technology, while avoiding some other specific kinds of investment or technology. Indeed, in many situations it is safe to say that foreigners would be interested only in those sectors of the economy dominated by sophisticated investors and would only make use of technology at least as sophisticated as those used by the sophisticated local investors.

Thus, foreign investors know ρ^w but not the actual ρ^d in the domestic economy or the actual μ adjustment that the local investors are using. In particular, the foreign investors are not sure that these are identical to the ρ_m^d and μ^d of equation (5). The foreign investors also have prior beliefs about the distribution of investors, in the particular country, between s and u types.

Foreign investors' decision to invest, and how much, will depend on the extent to which they believe that the signal which they received at the end of period $t-1$ came from s and u local investors, respectively. They compute the probability that the signal, L^d , came from s investors as follows, using Bayes' rule:

$$(6) \quad P(s|L^d) = P(s) \left[\frac{P(L^d|s)}{P(L^d|s)P(s) + P(L^d|u)P(u)} \right]$$

where $P(s) + P(u) = 1$, with $P(s)$ and $P(u)$ being the foreigners' prior probabilities. The updating factor is shown in brackets. Let ρ_m^s and ρ_m^u be the foreign investors' beliefs about the minimum return that will induce a sophisticated and unsophisticated local investor, respectively, of the particular country, to invest in the domestic economy. Then define the foreigners' expected minimum return from investing in the domestic economy as follows:

$$(7a) \quad E(\rho^{df}) = \rho_m^s [P(s|L^d)] + \rho_m^u [P(u|L^d)],$$

or

$$(7b) \quad E(\rho^{df}) = \rho_m^s [P(s|L^d)] + \rho_m^w [1 - P(s|L^d)]$$

with the subscript t left out of equations 7(a) and (7b), for convenience. In equation (7b) we have assumed that the unsophisticated investor is believed willing (by the foreign investors) to take a minimum rate of return equal to the world risk-free interest rate; this assumption is not necessary for the analysis and the more general rate, ρ_m^u , could be maintained in that equation as well. Again the two interest rates— ρ_m^s and ρ_m^u —are priors of foreign investors about local investors in the country, with an automatic connection between an interest rate and an investor type.

Given expected returns in other countries, I_t^f (and therefore α_t) will be a function of the foreigners' expected minimum return—after adjusting for country risk—from investing in the local economy under consideration. That is, given expected returns in other countries,

$$(8) \quad \alpha_t = \alpha_t[E(\rho_t^{df})]$$

More generally, the foreign investors' equilibrium behavior is to increase α in a country j (for $j = 1, \dots, J$ countries which constitute their world) as long as the expected return after adjustment for risk is greater for investment in country j than for the best alternative investments in the rest of the world.⁹ That is, the foreigners follow the rule:

$$(9a) \quad \text{if } [E(\rho_{jt}^{df} | L_{jt}^{df})] \geq [E(\rho_{-jt}^{df} | L_{-jt}^{df})] \text{ then increase or maintain } \alpha_j$$

$$(9b) \quad \text{if } [E(\rho_{jt}^{df} | L_{jt}^{df})] < [E(\rho_{-jt}^{df} | L_{-jt}^{df})] \text{ then decrease } \alpha_j$$

where the L^{df} are the signals from local investors observed by foreign investors, and the subscript $-j$ refers to the local investors of all countries other than country j .

V. SOME GENERAL IMPLICATIONS

It is useful to underscore certain costs to countries associated with signaling and the separating nature of the equilibrium, as well as comment on certain empirical implications of and support for the analysis in the paper. On the first issue, the model shows that when foreigners have incomplete information about investment opportunities in a country and must rely on a signal (such as the investment activity of local investors), which the foreigners then assess with some degree of doubt, some types of countries may benefit while others lose. For example, in the particular model of this paper, a country with predominantly sophisticated investors lose; namely, these countries end up facing higher minimum return demand schedules by foreign investors, as compared to a situation of complete information, for investment in the local economy. In contrast, the countries with mainly unsophisticated investors gain. The underlying reason is that, with incomplete information, in equilibrium, separation is not perfect in all respects. Hence some s-type countries get affected by the (even if small) chance that the signal they send could actually have originated from u-type countries.

An additional cost of having to use a signal, which we have already dealt with at length, warrants underlining in this context; namely, to use the signal effectively, as we have seen, may mean adjustment assistance which has opportunity costs. But an important implication of this fact remains unappreciated. The motivation for adjustment assistance has

⁹An extensive theoretical and empirical literature exists on the determinants of foreign direct investment. See, for example, Goldsborough (1979), Agarwal (1980), Jeon (1992), Wheeler and Mody (1992), Moore (1993), Barrell and Pain (1996), and Belderbos and Sleuwaegen (1996).

been, so far, that investors incur adjustment costs as they try to expand or reallocate their capital during policy reform. But the beneficial effect of local investment in inducing foreign investment involves a positive externality—the benefits of activities of local investors are not fully internalized by the local investors. Thus the adjustment assistance could be motivated by the existence of this externality. The investment by the domestic investors has a public good element to it, which explains why the government obtains utility from its expenditure on adjustment assistance.

Once the subsidy is motivated by the presence of an externality rather than by genuine adjustment costs, the question arises whether foreigners will be deterred from investing without equal treatment when they know or can deduce that local investors are being subsidized. It is difficult to defend an affirmative answer to this question.¹⁰ Foreigners bring into the country for investment a marginal unit of their resources, if they are at least as well off from doing so as if they invest in some other country—without any subsidy. In addition, reinvestment of profits and reallocation of capital by the foreign investors qualify for the subsidy (as local investments) in their role as signal. In any event, the government assesses its policy in every period and will cease a policy of subsidization on external economy grounds once it becomes suboptimal for it to continue to do so.

A related issue is whether a case cannot be made for a direct subsidy to foreign investors, also on external economy grounds. Namely, foreign investors can bring with their investment certain levels of technology and skills to the local economy and can have contacts with international markets that help promote external trade for the country. Leaving aside the need to establish that in fact the foreign investors do not end up internalizing the associated gains, and the fact that this does not address the question of adjustment cost to policy reform of those investing already in the economy, this is an old issue. The general conclusion has been that such subsidies do not necessarily attract significant foreign investment because foreigners need to expect appropriate profits (given the opportunity costs of their funds) before they would want to invest in a country.¹¹ In short, foreigners need evidence—signals—that their investments would be profitable inclusive of the subsidy, before they would be attracted by the subsidy. The investment activity of local investors would, in our model, be one such signal.

As to the separating nature of the equilibrium, countries dominated by s-type investors attract foreign investment at a lower minimum rate of return to investment than countries dominated by u-type investors. If one labels the former set of countries S-type countries and the latter set of countries U-type, then, other things being equal, the schedule relating foreign

¹⁰If the foreigners nevertheless reject the opportunity because of a sense of unfairness, we have an anomaly of a form well known from the ultimatum game (see e.g., Thaler, 1988).

¹¹See, e.g., Lent (1971), Wheeler and Mody (1992), and Lansbury, Pain, and Smidkova (1996).

investment and rate of return to investment—say $I^f = I^f(\rho)$ —will be higher for the S-type countries than for the U-type countries.

Some countries may benefit from finding ways to exploit the separating nature of the equilibrium. Countries, for instance, often try to attract foreign investment by advertising in international papers and magazines. On such occasions, countries may benefit from providing more than the usual information (quantitative as well as qualitative), found in these advertisements, about the activities of local investors. Such information would include, for example, the sectors in which the local investors are operating, the rates of investment during the recent past, indications of the technology and the human skills being utilized by the local investors in their activities, and the real rates of return being earned by the firms involved. The evidence that existing foreign investment attracts additional foreign direct investment (Wheeler and Mody, 1992) suggests, as also useful information to potential foreign investors, data on the profit reinvestment and capital reallocation activity of the existing local investors whose capital historically originated abroad.¹²

Countries have also found it worthwhile to invite potential foreign investors for a visit to improve information on potential investment opportunities in the countries. An implication of the analysis in the paper is that, during such visits, the host countries may benefit from having the foreigners see what local investors are actually doing and discuss experiences with such local investors. Such practices should help improve the quality of information relevant to the foreign investors and thereby reduce the imperfection in the separation of the equilibrium. Obviously this improved separation does not benefit those countries which, in a world of complete information, would, in any event, be still classified as u-types.

Empirically, the analysis in the paper suggests that the share of total foreign direct investment (FDI) flowing to different countries undertaking major policy reforms will vary positively with indicators (observable by foreign investors) of local private investor activity. Such indicator variables could include government privatization activity; volume and value of external trade between the investing and host countries; and investment activity of joint ventures. As regards external trade, the rapid increase of certain exports from a country could be a good indicator of relative factor cost advantage or the presence of certain skill or technological advantage (all of which are stimulating the investment activity engendering the exports) that an investor from another country may want to exploit. The analysis in the paper also suggests a positive correlation between the shares of world FDI flows (among policy reformers) and the relative shares of sophisticated investors in a country's investment activity, other things being equal. Indicators of relative shares of sophisticated investors could include

¹²In this context, Belderbos and Sleuwagen (1996) find that for Japanese firms, as far as investment in Southeast Asia is concerned, the FDI of member firms of horizontal business groups are significantly positively related to the number of manufacturing subsidiaries established by all other member firms of the group (at least for the specific case of the electronics industry).

patents granted to local individuals/firms of the host country, energy consumption per capita, or the telecommunications facilities used.

In general, the available evidence lends support to the analysis in the paper. For instance, several authors have found that privatization programs have had a marked influence on the pattern of inward investment in the transition economies.¹³ In this regard, knowledge that a centrally planned economy with a relatively large domestic market is pursuing significant privatization seems to constitute substantial incentive to foreign direct investors, particularly in the case of those foreign investors with geographical proximity in their favor.¹⁴ Note that empirical studies consistently find economic size positively correlated with FDI (other things being equal). The advantage of size may arise from savings in marketing costs or production costs not already controlled for¹⁵—that is, the advantage could reflect economies of scale in production or marketing—or both, depending on the host country and the products involved.¹⁶

¹³See, e.g., Lansbury, Pain, and Smidkova (1996), who study FDI flows from OECD countries to Hungary, Poland and the Czech Republic over the period 1991–93. Their study is an empirical explanation of the flow of FDI from each of the 14 investing countries to each of the three host countries, relative to total OECD foreign direct investment flows. Most notably, the authors find a positive correlation between FDI and (i) *private sector share of GDP*, (ii) *trade* (the ratio of total trade between the two countries concerned to the total trade of the host—recipient—country), and (iii) *patents* (the relative stock of patents granted to residents in the host country); in contrast, they find a negative correlation between FDI and *unit labor costs* (relative to other potential hosts in Central Europe).

¹⁴See, e.g., Wang and Swain (1995), who, in their empirical work on China and Hungary, used the real annual change in foreign direct investment during the period 1978–92 (in US dollars for Hungary and Rmb for China) as the FDI variable to be explained. They find, inter alia, the size of market variables and political stability (which they interpret to include freeing of the market) highly significant in explaining FDI. In China, it is noteworthy that 60% of total inward investment originated from Hong Kong and Taiwan. The relevance of the proximity of the source of FDI to the potential host country is further supported by their finding that OECD real growth rates played a minor role in foreign capital flows to China but a prominent role in the case of Hungary. Moore (1993) also finds evidence that proximity may be an important factor in explaining the direction of German FDI (at least for the 1980–88 period).

¹⁵On this, see, for example, Moore (1993).

¹⁶In this regard, the studies usually control separately for factor cost differentials (typically by including a variable or variables for relative wage differences) and for protectionist barriers (usually by including a variable for tariff levels in the host country).

The importance of existing trade links as a source of information to foreigners about local investment activity and opportunity, and hence in influencing FDI, would seem to be supported by the significance of such links in the determination of FDI as well as the positive effect of FDI on exports and imports.¹⁷ Lansbury, Pain, and Smidkova (1996) also found positive correlation between FDI and patents, the cumulative flow of the latter over time being indicative of the quality of a research base and the flow of innovation. Furthermore, Wheeler and Mody (1992) find evidence of infrastructure as a significant positive factor in attracting FDI in developing countries.

VI. CONCLUDING REMARKS

This paper has presented a model of a government and potential foreign investors in the economy in which the government uses the investment activity of local investors as a signal to attract foreign investment, taking into account the optimal response of foreign investors to local investors' investment activity. The government optimizes by maximizing its utility subject to its budget constraint given the opportunity cost (in utility) of funds used to promote domestic investment via adjustment assistance. The government equilibrium behavior in period t is given by equation (4); in equilibrium the government's chosen level of investment assistance, $A (= A^*)$, maximizes its utility for the given equilibrium behavior strategy of the foreign investors. The foreign investors also want to maximize their utility subject to their budget constraints; the objective manifests itself in the attempt to allocate investment resources around the world so as to maximize the expected rate of return on total investment resources. The equilibrium behavior strategy of the foreign investors is given by equations (9a-9b); in equilibrium the foreigners' selected $\alpha (= \alpha^*)$ maximizes their utility for the given $A = A^*$ and the schedule of rates of transformation of adjustment assistance into increased investment by local investors.

The paper underscored that having to use a signal has its costs for a country, particularly a country that could benefit greatly from more complete information by investors. One cost is that the rate of return demanded by investors would be higher than otherwise. Another cost arises from the fact that signaling entails use of real resources with opportunity costs; in the model of the paper, the government uses some of its budgetary funds to provide assistance to defray adjustment costs of local investors trying to respond to policy reform of the authorities.

¹⁷See, again, Lansbury, Pain, and Smidkova (1996), as well as Lin (1995), and Wang and Swain (1995). One of the more interesting issues raised in this context has been whether for the originating country FDI and exports to the host country are compliments or substitutes. Empirical evidence would seem to support the position that it could be either depending on the context—country and product in particular. See Lin (1995) for a summary; the author also found evidence that for the originating country FDI could be compliments with imports from the host country.

Despite these costs, certain countries benefit greatly from the separating nature of the equilibrium. Countries classified as having predominantly sophisticated investors (whose signals induce significant positive response from foreign investors) will have a higher investment supply schedule (investment as a function of real rates of return) than countries classified as having predominantly unsophisticated investors. Thus countries undertaking policy reform and with relatively sophisticated investors, which try to attract foreign investors via advertising or organizing visits of investors, could benefit by ensuring that, in the process, foreigners find out what and how local investors are doing, including details that would permit proper assessment by foreign investors of the sophistication of the local investors.

REFERENCES

- Agarwal, Jamuna P., 1980, "Determinants of Foreign Direct Investment: A Survey," *Weltwirtschaftliches Archiv*, Vol. 116, No. 4, pp. 739-73.
- Barrell, Ray and Nigel Pain, 1996, "An Econometric Analysis of U.S. Foreign Direct Investment," *Review of Economics and Statistics*, Vol. 78 (May), pp. 200-07.
- Bartolini, Leonardo and Allan Drazen, 1997, "Capital-Account Liberalization as a Signal," *American Economic Review*, Vol. 87 (March), pp. 138-54.
- Belderbos, René and Leo Sleuwaegen, 1996, "Japanese Firms and the Decision to Invest Abroad: Business Groups and Regional Core Networks," *Review of Economics and Statistics*, Vol. 78 (May), pp. 214-20.
- Caplin, Andrew and John Leahy, 1996, "Monetary Policy as a Process of Search," *American Economic Review*, Vol. 86 (September), pp. 689-702.
- Dixit, Avinash, 1989, "Intersectoral Capital Reallocation Under Price Uncertainty," *Journal of International Economics*, Vol. 26 (May), pp. 309-25.
- , and Robert S. Pindyck, 1994, *Investment under Uncertainty* (Princeton, New Jersey: Princeton University Press).
- Goldsbrough, David, 1979, "The Role of Foreign Direct Investment in the External Adjustment Process," *International Monetary Fund Staff Papers*, Vol. 26 (December), pp. 725-54.
- Haque, Nadeem, U., M. Nelson, and D. T. Mathieson, 1997, "Creditworthiness Ratings: Their Political and Economic Content," in *Risk and Agencies of Restraint: Reducing the Risks of African Investment* (London: Macmillan), edited by Paul S. Collier and Cathy Patillo forthcoming.
- Jeon, Yoong-Deok, 1992, "The Determinants of Korean Foreign Direct Investment in Manufacturing Industries," *Weltwirtschaftliches Archiv*, Vol. 128, No. 3, pp. 527-41.
- Lansbury, Melanie, Nigel Pain, and Katerina Smidkova, 1996, "Foreign Direct Investment in Central Europe Since 1990," *National Institute Economic Review*, Number 156 (May), pp. 104-14.
- Lent, George E., 1971, "Tax Incentives for the Promotion of Industrial Employment in Developing Countries," *International Monetary Fund Staff Papers*, Vol. 18 (July), pp. 399-417.
- Lin, An-loh, 1995, "Trade Effects of Foreign Direct Investment: Evidence for Taiwan with Four ASEAN Countries," *Weltwirtschaftliches Archiv*, Vol. 131 No. 3, pp. 737-47.
- Lucas, Robert E. Jr., 1967, "Adjustment Costs and the Theory of Supply," *Journal of Political Economy*, Vol. 75 (August), pp. 321-34.
- Moore, Michael O., 1993, "Determinants of German Manufacturing Direct Investment: 1980-1988," *Weltwirtschaftliches Archiv*, Vol. 129, No. 1, pp. 120-38.
- Pindyck, Robert S., 1982, "Adjustment Costs, Uncertainty, and the Behavior of the Firm," *American Economic Review*, Vol. 92 (June), pp. 415-27.
- Rodrik, Dani, 1989, "Promises, Promises: Credible Policy Reform Via Signaling," *Economic Journal*, Vol. 99 (September), pp. 756-72.

- Stiglitz, J. E. and Weiss A., 1981, "Credit Rationing in Markets with Imperfect Information," *American Economic Review*, Vol. 71 (June), pp. 393–410.
- Thaler, Richard H., 1988, "The Ultimatum Game," *Journal of Economic Perspectives*, Vol. 2 (Fall), pp. 195–206.
- Wang, Zhen Quan and Nigel J. Swain, 1995, "The Determinants of Foreign Direct Investment in Transforming Economies: Empirical Evidence from Hungary and China," *Weltwirtschaftliches Archiv*, Vol. 131, No. 2, pp. 359–82.
- Wheeler, David and Ashoka Mody, 1992, "International Investment Location Decisions: the Case of U.S. Firms," *Journal of International Economics*, Vol. 33 (August), pp. 57–76.
- Zeira, Joseph, 1987, "Investment as a Process of Search," *Journal of Political Economy*, Vol. (February), pp. 204–10.