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Direct Investment: A Doubtful Alternative to International Debt*

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The international debt crisis has highlighted the difficulties of using debt to finance investment in less-developed countries (LDCs). When a country's economic conditions deteriorate, repaying its foreign debts can be both politically and economically burdensome. During the debt crisis, a number of LDCs have been unwilling to meet their commitments to foreign lenders, resulting in a substantial reduction in investment in these countries. This has led to an interest in alternative forms of financing foreign investment which would reduce the incentive problems associated with debt and hence raise investment levels.

Equity investment has been seen as a promising alternative to foreign debt. The hope has been that when the form of the foreign investment is such that the investors share in the fortunes of the enterprise, these incentive problems will be reduced. In particular, this will reduce the incentive of the host country's government to not enforce or to renege on the investors' claims after the investment is in place and therefore generate higher (more efficient) levels of investment. In the model developed in this paper, we explore one particular type of equity investment in which the foreign investor owns and operates a firm in the host country, *direct* investment, and unfortunately raise some doubts about this hope.[1]

Any form of financing foreign investment must confront the difficulty of enforcing international contracts. Since there is not a well-developed legal system for doing that, international investment contracts may need to be self-enforcing.[2] *Self-enforcement* in this context means that without outside intervention contracts must be such that the expected gains from breaking them do not outweigh the expected costs. A benefit of violating a foreign investor's property right and expropriating his or her investment is that the need to pay to acquire it is removed. One cost of expropriating is the reduction in future investment that will result.[3] We show that direct investment contracts may not always be self-enforcing. In particular, the risk-sharing aspect of such contracts may be insufficient to fully offset the gains from expropriating in adverse economic conditions. We also show that direct investment contracts are more likely to be self-enforcing when the level of foreign investment is high. This suggests that for direct investment to succeed in raising foreign investment levels, international institutions or industrialized country governments may need to promote or help concentrate it.

While economists have extensively studied the incentive problems associated with international debt contracts, there has been little work on direct investment. This is surprising given its importance. In the late 1980s, about one-third of the aggregate net long-term resource flows to LDCs took the form of direct investment. Since new private lending was negligible during this period, virtually all private capital flows were direct investment. In 1988 and 1989, direct investment amounted to about $20 billion a year. Of this total, about $4 billion a year has come through debt/equity swap programs of some heavily indebted countries (World Bank 1991, pp. 9, 46).

In the past, direct investors have faced a substantial risk of having the fruits of their investments expropriated. One estimate suggests that about 11 percent of the direct investment made between 1956 and 1972 was expropriated without compensation (Williams 1975). In addition, when compensation was made, it rarely covered the entire value of the expropriated capital and it was generally paid with a delay (Sigmund 1980, Table 1).

The fact that this high level of expropriation occurred even though the investors' governments have often been willing to intervene highlights the degree to which these contracts are in fact not self-enforcing. Until recently, the U.S. government was willing to intervene based on Cold War fears of the spread of communism. For example, the U.S. intervened in Guatemala in 1954 and imposed economic sanctions on Cuba in 1960 (Sigmund 1980, pp. 87–89). Where expropriation has not been part of a move toward communism, the U.S. government has been less willing to intervene. For example, the U.S. supported Chile's takeover of the copper industry in the 1960s (Sigmund 1980, p. 143). The cessation of the Cold War has probably reduced the willingness of developed-country governments to intervene to support the foreign investors' claims. Hence, direct investments in LDCs may become even riskier.

A Strategic Model

We consider a model of a small developing country in which the cost of expropriation is a loss of access to foreign capital goods and a permanent cessation of foreign direct investment. Since we assume that capital is long-lived, but cannot be directly purchased, the investment cutoff leads to a fall in the capital-to-labor ratio and, consequently, the level of per-capita income over time.[4] This cost of expropriation is consistent with the historical evidence that successful, uncompensated nationalizations have required a domestic supply of skilled workers, a domestic marketing network, and an ability to obtain spare parts from other sources, often in other countries (Sigmund 1980).

Our model includes a host country that receives direct investment from a large number of small, identical, risk-neutral foreign investors whose real cost of capital is r. Agents in the host country have no capital, live forever, and grow in number at a constant rate n. There is only one consumption good in the model. The good is perishable, so must be consumed in the period it is produced. Agents can neither accumulate additional capital by saving the consumption good nor consume capital directly.

We make four basic assumptions about foreign investment in the host country. First, the foreign investors can costlessly invest in the host country. Second, competitive firms there rent foreign capital and hire domestic labor, using them to produce the one consumption good. Thus, capital and labor receive their marginal products. The rents earned on the capital in the host country belong to the foreign investors unless the government of the host country expropriates their assets. We allow only the government to take over foreign assets; we assume individual firms cannot do so. Events in each time period t occur in this order:

- Foreign agents decide whether or not to *invest* in the host country by renting capital to firms there.
- Firms in the host country *produce* the consumption good.
- The government in the host country decides whether or not to *expropriate* the foreign investment.
- Agents in the host country *consume* the consumption good.

Our third assumption is that the host country's government acts to maximize the welfare of the representative citizen. As a result, if the government chooses to expropriate foreign capital, then it will rent out that capital and distribute the profits to the population. Finally, we do not allow agents in the host country to purchase foreign capital or to borrow the consumption good from foreign investors. These four assumptions greatly simplify the analysis.

Since productivity shocks are observable, one might want to consider an optimal incentive-compatible contract similar to those studied by Worrall (1990) and Atkeson (1991). Such contracts would preclude expropriation and could raise welfare. Since expropriation does occur, however, such contracts may not be of great practical interest.

Our model is inherently strategic in that the actions of one agent, the host country's government, have a major effect on the returns earned by other agents, the foreign investors. Thus, the investment decision will be largely determined by the foreign investors' beliefs about the subsequent behavior of the government. Similarly, the government's decision to expropriate will depend in part on its beliefs about the behavior of the foreign investors after such an action. Thus, in order to derive the optimal behavior of the investors and the government, we need to specify each of their beliefs about the actions of the other. Moreover, a description of an equilibrium of the model must state the actions taken in each situation and also the beliefs of the agents that rationalize these choices. We must specify beliefs not only for situations that arise in the equilibrium, but also for situations that do not. These beliefs are needed because the payoffs agents expect to get in these situations may affect their equilibrium behavior. We must also show that the beliefs are *rational* in the sense that the actual behavior of the agents coincides with their expected actions.

In the particular set of equilibria we examine, the foreign investors will only invest if the host country's government has never taken over foreign investment. If the government were to expropriate any of the foreign-owned capital, then the foreign investors would never invest in the host country again. As a result, the capital-to-labor ratio in the host country would decline over time due to population growth. This form of strategic behavior by the foreign investors—known as a *trigger strategy*—is a method of promoting cooperative behavior on the part of the host country's government when other methods of contract enforcement are not available. The threat of retaliation (the cutoff of future investment) in response to a noncooperative action (the expropriation) can serve to discourage that sort of action. A key question in any model in which the threat of retaliation promotes cooperation is the plausibility of the threatened punishment. This problem is especially severe when the threat proves so effective a deterrent that the punishment is never imposed.

Formally, our strategic model is a game in which, in every period, the foreign investors choose how much to invest and then the host country's government chooses whether or not to take over that investment. Since the investment decision is made at the beginning of the period, a history for the foreign investors up until some time period t is a record of past investment and expropriation decisions. Since the government makes its decision after the foreign investors, a history up to time t for the government also includes the investment decision of the foreign investors in period t. A *strategy* is a sequence of prescriptions for an agent's decision in every period t and for every possible history up to t. Because all the investors are assumed to be small and identical, we restrict ourselves to symmetric equilibria in which all the investors behave identically. Thus, we need only specify a single strategy for the foreign investors which gives their aggregate investment level for every possible history. A (subgame perfect Nash) equilibrium of a (complete information) game such as ours consists of a pair of strategies, one for each type of agent in the model, such that the prescribed action is in every case (at each point in time and for every possible history) optimal given the other agent's strategy and such that the future outcomes will be determined by the players' strategies and the resulting histories of outcomes.

In this definition of an *equilibrium*, we set each agent's beliefs about the future conditional actions of the other agents equal to those agents' strategies. This means that these beliefs will at a minimum take into account the fact that the other agents are rational, optimizing agents. We then require that each agent's actions be optimal given the agent's beliefs. Note that in equilibrium no agent is ever surprised, so beliefs need never be reformulated. In addition, in order to rule out implausible threats, we require that the strategies be optimal not only for histories that actually arise in equilibrium, but also for those that do not.

Trigger strategy equilibria are only a small subset of the model's possible equilibria. The advantage of the equilibria we focus on here is their simplicity. All equilibria with positive net investment must be similar in two respects: there must be some sort of punishment to induce payment to the foreign investors, and the possible punishments must include a reduction in the level of investment.[5]

One result in our model is not likely to be robust: expropriation is always complete. In the model, investors believe that any partial expropriation implies an intent to completely expropriate in the future, so they cut off additional investment. In practice, of course, partial expropriation is possible, for example, through high taxation, exchange controls, or partial compensation. Such partial expropriation may not lead to an immediate exodus of all foreign investors (Eaton and Gersovitz 1983).

The Optimal Strategy for the Government . . .

Now we formally analyze the incentive of the host country's government to expropriate foreign investment in an attempt to determine the conditions under which expropriation will occur. First, we specify the government's technology, preferences, and beliefs about the strategy of the foreign investors. Then we derive the government's optimal expropriation rule. (Later we verify that the government's beliefs about the behavior of the foreign investors' strategy are consistent with their actual behavior.)

The host country has a Cobb-Douglas technology available to produce the consumption good. It is

$$(1) \qquad Y_t = z_t F(K_t, N_t) = z_t K_t^{\alpha} N_t^{1-\alpha}$$

where Y is the total amount of the good produced, K is the amount of capital used to produce it, N is the amount of labor used, z is a productivity shock, and the parameter α is a positive fraction. We can write this production function in per-capita terms as

$$(2) \qquad y_t = z_t f(k_t) = z_t k_t^{\alpha}$$

where y is the output per person and k is the capital-to-labor ratio.

The productivity shock z is assumed to be independently and identically distributed with a time-independent continuous probability density function $g(z)$. The shock has finite upper and lower bounds, $\bar{z}$ and $\underline{z}$, with $\underline{z} > 0$. The probability density function of z is assumed to be nonzero over $(\underline{z}, \bar{z})$.

Agents in the host country receive an endowment of zw units of the consumption good each period. We think of this endowment as the output from an agricultural sector, that is, from the part of the economy that is not dependent on foreign capital. The host country agents are also each endowed with a unit of labor each period.

A representative agent in the host country has these preferences:

$$(3) \qquad E_t \sum_{i=0}^{\infty} \beta^i u(c_{t+i})$$

where the parameter β determines the extent to which the agent discounts future utility. The individual's utility u from

consumption c exhibits constant relative risk aversion and is given by

$$(4) \qquad u(c) = (c^{1-\gamma}-1)/(1-\gamma).$$

Here, the parameter γ, which is constrained to be nonnegative, determines the curvature of the utility function and, hence, both the degree of risk aversion and the willingness to intertemporally substitute consumption. Leisure does not enter the agents' utility functions, so they each supply their one unit of labor inelastically each period.

In the equilibria we consider, the foreign investors invest enough capital each period to keep the capital-to-labor ratio in the host country equal to its present level $\bar{k}$ until expropriation occurs. As noted above, if the host country's government expropriates any of the foreign-owned capital, then the foreign investors will never invest again. (We show later that this strategy for the investors is optimal given the strategy of the host country's government.) Notice that the penalty for partial expropriation is the same as that for total expropriation. As a result, the host country's government will never choose to partially expropriate.

If the government chooses not to expropriate, then consumption by the representative agent is

$$(5) \qquad c^n(z_t) = z_t w + z_t f(\bar{k}) - z_t \bar{k} f'(\bar{k}).$$

Note that the productivity shock is country-specific rather than industry-specific. Thus, it applies to both domestically owned sectors (the endowment) and foreign-owned sectors.

If the government chooses to expropriate foreign capital at time t, then per-capita consumption at time $t + i$ is

$$(6) \qquad c_i^e(z_{t+i}) = z_{t+i} w + z_{t+i} f(\bar{k}(1+n)^{-i}).$$

Notice that consumption is initially larger after an expropriation; $c_0^e > c^n$. Thus, if the population did not grow, expropriation would occur immediately. If, however, the rate of population growth were positive, then expected consumption would decline after expropriation occurred. This decline in consumption is what may induce the host country's government to honor the foreign claims on capital.[6]

The government in the host country has a social welfare function given by[7]

$$(7) \qquad W = E_t \sum_{i=0}^{\infty} \beta^i u(c_{t+i}).$$

The government maximizes social welfare each period simply by choosing whether or not to expropriate the foreign assets. It is useful to define two possible levels of welfare:

$$(8) \qquad W_t^e(z_t) = u(c_0^e(z_t)) + E_t \sum_{i=1}^{\infty} \beta^i u(c_i^e(z_{t+i}))$$

$$(9) \qquad W_t^n(z_t) = u(c^n(z_t)) + \beta E_t[\max(W_{t+1}^e(z_{t+1}), W_{t+1}^n(z_{t+1}))].$$

The term $W_t^e(z_t)$ is social welfare in period t if the government chooses to expropriate the foreign capital, and $W_t^n(z_t)$ is social welfare if the government chooses not to do so. Using this notation, we can write the government's dynamic programming problem as

$$(10) \qquad W_t(z_t) = \max\{W_t^e(z_t), W_t^n(z_t)\}.$$

This is an infinite-horizon problem with a stationary environment; that is, the government's preferences, the investors' strategies, and the productivity shocks are all time-invariant. Thus, the value functions W_t, W_t^n, and W_t^e are time-invariant. Moreover, if an optimal strategy exists, then a stationary optimal strategy exists (Bertsekas 1976). Thus, we consider only stationary strategies.[8]

An optimal strategy for this problem is to expropriate at time t if $W^e(z_t) > W^n(z_t)$. Using the definitions in equations (8) and (9), we can write this condition as

$$(11) \qquad u(c_0^e(z_t)) + E_t \sum_{i=1}^{\infty} \beta^i u(c_i^e(z_{t+i})) > u(c^n(z_t)) + \beta E_t W(z_{t+1})$$

$$(12) \qquad u(c_0^e(z_t)) - u(c^n(z_t)) > \beta E_t W(z_{t+1}) - E_t \sum_{i=1}^{\infty} \beta^i u(c_i^e(z_{t+i})).$$

The left side of (12) is the gain in utility today due to expropriation, which depends on z_t. The right side of (12) is the expected future cost of expropriating today, which is constant due to the time stationarity of the problem.

We define $\Gamma(z_t)$ to be the total benefit for agents in the host country if their government expropriates foreign investment. This is the left side of the inequality in (12):

$$(13) \qquad \Gamma(z_t) \equiv u(c_0^e(z_t)) - u(c^n(z_t)).$$

Clearly, $\Gamma(z)$ is continuous in z because the levels of consumption are linear in z and the utility function is continuous.

We define χ to be those agents' expected future cost of expropriation today, or the right side of (12):

$$(14) \qquad \chi \equiv \beta E_t W(z_{t+1}) - E_t \sum_{i=1}^{\infty} \beta^i u(c_i^e(z_{t+i})).$$

It is straightforward to show that the expected future cost of expropriation is positive if the population of the host country is growing. To do so, note that, given the definition of W, $EW \geq EW^e$. (The two would be equal only if expropriating were always at least as good as not expropriating.) Thus,

$$(15) \qquad \chi \geq \beta E_t \sum_{i=0}^{\infty} \beta^i u(c_i^e(z_{t+1+i})) - E_t \sum_{i=1}^{\infty} \beta^i u(c_i^e(z_{t+i}))$$

or

$$(16) \qquad \chi \geq E_t \sum_{i=1}^{\infty} \beta^i [u(c_{i-1}^e(z_{t+i})) - u(c_i^e(z_{t+i}))] > 0.$$

The last inequality holds because, with the population growing, expected per-capita consumption drops over time after expropriation.

For a given cost of expropriation, there will be a set of realizations of z for which $\Gamma(z) > \chi$, and then the host country's government will choose to expropriate the foreign assets. We call this set Z^e:

$$(17) \qquad Z^e = \{z \,|\, \Gamma(z) > \chi\}.$$

For other realizations of z, the government will not expropriate the foreign assets; we call the set of such realizations Z^n:

$$(18) \qquad Z^n = \{z \,|\, \Gamma(z) \leq \chi\}.$$

We define π to be prob$[z \in Z^n]$, that is, the probability that the government will choose not to expropriate.

Because Γ is continuous in z, Z^e will be one or more intervals in $[\underline{z}, \bar{z}]$. Moreover, if Γ is monotonically increasing in z, then the expropriation set is the interval $(z^*, \bar{z}]$, where z^* is the point where $\Gamma(z) = \chi$ (benefits equal costs). Alternatively, if Γ is monotonically decreasing in z, then the expropriation set is $[\underline{z}, z^*)$. Making use of our assumption that the prefer-

ences of agents in the host country exhibit constant relative risk aversion, we can write Γ as

$$(19)\quad \Gamma(z) = [z^{1-\gamma}/(1-\gamma)]\{[w + f(\bar{k})]^{1-\gamma} - [w + f(\bar{k}) - \bar{k}f'(\bar{k})]^{1-\gamma}\}.$$

There are three cases of interest. First, if the degree of relative risk aversion $\gamma < 1$, then the term in braces in (19) is a positive constant and the other term is increasing and concave in z. Moreover, the latter term is zero for $z = 0$ and goes to infinity as z rises without bound. Thus, when $\gamma < 1$, expropriation occurs in good states, that is, when z is high. The second case of interest is when $\gamma > 1$. Then both terms in (19) are negative. The first term is increasing and concave in z. In this case, the utility gain from expropriation goes to infinity as z goes to zero and goes to zero as z goes to infinity. Thus, expropriation will be preferred in bad states. The third case is when $\gamma = 1$. Here, utility is logarithmic, and the gain from expropriation can be shown to be constant. Thus, expropriation happens either immediately or never.

The intuition for these results is straightforward. Expropriation can be thought of as occurring for one of two reasons: opportunism or desperation. When $\gamma < 1$, the curvature of the utility function of the country's representative agent is not very large, and the agent is very willing to intertemporally substitute current consumption for future consumption. As a result, the utility gain from expropriation is largest when the consumption gain from it is largest, that is, when z is big. We call such governments *opportunistic* because they expropriate when the return on capital is high. In contrast, when $\gamma > 1$, the utility function of the country's representative agent has more curvature, and the agent is more risk averse and less willing to substitute consumption intertemporally. As a result, the largest utility gain from expropriation occurs when z—and therefore consumption—is low, even though the consumption gain in that situation is small. These governments are *desperate:* they choose to expropriate because consumption in their country is very low and their marginal utility is very high. In the case of log utility, these two effects offset each other.[9]

Using successive substitution and time stationarity, we can show that the cost of expropriation is

$$(20)\quad \chi = [\beta(1-\pi)/(1-\beta\pi)]E[u(c_0^e) - u(c^n)\,|\,z \in Z^e] + [(1-\beta)/(1-\beta\pi)]E\sum_{i=1}^{\infty}\beta^i[u(c^n) - u(c_i^e)].$$

The first term here is the cost due to the fact that expropriating today precludes expropriating tomorrow. The second term is the cost due to the decline in consumption over time as the capital-to-labor ratio falls.

Other than the expropriation set, the cost of expropriation is affected by the rate of discount and the rate of population growth. The cost of expropriation can be shown to rise as the discount factor β rises. This dependence on the rate of discount is intuitive. If β is high, the future cost is discounted less, and the government is less likely to choose to expropriate. In fact, here the usual folk theorem result holds: for β sufficiently close to one, expropriation will never occur. The effect of a change in the rate of population growth is also straightforward. If population growth is faster, then the per-capita capital stock declines more rapidly, so the cost of expropriation is larger.[10]

Equation (20) shows that the cost of expropriation is a function of the level of investment in future periods and the expropriation set in future periods. In the stationary equilibria we are focusing on, neither of these changes until expropriation occurs. Because of our assumption of constant relative risk aversion preferences, the expropriation set is determined by a critical value of z, z^*, at which the government is indifferent between expropriating and not expropriating. This value satisfies

$$(21)\quad \Gamma(z^*) = \chi(z^*,\bar{k}).$$

Thus, for $\gamma < 1$, z^* satisfies

$$(22)\quad u(c_0^e(z^*)) - u(c^n(z^*)) = [\beta(1-\pi)/(1-\beta\pi)]E[u(c_0^e) - u(c^n)\,|\,z \in (z^*,\bar{z}]] + [(1-\beta)/(1-\beta\pi)]E\sum_{i=1}^{\infty}\beta^i[u(c^n) - u(c_i^e)]$$

where $\pi = \text{prob}(z \in (z^*,\bar{z}])$. A similar equation holds for $\gamma > 1$. Equation (22) implicitly defines z^* as a function of k. That function is the reaction function for the host country's government. Sample reaction functions are shown in Charts 1 and 2. (In the charts, the reaction functions are drawn for $\beta = 0.96$, $n = 0.06$, $w = 2$, and Cobb-Douglas production with a capital share σ of 0.33. The distribution of z is uniform over (0.5, 1.5). Details of the calculations are available from the authors on request.)

Note that in the charts the government's reaction functions imply that the probability of expropriation falls as the level of investment rises. This result is generalized in the following proposition:

PROPOSITION 1. *If* $(z^*)^{1-\gamma} \geq [\beta(1-\pi)/(1-\beta\pi)]E[z^{1-\gamma}\,|\,Z^e]$, *then the probability of expropriation will be reduced by an increase in k and raised by an increase in w.*

Proof. See Cole and English 1991, pp. 221–27.

The proposition shows that, for $\gamma < 1$, the government's reaction function is upward-sloping, while for $\gamma > 1$, it is downward-sloping. In either case, an increase in the endowment shifts the reaction function to the right.

This proposition displays an important difference between international debt and equity contracts. Increased lending raises the probability of expropriation because it means that larger repayments will be required (Kletzer 1984, Sachs 1984). But increased direct investment lowers the probability of expropriation. An investment increase raises the level of consumption both if expropriation occurs and if it does not. An investment increase does not, however, raise the level of consumption in the long run after expropriation. Thus, an investment increase exacerbates the decline in consumption after expropriation.[11]

The second part of the proposition—that an increase in w raises the probability of expropriation—is more obvious. Given our assumption of constant relative risk aversion preferences, absolute risk aversion is decreasing in consumption. Thus, an increase in w lowers the cost of the more variable consumption path that results from expropriation. This makes expropriation a more attractive policy.[12]

To understand why the condition in the proposition is needed, remember that the cost of expropriation has two parts. One is that, after one expropriation, the government can never expropriate again. The other is that, after an expropriation, the consumption trajectory declines. The condition in the proposition makes the effect of changes in w and k on the first part small. Without that condition, an increase in w could make expropriation not only more desirable, but so much more desirable in some states that it is worth delaying expropriation to get a particularly good state. In such cases, the proposition's results would be reversed.

. . . And for the Foreign Investors

Here we assume that foreign investors know that the host country's government will follow the expropriation rule just derived. We specify the investors' preferences and constraints

given their beliefs, and then we derive their optimal level of investment in the host country.

The level of investment by individual foreign investors is very small relative to the total amount of investment. Thus, each investor takes as given the amount of capital per capita in the host country. Therefore, the investors also take as given the marginal product of capital and the probability of expropriation.

It is useful to define two levels of investor profits. If expropriation does not occur in period t, then an investor's profit P_t is

$$(23) \qquad P_t^N = (1+z_tR_t)k_t - (1+r)k_t$$

where z_tR_t is the rate of return on capital in the host country. If expropriation does occur, however, then the profit is simply

$$(24) \qquad P_t^E = -(1+r)k_t.$$

Thus, the investor's problem is

$$(25) \qquad P = \max_k\{\pi E[(1+zR)k \,|\, z \in Z^n] - (1+r)k\}.$$

The first-order condition for an interior solution to this problem is

$$(26) \qquad 0 = \pi E[(1+zR)k \,|\, z \in Z^n] - (1+r).$$

If this equality does not hold, then all of an agent's assets will be invested either at home (if the expression is negative) or abroad (if the expression is positive). This condition requires that the investor be indifferent about the location of investment as long as rates of return are equal (where the rates of return take account of the probability of expropriation and the states in which it occurs). Thus, the level of investment per capita in the host country is given by

$$(27) \qquad \pi E[1 + zf'(\bar{k}) \,|\, z \in Z^n] = 1 + r.$$

Given the expropriation set for the host country's government, this equation gives the reaction function for the investors, or the level of investment they will choose given a particular expropriation set chosen by the government. Two such reaction functions for $r = 0.10$ are shown in Charts 1 and 2.[13] Not surprisingly, the optimal level of investment rises as the probability of expropriation falls.

Since in our model the marginal return on investment is higher than the world interest rate, equation (27) implies that the host country will not be able to raise an efficient amount of capital due to fears that foreign investment will be nationalized without compensation. This result is similar to that found in models of international debt (Eaton and Gersovitz 1981) and in simpler models of international direct investment (Eaton and Gersovitz 1983, 1984).

Equilibrium

Thus far we have derived the best responses of the foreign investors and the government of the host country to the strategies they believe the other agents in the model are following up to the time of expropriation. To determine the equilibrium strategies, we need to determine the equilibrium levels of k and z^*. These are determined by equations (22) and (27). Since each agent's strategy is a best response to (or an optimal response given) the conjectured behavior of the other agent, the prescribed actions are optimal at every node on the equilibrium path (every date and history realized in equilibrium) in which expropriation has not yet occurred. To verify that these strategies are a subgame perfect Nash equilibrium, we must show that the strategies after expropriation and at nodes off the equilibrium path are best responses.

Again, after an expropriation has occurred, the foreign investors will choose not to invest in the host country. Given their belief that the host country's government would expropriate any additional capital they invested, this is an optimal response. Similarly, given the government's belief that the foreign investors will never invest additional capital, the government's optimal response is to continue to expropriate the existing capital. Thus, the government's strategy is also a best response, and together these strategies are a Nash equilibrium.

In order to show that these strategies are a subgame perfect equilibrium, we must also demonstrate that they are equilibrium strategies for subgames starting from nodes off the equilibrium path. There are two such subgames after expropriation has occurred at least once. First, in any subgame that requires the host country's government to choose whether or not to expropriate after some amount of new capital has been invested, it will choose expropriation. This choice is optimal given the government's belief that no investor will invest again after the expropriation. Given this belief, expropriation has no cost but does have a certain gain. Second, in any subgame in which the government in the host country does not expropriate the existing capital (that is, does allow the foreign investors to have the return on the capital for a period), the foreign investors will still choose to make no additional investment. This is an optimal response because they believe that the host country's government will expropriate again next period and in every subsequent period. Thus, the strategies are a subgame perfect equilibrium.

Now we produce some examples to show that the equilibria we have discussed exist for some values of the parameters. Table 1 displays the parameter values we assume (those used in Charts 1 and 2). Table 2 gives the equilibrium levels of investment and the expropriation sets for two situations: one with $\gamma < 1$ and another with $\gamma > 1$. The corresponding reaction functions are those seen in Charts 1 and 2. As is usual, the intersections of the two agents' reaction functions are the equilibria of the model.

Even though we are considering only trigger strategy equilibria with infinite punishment intervals, we can still have multiple equilibria. Charts 1 and 2 show cases (γ's of 0.99 and 1.01) in which there are three equilibria, one with no investment, one with zero probability of expropriation, and a third with an intermediate level of investment and a probability of expropriation between zero and one.

It is fairly easy to see that the welfare level of the host country's government is highest in the equilibrium with the highest level of pre-expropriation direct investment. Note that for a given sequence of productivity shocks, the equilibria differ in only two key respects: the timing of the expropriation decision and the level of k. If, again for a given sequence of productivity shocks, we fix the timing of expropriation, then the level of consumption—and, hence, welfare—is strictly increasing in k. In the equilibrium with the higher k, the host country's government always has the option of choosing the same expropriation rule as it would in the equilibrium with the lower k. Thus, the higher level of investment must raise the government's welfare.

The Effect of an Investor Cartel

Now we attempt to see how the collective interests of foreign investors differ from their individual interests. We do this by assuming that the investors form a cartel. This lets them take account of the effect that the level of investment has on the expropriation set chosen by the host country's government. It also lets them take account of the effect of changes in the level of investment on the marginal product of capital.

Even collectively, the foreign investors want to maximize profits. They know the reaction function of the host country's government. Because the government believes that the level of per-capita investment will not change until expropriation occurs, its behavior is quite simple: for each level of investment today k_t, there is an expropriation set $Z^e(k_t)$.[14] Because these sets do not vary over time, the investors' problem does not either. Hence, we again consider only time-invariant strategies.

PROPOSITION 2. *An investor cartel may choose a larger or a smaller level of investment than the individual, decentralized investors would.*

Proof. We provide the proof for the case with $\gamma < 1$; the proof for $\gamma > 1$ is similar. If $\gamma < 1$, then the expropriation set is simple: $Z^e(k)$ is $(z^*(k), \bar{z}]$. Thus, the cartel's problem is

$$(28) \qquad P = \max_k \{-(1+r)k + \pi(k)E[(1 + z f'(k))k \mid z \in Z^n]\}.$$

The first-order condition for this problem is

$$(29) \qquad \begin{aligned} 0 = {} & -(1+r) + \pi E[1 + z f'(k) \mid z \in Z^n] \\ & + \pi E[zk f''(k) \mid z \in Z^n] \\ & + k(1 + z^* f'(\bar{k}))g(z^*)(dz^*/dk). \end{aligned}$$

All of these terms are intuitive. The first two are the same as those in the individual, decentralized case [equation (27)]. The third term takes into account the fact that the cartel can act as a monopolist in the investing of capital and so should take account of the effect of investment on the marginal product of capital. This term is negative and so reduces the optimal amount of investment relative to the individual investment case. The fourth (and last) term takes account of the fact that the cartel can act as a leader: its choice of investment has an effect on the government's expropriation set. As shown in Proposition 1, increased investment reduces the probability of expropriation; that is, $dz^*/dk > 0$. Thus, the fourth term in (29) is positive and will raise the optimal amount of investment relative to the individual investment case. In fact, dz^*/dk increases without bound as γ goes to one (the log case, as in Charts 1 and 2), and f'' can be close to zero. Thus, the fourth term in (29) can dominate the third. Q.E.D.

Table 3 shows the investor cartel equilibrium for the two equilibria shown in Chart 1 (where, recall, the assumed parameters are as displayed in Table 1). With $\gamma = 0.25$, additional investment reduces an investor's profits, and the cartel invests less than individual investors would. In contrast, with $\gamma = 0.99$, additional investment (starting from the interior equilibrium) raises an investor's profits. In this case, the equilibrium level of investment is the level that makes investment riskless.[15] Here, as equation (29) predicted, the effect of increased investment on the probability of expropriation is very large.

This result implies that a centralized investment decision may lead to more capital investment rather than less. Such an increase could be accomplished without formal centralization if the foreign investors' government provided an investment subsidy. The increase in investment would be Pareto-improving because it would also benefit the host country.

Concluding Remarks

Our three major results are substantially different from those in the international debt literature.

First, unlike with debt contracts, where a government only has an incentive to break its commitments in bad economic conditions (when output is low), with direct investment a government may have such an incentive under either good or bad economic conditions, depending on the degree of risk aversion of agents in the host country. This result suggests that direct investment contracts may not be a promising substitute for loans to LDCs. It may also explain why direct investment flows have not increased to offset the curtailment in new private foreign lending to nonoil LDCs.

Second, increases in the level of direct investment in the host country can have the surprising effect of reducing the incentive for a government to expropriate and, hence, decreasing the probability of that occurring. This is just the opposite of the result found in the international debt literature, where increased borrowing raises the likelihood of default. Not surprisingly, this effect may cause a country to be stuck in a low-investment equilibrium when high-investment equilibria were possible.

Finally, even in best possible equilibria, the level of investment chosen by individual, decentralized investors can be lower than the level they would choose as a cartel. This is because the reduction in the marginal product of capital caused by increased investment can be more than offset by the reduction in the probability of expropriation it causes. Again, this result is just the opposite of that for international debt. With debt, countries are better off if they can commit to limit their borrowing because doing so makes the debt safer, and as a result, the interest rate is reduced.

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[1]There are two basic types of foreign investment: lending and equity investment. Foreign lenders can make loans to the government or to firms. (Of course, loans to firms may be guaranteed by the government.) Equity investment can be either *direct* investment, where the investor owns and operates a firm in the host country, or *portfolio* investment, where the investor holds shares of a firm but does not have control over the firm. While portfolio investment in LDCs has increased recently, most foreign investment has been in the form of loans to governments, government-guaranteed loans to firms, and direct investment.

[2]For a discussion of the legal issues, see Bulow and Rogoff 1989, Appendix. For an excellent discussion of the handling of sovereign immunity in U.S. and British courts, see Alexander 1987.

[3]Countries have asserted three main benefits from nationalization. (1) It lets them gain national control over natural resources such as oil or deposits of ores of various types. (2) It lets them pursue policies to promote domestic growth and equity. Countries have argued that foreign firms are bad for the domestic economy because the firms tend to use their economic and political power in the country to maximize profits rather than the welfare of the population. (3) Socialist governments have taken over foreign investment as part of a more general policy of nationalization, as happened in Cuba after 1959. (See Sigmund 1980, pp. 13–19.)

The costs of nationalization depend on whether or not the foreign investors are fully compensated. As long as the investors are fully compensated, the cost of the nationalization is the compensation plus the losses resulting from suboptimal operation of the firm by the government due to such factors as inexperience and political constraints. In addition, the foreign investors may be able to limit or cut off access to spare parts for specialized machinery, skilled workers to operate the machinery, improvements in technology, and marketing networks. In contrast, the cost of an uncompensated or partially compensated nationalization, while reduced by the smaller amount of compensation, also includes possible sanctions by the nationalized firms or their governments and a likely reduction in the future level of direct investment. (See the cases discussed in Sigmund 1980.) This last cost arises because the country may get a reputation for nationalizing, so it may no longer be able to obtain foreign direct investment.

[4]In cases involving high-tech or proprietary capital, the assumption that an LDC could not replace the foreign capital seems reasonable. Without substantially changing the results, we could instead allow the country to either purchase capital abroad at a high price or produce domestic capital inefficiently. In either case, the level of consumption in the economy's long-run steady state would be higher with direct investment than without it. The effect of expropriation would be to raise domestic income initially, but income would fall over time to the no-direct-investment steady-state level. Thus, expropriation would imply a short-run gain and a long-run loss—just as it does in our model.

[5]Extending the analysis to finite punishment intervals would be easy. Clearly, if the interval were too short, the only equilibrium would be one without any investment, since the cost of expropriation would be too low to keep the host country from expropriating. If the interval were not too short, however, investment would start again eventually.

[6]We could model the cost of expropriation as caused by depreciation rather than population growth. This variation would be equivalent if the depreciation rate δ were chosen by $1 - \delta = 1/(1+n)$, where n, recall, is the rate of population growth in the host country.

[7]This social welfare function implies that the government cares only about those agents now living. If the government's rate of discount were $\beta' = (1+n)\beta$, then the government would discount the welfare of each generation at a rate β. As long as $\beta' < 1$, the results would not be greatly changed.

[8]There may be many nonstationary optimal strategies. For example, for the values of z that make the government indifferent between expropriating and not expropriating, it could have a time-dependent probability of expropriation. However, this would not affect the equilibrium because these z's occur with probability zero.

[9]This result, like many others, can be thought of in terms of income and substitution effects. As z rises, income in the host country rises. If the utility function curves at all, then the rise in income lowers marginal utility and so reduces the incentive to expropriate a given amount of the consumption good. As z rises, however, the amount of the consumption good gained from expropriation rises—thereby increasing the incentive to expropriate. For log utility, these income and substitution effects cancel.

[10]Had we based our cost of expropriation on depreciation rather than population growth, this result would imply that foreign investors should use capital that depreciates rapidly. Doing so would raise the cost of expropriation for the host country. The effect of possible expropriation on the type of investment chosen is considered in Eaton and Gersovitz 1983, 1984.

[11]The effect that increases in direct investment have on the probability of expropriation may help explain why foreign direct investment is concentrated in a small number of countries. For example, U.S. foreign direct investment in manufacturing corporations in non–Middle East LDCs was $18.8 billion in 1982 (U.S. 1985, Table IS3). Of this amount, 73 percent was in four countries: Argentina, Brazil, Mexico, and Venezuela. Of the investment in Africa, Asia, and the Pacific, 61 percent went to five countries: Hong Kong, the Philippines, Singapore, South Korea, and Taiwan. The reason for this concentration may be that, given a choice of investing in countries with different amounts of foreign-owned capital, firms choose to invest in those with a large amount. They would do so if the effect of the higher level of investment on the probability of expropriation outweighs its effect on the marginal product of capital.

[12]This result may seem unrealistic since more than three-quarters of U.S. direct investment is in other developed countries (U.S. 1985, Table IS3). Our model is not intended to apply to such investments, however, because these developed countries also have substantial direct investment in the United States. The two-sided nature of the direct investment makes the government's expropriation decision more complex. In another paper (Cole and English, forthcoming), we develop a model of two-sided equity investment which may be more appropriate in such circumstances.

[13]Charts 1 and 2 show the functions for $\gamma > 1$ and $\gamma < 1$. Notice that for a given probability of expropriation (say, a z^* of 1), the level of investment is higher if $\gamma > 1$. That is because expropriation occurs when the marginal product of capital is low. Details of the calculations are available from the authors on request.

[14]Because the host country's government thinks the foreign investors will make the same per-capita investment in every period, the investors cannot promise higher investment in the future in order to induce better behavior today. There may be equilibria in which this is not so. But in such equilibria, the issue of time consistency would arise.

[15]Note that the cartel case has only one equilibrium level of investment because the investors have no coordination problem. The cartel's equilibrium level of investment is higher than two of the three individual levels.

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Charts 1 and 2

Sample Optimal Strategies for the Foreign Investors and the Host Country's Government

Reaction Functions With the Parameter Values in Table 1

Chart 1 When Risk Aversion in the Host Country Is Low ($\gamma < 1$) . . .

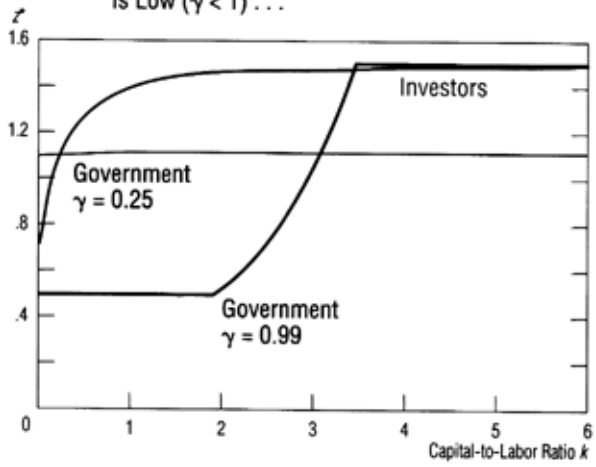

Chart 2 . . . And When It Is High ($\gamma > 1$)

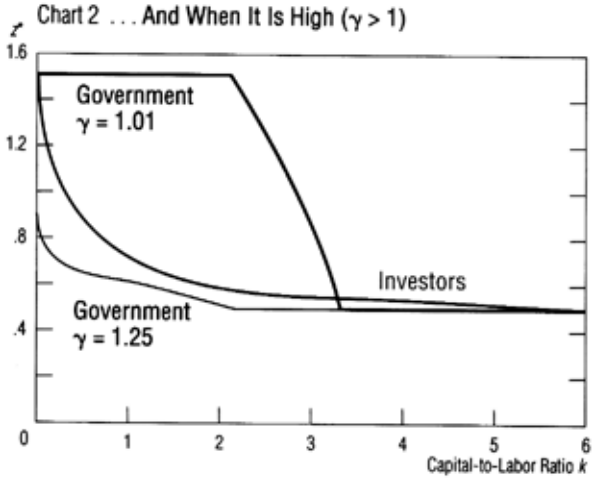

Table 1

Assumed Parameter Values

On Charts 1–2 and Tables 2–3

Parameter	Value
Discount Factor β	.96
Growth Rate of Population in the Host Country n	.06
Endowment of the Consumption Good wz ÷ Productivity Shock z	2.00
Capital's Share in the Production Function σ	.33
Real Interest Rate r	.10

Table 2

Two Sample Equilibria

Relative Risk Aversion in the Host Country	Equilibrium Values		
	Capital-to-Labor Ratio k	Expropriation Cutoff Point z^*	Probability of Government Not Expropriating π
Low: $\gamma = 0.25$	.235	1.142	.642
High: $\gamma = 1.25$	5.942	.500	1.000

Table 3

The Effects of an Investor Cartel on Two Sample Equilibria

Relative Risk Aversion in the Host Country	Type of Investors	Equilibrium Values			
		Capital-to-Labor Ratio k	Expropriation Cutoff Point z^*	Probability of Government Not Expropriating π	Investor's Profit P
$\gamma = 0.25$	Individual	.235	1.142	.642	.000
	Cartel	.045	1.135	.635	.041
$\gamma = 0.99$	Individual	3.472	1.464	.964	.000
	Cartel	3.476	1.500	1.000	.149