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PUBLIC DEBT GUARANTEES AND
PRIVATE CAPITAL FLIGHT

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Public Debt Guarantees and Private Capital Flight

ABSTRACT

Significant amounts of private capital have flowed out of several of the more heavily indebted developing countries. This outflow, often called "capital flight," largely escapes taxation by the borrowing-country government, and has generated concern about the prospects for future servicing of the debt. Imperfect contract enforcement may lead to implicit or explicit government guarantee of foreign debt. The model developed below demonstrates that a government policy of guaranteeing private debt can, in turn, generate more than one outcome. One such outcome replicates the allocation under perfect contract enforcement: national savings is invested domestically and foreign debt is repaid. The tax obligation implied by potential nationalization of private debt, however, can also lead to another outcome in which national capital flees and foreign debt may not be repaid.

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Introduction

A striking feature of several of the large debtor countries is the extent to which private capital outflows have eroded net inflows. Based on different methodologies, Dooley, Helkie, Tryon and Underwood (1986) and Cuddington (1987) provide estimates that are reported in Table 1. They find that up to a half or more of the increase in the gross indebtedness of Argentina, Mexico, and Venezuela during 1974-1982 was offset by private capital outflows.¹

These outflows have increased the cost to these countries of raising revenue to service debt, and have consequently generated concern about the prospects for debt repayment. The outflows mean that borrowing by these countries added much less to domestic resources than was initially thought. This is reflected in the decline in domestic fixed capital formation between 1980-1981 and 1982-1984 in six of the eight countries reported in Table 1. In addition, funds invested abroad frequently escape the tax base of the borrowing-country government. For this reason these outflows have been referred to as "capital flight."

The implications of capital flight for public policy in both creditor and debtor countries remain largely uninvestigated. To a significant extent standard portfolio diversification motives can explain two-way flows. If this is the reason that flight has occurred, then these outflows do not constitute evidence of a market failure that warrants intervention. The current concern about it is consequently misplaced.

Some features of international capital markets may justify a less sanguine view, however. A particular problem is the enforceability of debt contracts. Creditors typically must rely on government intervention, or the threat of intervention, to enforce payment. In the event of default domestic

bankruptcy proceedings result in a transfer of the debtor's assets to the creditor. In an international context, however, the willingness or ability of the borrower's government to effect such a transfer is in doubt. Lenders may have little ability to assess the solvency of a particular private borrower in a developing country, at least relative to the ability of the government of that country. They may also be much more able to penalize the country as a whole for nonpayment than to impose sanctions on an individual private borrower in that country. For these reasons loans for private borrowers may be channeled through the government, or lenders may require that loans to private borrowers come with government guarantees.

A major part of lending to less developed countries has taken the form of public or publicly-guaranteed debt. Even where no guarantee was provided, lenders have held governments accountable for the debts of private borrowers in default. Diaz-Alejandro's (1985) account of the bankruptcy of some Chilean banks provides an example. Even though the Chilean government explicitly did not guarantee foreign loans to these banks, creditors demanded and received payment from the government when private banks became insolvent.

There is evidence that governments assumed a substantial amount of private debt during the period in which capital flight appears to have been most dramatic. Data taken from Sachs (forthcoming), on the percentage of U.S. bank exposure owed by the public sector among some of the major debtor countries is reported in Table 1.

This paper develops a model in which the expectation of increased tax obligations created by the potential nationalization of private debt generates capital flight. One possibility is that government guarantees have no implications for the allocation of resources. In this case investment patterns replicate those that would emerge if private lenders could enforce

debt contracts directly. Subject to certain incentive-compatibility constraints on individual borrowers, an efficient allocation of resources emerges.

Through the budget constraint of the government, however, implicit or explicit public guarantees create an interdependence among private investment decisions that is otherwise absent. A move by one borrower that increases the likelihood of his own default increases the expected tax obligations of other borrowers. This increases the incentive for other borrowers to place their own funds abroad, and increases the likelihood of default on their own loans as well. Capital flight arises as a form of contagion.

In the first version of the model, developed in section I, the mechanism that leads to capital flight is outright fraud. Private borrowers have the ability to invest their own and borrowed funds abroad, where they are not only less productive than in domestic investment projects, but where they earn less than the cost of funds from abroad. But by placing these funds overseas the borrower escapes the obligation to repay his loan or to pay taxes to his government.

The assumption that funds placed abroad escape the tax base of the borrower's government and the reach of foreign creditors seems largely consistent with the observed operation of international capital markets. Transfers of these funds are often not recorded, and have apparently been effected through such devices as underinvoicing of exports and overinvoicing of imports. (See Dooley's (1986) discussion, in particular.) Without an official record, taxation is difficult. At the same time, borrowers can make it difficult for lenders to match the identities of particular private depositors and private borrowers. For one thing, the first tend to be individuals and the second limited liability firms. For another, intrafamily

transfers can make funds difficult to trace. Hence, while lending institutions have knowingly accepted deposits of private individuals from large debtor countries in significant amounts, they apparently do not, to date, have the legal ability to use these deposits as collateral against outstanding loans. The analysis in this paper is based on the extreme assumption that flight capital escapes entirely both the tax base of the borrower's government and funds available for collection by foreign lenders. The basic points would survive (under more restricted conditions) generalization to situations in which funds abroad were only partially susceptible to taxation and to confiscation by lenders.

Given the tax obligations of domestic borrowers, lenders can restrict loan amounts to ensure that investing domestically and subsequently repaying is in each borrower's interest. Potential nationalization of private debt means that the flight of any one borrower's capital raises the tax obligations of other borrowers. Hence it raises the incentive for other borrowers to invest abroad as well. Consequently, equilibrium may involve all borrowers investing domestically, with foreign loans repaid, or all investing abroad, with government insolvency and default on foreign loans as the possible consequence.

In the second version of the model, developed in section II, the reason for flight is somewhat more subtle. The borrower's effort in managing his project and generating returns on his investment will determine whether he is able to finance repayment. But the incentive to put in the necessary effort depends negatively on debt-service obligations and anticipated tax obligations. Again, lenders can design loan contracts that provide the required incentive, given tax obligations.² Here again, however, potential nationalization of private debt implies that a low level of effort by one

borrower, leading to his default, increases the tax obligations of others. Their incentive to expend effort is consequently diminished as well. The interdependence of borrowers' effort decisions generates the same potential for contagion as in the first version of the model. In one equilibrium borrowers expend sufficient effort to service debt. In another they do not. In this second equilibrium they place their own capital abroad, since here it earns a higher return.³

The analysis in this paper builds on previous work on capital flight. Khan and Haque (1985) model the phenomenon as the response to an asymmetric risk of expropriation facing domestic and foreign investors. Domestic investors face a higher risk of expropriation, so invest abroad. Domestic investment is consequently financed with foreign funds. The model here extends this approach by relating the risk of expropriation (through high taxation) of domestically-owned capital to public and publicly-guaranteed foreign debt. Eaton and Gersovitz (forthcoming) also provide a model in which public debt can lead to the flight of private capital. Their concern is with government borrowing to finance public goods rather than with publicly-guaranteed private debt, but in both models anticipated tax obligations generate the potential for flight.

Dornbusch (1985) and Ize and Ortiz (1986) analyze capital flight in a macroeconomic context. To quote Dornbusch on the Argentine case:

The source of capital flight was the combination of currency overvaluation, the threat of devaluation, and ongoing and increasing domestic financial instability. The domestic instability derives from an inability to bring deficits under control and [to] stop the inflationary process in a decisive way. (p. 229)

This view complements the analysis here. The government's inability to finance expenditure, including debt-service obligations, led to inflationary finance, a form of taxation of domestic capital. As a consequence, capital fled.⁴

I. CAPITAL FLIGHT AND POTENTIAL FRAUD

The contagion problem can be illustrated most succinctly in a simple deterministic model. A national economy that is small in world capital markets is endowed with n potential projects. Project i yields an output valued as:

$$q_i = f_i(k_i) \quad f'_i > 0, f''_i \leq 0 \quad (1)$$

where k_i is total capital invested in the project. Each project is owned by an entrepreneur with an endowment of capital \bar{k}_i . In addition, he is permitted to borrow up to an amount \bar{k}_i^f from abroad at a gross interest cost, s_i , which will turn out to be a constant.

If the owner invests the funds in the project then he must service any debt from borrowed funds and pay a tax, t_i . His after-tax return is consequently $q_i - s_i k_i^f - t_i$ where k_i^f denotes actual foreign borrowing.⁵ Alternatively he may invest his own and borrowed funds abroad, default on his loan and evade the tax. His return on this investment is ρ_i , assumed to be a constant. The decision to invest at home or abroad consequently depends upon whether the net after-tax return on domestic investment is greater than or less than that on foreign investment:

$$f_i(\bar{k}_i + k_i^f) - s_i k_i^f - t_i \geq \rho_i (\bar{k}_i + k_i^f) \quad (2)$$

Given s_i , the borrower's interest cost of foreign capital; \bar{k}_i , the entrepreneur's own capital; ρ_i , the interest rate on funds placed abroad; and t_i , the tax, expression (2) constrains the amount of foreign capital that the entrepreneur can borrow without having an incentive to invest abroad.

In the region where the amount invested is so low that $f_i' > s_i + \rho_i$, an increase in foreign indebtedness reduces the incentive for flight. As long as the left hand exceeds the right hand side of (2), foreign lenders will be willing to extend further credit, since doing so will not create an incentive to default, while domestic lenders will want to borrow more since the return to domestic investment exceeds the marginal cost of borrowing, s_i . Once the amount invested domestically reaches a level such that $f_i' < s_i + \rho_i$, however, as foreign indebtedness increases so does the incentive for flight. The point at which expression (2) holds with equality consequently defines a maximum amount that lenders will be willing to extend, \bar{k}_i^f . Note that it is a decreasing function t_i , s_i , and ρ_i .

It would never be in the interest of someone intending to repay to borrow more than an amount k_i^{f*} determined by the condition:

$$f_i'(\bar{k}_i + k_i^{f*}) = s_i. \quad (3)$$

Hence whether this ceiling is binding or not depends upon whether $k_i^{f*} \geq k_i^f$. In any regime in which the credit ceiling \bar{k}_i^f is binding, the marginal product of capital domestically will exceed the return on funds placed abroad (i.e., $f_i' > \rho_i$). Thus, wherever it is binding, the ceiling is an increasing

function of the entrepreneur's own capital, as can be demonstrated by differentiating condition (2) with respect to \bar{k}_i .

Consider, as an example, the case in which technology is linear, so that

$$f_i(k_i) = \alpha_i k_i.$$

For there to be an incentive to perpetuate fraud at any level of indebtedness requires that $\alpha_i < s_i + \rho_i$, while a borrower's willingness to borrow and invest any amount domestically requires that $\alpha_i \geq s_i$. Under these restrictions, condition (2) implies a debt ceiling,

$$\bar{k}_i^f = \frac{(\alpha_i - \rho_i)\bar{k}_i - t_i}{s_i + r_i - \rho_i}.$$

In general, more borrowed capital can safely be provided the more productive the project in question, the lower the interest cost of the loan, the lower the return on funds placed abroad, the lower the tax, and the more that the entrepreneur himself has to invest. The debt ceiling, \bar{k}_i^f , reflects the complementarity between the entrepreneur's own capital and borrowed funds when loans are rationed.

Foreign lenders are competitive, and supply loans at a risk-free gross rate, $r \geq \rho_i$, given to this economy. The loan rate charged may be strictly greater than the rate of return on investments by domestic investors abroad due to (i) the cost of foreign banking services, (ii) foreign reserve requirements, and (iii) the cost to domestic borrowers of evading exchange controls. If foreign lenders can observe all the parameters of individual projects, including the borrower's total indebtedness, and repayment of loans in the absence of fraudulent investment is automatically guaranteed, then they

will provide any amount up to \bar{k}_i^f at the safe rate. Hence, $s_i = r$. Funds in excess of this amount will not be available at any rate, since default is then a certainty. If the credit ceiling is not binding then borrowing proceeds to the point at which the domestic return equals the world cost of capital. Otherwise the incentive-compatibility constraint implies a marginal product of capital in excess of this cost.

In neither case does capital flight or default ever occur. This is because lenders know all the parameters of the borrower's decision and ensure that this option is not in the borrower's interest. With imperfect information capital flight, and consequent default on foreign loans, could occur if lenders overestimate the productivity of a particular project or the amount that the borrower himself has at stake, or underestimate total indebtedness or the borrower's return on funds placed abroad.

Government Guarantees

Foreign lenders may make loans contingent on a guarantee from the borrower's government for either of two reasons. One is that lenders may not be able to observe the parameters of particular loan projects directly, and rely on the local government to determine whether or not these are at financially sound levels. Requiring a loan guarantee makes accurate reporting of the relevant data incentive-compatible for the government.

A second reason is that lenders may have no direct method to enforce repayment. Even if funds are invested domestically, lenders must rely on the local government to pursue bankruptcy proceedings against a borrower who does not repay. Lenders may have penalties to invoke against nations as a whole to

enforce repayment but these may have no deterrent effect if invoked at the level of an individual borrower.

An obvious example is a credit embargo. A threatened embargo against an individual borrower will have little effect in deterring default if the borrower foresees little need to borrow again. Conversely, the central government may have a much stronger incentive to maintain access to foreign capital markets for other potential borrowers, including itself.

For current purposes I assume that the impact of the penalty for failing to repay a guaranteed loan contract is sufficient to ensure that the government will enforce repayment of any loans that are extended, given that borrowed funds were invested domestically. If P is the penalty that lenders impose on the country as a whole for failing to enforce a loan contract, and total debt service obligations are $S \equiv \sum_{i=1}^n s_i k_i^f$, then lenders will ensure that $P \geq S$ for any debt obligations that arise.⁶

The Government Budget Constraint

The government's net financing requirement from the n investment projects (its expenditure less taxes from other sources) is denoted R . If all foreign borrowed and domestic funds are invested locally, then the government need only enforce existing loan contracts to make good on its loan guarantees. A set of taxes, t_i , that satisfy

$$\sum_{i=1}^n t_i \geq R$$

will provide sufficient revenue.

A useful simplification is that firms are identical in the sense that

$$\left. \begin{array}{l} f_i(k) = f(k) \\ \bar{k}_i = \bar{k} \\ \rho_i = \rho \\ t_i = t \end{array} \right| \quad i = 1, \dots, n. \quad (4)$$

These firms will have borrowed the same level of foreign capital

$k^f = \min(\bar{k}^f, k^{f*})$ at a uniform cost, s .

Let m denote the number of loans fraudulently obtained for domestic projects in which the funds were invested abroad. The consequent default on these loans generates an additional revenue requirement, equal to msk^f , if the government is to fulfill its loan guarantees. The minimum per firm tax on the remaining $n - m$ projects necessary to meet this requirement is

$$\underline{t} = (R + msk^f) / (n - m) . \quad (5)$$

This tax implies a maximum after-tax income for a borrower who invests domestically of

$$\Psi(\bar{k}, k^f, s, R, m) \equiv f(\bar{k} + k^f) - sk^f - (R + msk^f)/(n - m) . \quad (6)$$

Given k^f , this return falls as m , the number of firms engaging in fraud, rises (i.e., $\Psi_m < 0$).

At the time that loans are extended the government cannot precommit itself both to a given tax structure and to guarantee loans unless it can also ensure that all borrowed funds are invested domestically and consequently will provide a base for repayment. Otherwise, its budget constraint forces the

government to modify taxes in response to actual investment patterns if it is to fulfill loan guarantees.

Multiple Equilibria

At the time that borrowers allocate funds between domestic and foreign investment, the values of k^f and s as well as \bar{k} and R are predetermined. Given these values, a Nash equilibrium in investment allocation is an allocation in which no single borrower has an incentive to deviate from his investment decision given the investment decisions of the other $n - 1$ borrowers.

The basic result of this paper is that under reasonable conditions there are at least two such equilibria. These equilibria have different welfare implications and one Pareto-dominates the other. It follows from observing that, since $\Psi_m < 0$, for some parameter values

$$\Psi(\bar{k}, k^f, s, R, n-1) < \rho(\bar{k} + k^f) \leq \Psi(\bar{k}, k^f, s, R, 0) \quad (7)$$

where $m = n - 1$ and 0 , respectively. The first term is what a single borrower would earn if he were the only borrower to invest domestically. The second is what can be earned abroad, which is independent of other borrowers' decisions. The third term is what a borrower earns by investing domestically if all other borrowers do the same. The second inequality in expression (7) is implied by condition (2) for $t = R/n$. Hence credit rationing should ensure that this inequality is satisfied. It implies that it pays to invest domestically if everyone else has. Hence in one equilibrium everyone does in fact invest domestically ($m = 0$). I call this the normal equilibrium.

The first inequality is more likely to be satisfied the larger R , k^f and n . It implies that it does not pay to invest domestically if no one else does, so that in another equilibrium no one invests domestically. I call this the flight equilibrium.⁷

In the normal equilibrium private borrowers repay loans, and foreign lenders necessarily receive payment. What happens in the flight equilibrium depends upon whether the government has sufficient revenue from other sources to repay. If $-R$, net revenue already available from other sources, exceeds debt-service obligations, nsk^f , then the government can repay without raising additional revenue. Assume that the possibility of raising additional revenue in an amount T incurs a cost (directly and in terms of excess burden, administrative cost, or negative political consequences) of $C(T)$. If the cost of raising the revenue needed to repay loans exceeds the penalty of default (i.e., if $C(nsk^f + R) > P$), then the government will choose to default on foreign loans and suffer the consequences. If this inequality is reversed then it will repay loans with income generated by taxes on other sources of income. In this second case a precommitment by the government to using these alternative sources of revenue to repay guaranteed loans in default would eliminate the potential for flight. As long as income generated by investment projects that do yield income is a less costly revenue source, however, a promise not to use these projects as a tax base is not credible.

Whether or not the government raises additional revenue, the normal equilibrium Pareto-dominates the flight equilibrium. The government avoids the default penalty or the cost of raising additional revenue, borrowers earn a higher return (as condition (2) directly implies), and lenders are necessarily repaid.

If in the flight equilibrium the government repays foreign loans, then the potential for flight will not affect the terms on which foreign loans are available. Loans from abroad will cost the safe world lending rate, r . If capital flight leads to default, however, then lenders must assess the likelihood of a flight equilibrium in deciding upon the terms on which they will supply loans. The next section discusses how the potential for flight can affect the availability of credit.

Sunspots

At the time loans are extended neither lenders nor borrowers know which equilibrium will emerge. Nothing intrinsic to the model determines the choice between them. One approach in such cases is to introduce uncertainty in the form of a lottery across equilibria, assuming that the generally observed resolution of a random process extrinsic to the model (e.g., "sunspots") determines the outcome (see, in particular, Cass and Shell (1983)).

Let ϕ denote the commonly observed outcome of a random process which can assume any value in the set Φ ; this outcome will influence lenders' and investors' expectations about capital flight. The true value of ϕ is observed after loans are extended but before the investment allocation decision is made. All agents share the belief that certain realizations of ϕ imply flight and that the remaining possible ones imply the normal outcome. When the true value of ϕ is realized agents then act accordingly. The probability that lenders (correctly) assign to a normal equilibrium outcome is denoted π ; the probability of flight is consequently $1 - \pi$.

Competition among risk-neutral lenders will ensure a level of investment that satisfies a zero-expected-return condition, i.e.,

$$E(\text{snk}^f) = \text{rnk}^f. \quad (8)$$

When flight leads to default, two types of situations could emerge:

No flight: lenders constrain the amount that they lend to a level so low that even a single borrower could repay the total debt and still earn a profit investing domestically. Formally, the level of k^f would satisfy:

$$\Psi(\bar{k}, k^f, r, R, n-1) \geq \rho(\bar{k} + k^f) \quad (9)$$

There is no flight equilibrium, so that the safe rate is the rate actually charged ($s = r$). This would typically involve very little lending.

Potential flight: lenders constrain k^f to a level at which repayment occurs only in the normal equilibrium, i.e.,

$$\rho(\bar{k} + k^f) \leq \Psi(\bar{k}, k^f, \tilde{s}, R, 0) \quad (10)$$

where

$$\tilde{s} \equiv r/\pi \quad (11)$$

At one extreme the probability of a normal equilibrium outcome, π , is equal to one; the capital flight equilibrium, while now a possibility, never actually occurs and private loan obligations are always met. Even though the government has guaranteed loans, it need never use general revenues to repay them. The allocation of resources is the same as what would have emerged if lenders could enforce loan contracts directly with borrowers without requiring a guarantee.

At the other extreme $\pi = 0$. Again, capital flight never occurs but now borrowers are rationed to the no-flight level, such a small amount that any one borrower could service the total foreign debt and still earn a net return in excess of that abroad.

For values of π near zero, this rationing will also be the equilibrium. For values of π closer to one the equilibrium amount borrowed will be intermediate between the levels observed at the two extreme values of π . In some states flight will occur and the government will not meet debt-service obligations.

Policies that reduce the probability of flight (raising π) benefit the country in two ways. They have the direct effect of increasing the likelihood of the normal equilibrium, in which lenders, borrowers, and the government are better off. They have the additional effect of expanding the amount of foreign capital available. Since the economy is, by assumption, one in which the marginal product initially exceeds the world cost of capital, this is an added benefit.

II. CAPITAL FLIGHT AND MORAL HAZARD

In the model developed in the previous section capital flight occurred because both domestic and foreign funds were invested fraudulently overseas rather than in domestic projects. Even if borrowed funds are invested domestically, however, government debt guarantees can imply multiple equilibria, one of which is characterized by the flight of nationally-owned capital and possible default on foreign loans.

Consider a situation in which the return on a project depends both on the outcome of an exogenous random process, denoted x , and on the level of

managerial effort, denoted e . Only the owner of the project can observe x and e . Consequently, outside observers cannot tell how much of the return on a project is determined by managerial effort and how much by luck.

The simplest case to consider is one in which the production relationship takes the form

$$g_i(k_i, e_i, x_i) \tag{12}$$

where e_i and x_i can take on values 0 or 1, and

$$g_i(k_i, 1, 1) = f_i(k_i)$$

$$g_i(k_i, 0, 1) = g_i(k_i, 1, 0) = g_i(k_i, 0, 0) = 0 .$$

That is, a positive return requires both a high level of effort and a positive realization of the random process. Let λ_i denote the probability that the random process is positive, $x_i = 1$. Given that the manager expends effort ($e_i = 1$), the expected gross output from the project is $\lambda_i f_i(k)$.

As before, let s_i denote a borrower i 's cost of foreign capital, \bar{k}_i his own endowment of capital, ρ_i his return on funds invested abroad, and t_i the tax on revenue from this project, which is only collectable if the project yields a positive revenue. In addition, let β_i denote the disutility in terms of income that the borrower suffers from exerting effort in managing his project.

Lenders can automatically recover loan obligations if the project has yielded the available resources, but not otherwise. Hence as long as

$$f_i(k_i) - t_i \geq s_i k_i^f \quad (13)$$

and $x_i = e_i = 1$ then repayment is effected. If $x_i = 0$ or $e_i = 0$, however, then there are no resources available for repayment. The lender, by assumption, does not have access to income from the borrower's own capital placed abroad, so in the absence of a government guarantee loans are not repaid.

The following events occur in sequence. First, owners of projects borrow a particular amount from foreign lenders (possibly with their own government acting as intermediary or guarantor). Second, the owners of these projects decide, simultaneously or sequentially, whether or not to exert effort in managing their investment project and where to invest their own funds. Finally, after all decisions have been made, the random component of the production process, x , is realized. In this version of the model owners of projects are precluded from shifting borrowed funds abroad, possibly because the lender or the government can monitor these funds, and placement abroad would signal a decision not to exert effort in management. The potential for embezzlement of borrowed funds could be introduced here as well, introducing elements of the previous analysis. For simplicity it is not.

At the time a borrower decides where to invest his own wealth and how much effort to expend, his foreign indebtedness is already determined, while the outcome of the random element in the production process is still unknown. Following the standard technique of backward induction, I discuss the effort and portfolio decision first, taking foreign indebtedness as given, and then turn to the prior borrowing decision.

Given that he intends to exert effort, the optimal portfolio decision for a risk-neutral individual is to invest his own funds in his own project to the

point at which the return at home equals that available abroad.

Mathematically, he should invest an amount w_i abroad where w_i satisfies:

$$\lambda_i f'_i(k_i^f + \bar{k}_i - w_i) = \rho_i \quad (14)$$

as long as the value of w_i that satisfies this expression lies between zero and \bar{k}_i . Here k_i^f denotes the predetermined level of foreign borrowing. If

$$\lambda_i f'_i(k_i^f) < \rho_i$$

then he should invest all his own funds abroad (set $w_i = \bar{k}_i$). Conversely, if

$$\lambda_i f'_i(k_i^f + \bar{k}_i) > \rho_i$$

then he should invest all his own funds domestically (set $w_i = 0$). Any income that the project generates is available for payment of debt and taxes. The highest expected income that the borrower can achieve given a decision to exert effort and given k_i^f is defined as $h^i(k_i^f)$ where:

$$h^i(k_i^f) \equiv \lambda_i \max[f_i(k_i^f + \bar{k}_i - w_i^*) - s_i k_i^f - t_i, 0] + \rho_i w_i^* - \beta_i.$$

Here w_i^* is the optimal level of w_i given a decision to exert effort.

Given a decision not to exert effort, the borrower's optimal portfolio decision is, of course, to invest all his own funds abroad, ensuring himself a return $\rho_i \bar{k}_i$. Given k_i^f , the decision to expend effort is thus incentive compatible if and only if

$$h^i(k_i^f) \geq \rho_i \bar{k}_i. \quad (15)$$

If this constraint is satisfied then the borrower will choose to exert effort in managing his project and set $w_i = w_i^*$. If not then he will choose not to exert any managerial effort and invest all of his own funds abroad (set $w_i = \bar{k}_i$). Note that, in particular, an increase in tax obligations makes this constraint more difficult to satisfy.

Having characterized the optimal effort and portfolio decision given foreign indebtedness, I now turn to the prior borrowing decision. In the absence of a government guarantee, lenders will only lend an amount that satisfies condition (15). If this condition is not satisfied then the borrower will not exert any effort in managing his project. Hence default is certain. If this condition is satisfied then the borrower will exert effort, ensuring repayment in the state of nature in which $x_i = 1$.

Competitive, risk-neutral lenders will be willing to extend loans in any amount that satisfies condition (15) at an interest rate that is high enough to offset losses on loans to firms that fail to generate output because of bad luck. Hence, for firm i the interest rate will be given by:

$$s_i = r/\lambda_i \quad (16)$$

where r continues to represent the safe world gross interest rate and λ_i the probability that $x_i = 1$.

Given this interest rate and the incentive compatibility constraint (15), risk-neutral borrowers will wish to borrow an amount that maximizes expected income, which is given by the function $h^i(k_i^f)$. Since the expected cost of funds from abroad, r , is at least as great as the return on funds placed

abroad, ρ , a risk-neutral borrower will never borrow abroad for domestic investment and then place his own funds abroad, given that he exerts effort.⁸ Hence the amount of borrowing that maximizes expected income is given by the condition:

$$\lambda_i f_i'(k_i^f + \bar{k}_i) = r \quad (17)$$

As in the previous version of the model, I denote the value of k_i^f that satisfies equation (17) as k_i^{f*} . For any borrowing ever to be possible requires that:

$$h(k_i^{f*}) \geq \rho \bar{k}_i \quad (18)$$

In the subsequent discussion I assume that this condition is satisfied at $t_i = 0$. This condition ensures that some movement of capital to this country increases its income. In contrast with the situation in which flight is the consequence of outright fraud, the incentive to flee does not grow with the total amount borrowed. If equation (18) is satisfied then k_i^{f*} is the actual amount lend; if not, no amount is offered.

Government Guarantees

As before, foreign lenders may require the guarantee of the borrower's government to extend a loan to any particular private borrower. This may be so that the government will enforce repayment or because the government can observe project returns not observable by the foreign lender. A guarantee

would then preclude a borrower's falsely claiming bad luck ($x_i = 0$), hence that output was zero, and that repayment could not be made.

Consider the case, then, in which foreign borrowing is channeled through the government, which guarantees foreign lenders a return r , and charges each individual private borrower $s_i \geq r/\lambda$. If the number of firms is large and x_i is independent across firms, then as long as the incentive-compatibility constraint (15) remains satisfied, the statistical law of large numbers ensures that the government's receipts from loans it has extended can finance payment to foreigners.

The Government Budget Constraint

Assume, as before, that the government's net revenue requirement is R . Given that private borrowers expend effort managing their projects, this revenue is generated by a set of tax rates, t_i , that satisfy

$$\sum_{i=1}^n \lambda_i t_i \geq R.$$

Again, it is convenient to focus upon the case in which firms are identical in the sense that

$$\left. \begin{array}{l} f_i(k) = f(k) \\ k_i = k \\ \lambda_i = \lambda \\ \rho_i = \rho \\ t_i = t \\ \beta_i = \beta \end{array} \right| \quad i = 1, \dots, n. \quad (19)$$

Consequently each firm will have borrowed the same amount, k^f , at cost s .

Let m now denote the number of firms whose owners have decided not to expend effort on their projects and have consequently invested their funds abroad. These borrowers will, of course, default on their loans. They generate an additional revenue requirement, mrk^f . In order to finance the total revenue required the government must impose a tax equal to the prior net financing requirement plus the loan default repayment, spread over those firms earning a positive return on domestic investment:

$$t = (R + mrk^f)/\lambda(n - m). \quad (20)$$

The consequent expected income of a borrower who expends effort and invests domestically is

$$\psi(\bar{k}, k^f, s, R, m) = \lambda[f(\bar{k} + k^f) - sk^f] - (R + mrk^f)/(n - m) - \beta.$$

Multiple Equilibria

The after-tax income of any borrower who invests domestically and expends effort on his own project falls as the number of borrowers who choose not to expend effort (and hence invest abroad) rises. Unless indebtedness is restricted to a level so low that even one borrower could repay the total debt and still earn a positive return (i.e. at which $\psi(\bar{k}, k^f, s, R, n-1) \geq r'\bar{k}$) there are again two equilibria.

In one equilibrium all owners of firms invest their own funds domestically and expend effort in managing their firms. The risk premium that the government charges on guaranteed loans to domestic borrowers compensates

for losses on loans to firms whose output is low for exogenous reasons.⁹ Foreign loans are repaid without recourse to additional taxation.

In the other equilibrium, all domestic borrowers place their own capital abroad and exert no effort in managing their firms. All private borrowers default, so that the government lacks revenue sufficient to repay foreign loans, and must either raise additional revenue from other sources or default as well. In contrast with the specification in section I, the flight equilibrium is not the consequence of the outright perpetration of fraud.¹⁰ Borrowers do not abscond with foreign capital that they have borrowed but do, as promised, invest it domestically. They manage their investment in a way that reduces the likelihood of repayment, however. Since their effort is never observable, this failure does not constitute verifiable fraud in the same sense that the misuse of borrowed funds did in the previous analysis.

The Optimal Pricing of Domestic Loans

Again, an extrinsic source of uncertainty ("sunspots") may generate a lottery between the two equilibria. When flight leads to default on foreign loans, if π is the probability of a normal equilibrium and $1-\pi$ the probability of a flight equilibrium, then foreign lenders will require an interest rate

$$\tilde{r} \equiv r/\pi \tag{21}$$

Expected national income generated by the projects under consideration is

$$Y^e = \pi[\lambda f(\bar{k} + k^f) - \tilde{r}k^f - \beta] + (1-\pi)\rho\bar{n}k$$

$$= n\{\pi[\lambda f(\bar{k} + k^f) - \beta] - rk^f\} + (1-\pi)\rho n\bar{k}. \quad (22)$$

The level of foreign borrowing that maximizes Y^e satisfies

$$\lambda\pi f'(\bar{k} + k^f) = r. \quad (23)$$

To achieve this level of foreign indebtedness the government should charge individual private borrowers a nominal interest rate which accounts for the probability of default: $s = r/\lambda\pi$. In the normal equilibrium the government collects rnk^f/π , which equals foreign debt-service obligations. Hence in this equilibrium the government can finance foreign debt fully out of interest received from domestic borrowers.

CONCLUSION

I have developed these two versions of the model to illustrate how a particular type of market failure, the inability to enforce contracts between private agents without public intervention, can generate capital flight. The interaction between government guarantees and private investment occurs in a very simple framework. As a consequence a number of issues remain outside the analysis.

For one thing, the government's tax base appears only very crudely. In principle the issues raised here relate to the government's overall fiscal and debt structure, including tax, expenditure and monetary policy. The role of seigniorage as a form of finance seems particularly relevant to the countries in question.

A second, and related, omission is an analysis of the government's default decision as the outcome of the weighing of the costs and benefits of repudiation. Here the cost of default is exogenous. Eaton, Gersovitz and Stiglitz (1986) provide a recent discussion of the incentives to avoid default.

A third omission is an analysis of the dynamics of accumulation. The issues raised in the model clearly have implications for savings behavior, but I have treated national wealth as given.

Because of these limitations the model does not provide an adequate framework for a general comparison of alternative policies. It does point to some considerations that could be important in weighing policy alternatives, however.

The most obvious one is that there is a benefit to extending the tax base of borrowing countries to include income from private assets abroad. The brain-drain literature has already made this point for a very different reason. Policies in both developing and developed countries could serve this end.

To the extent that taxing foreign income is infeasible, capital controls that succeed in preventing investment abroad could alleviate the problem simply by eliminating the possibility of flight. The benefits of such controls that are implied by this analysis need to be weighed against the administrative cost, the reduced possibility for diversifying exogenous risks, and the potential for rent-seeking activity that controls would pose. Another problem is that if such controls do not eliminate the possibility of flight, but only reduce the return on funds invested abroad, they will not, on their own, reduce the probability that flight will occur. Indeed, information that increases borrowers' expectation of future controls might lead to flight as

borrowers attempt to remove funds before controls are put into effect. An increased fear of controls would then be acting as a particular realization of an extrinsic random process (or "sunspot") that leads to flight.

The analysis suggests two other implications about policy that probably deserve greater emphasis. First, there may be a benefit to replacing explicit or implicit government backing of private loans with bankruptcy procedures more similar to those used domestically that compensate lenders with equity in the assets of private borrowers in default. Such a step would reduce interdependence among private investment decisions created by guarantees that can lead to flight. Second, the expansion of the tax base to include income from factors in fixed supply domestically (land, in particular) can reduce the incentive for flight. To the extent that income of this type is perceived as a source of finance that is no more costly than taxation of income from mobile factors, there is less reason for capital to flee in the presence of large potential government finance requirements.

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APPENDIX TABLE 1: Symbols used in the Model

C	=	costs (collection, administrative, political) to the government of raising additional tax revenue
e_i	=	managerial effort as a determinant of project return; value 0 or 1
f_i	=	gross return on domestic project i
k_i	=	total capital invested in project i
\bar{k}_i	=	entrepreneur capital endowment for each i
k_i^f	=	foreign capital borrowed for project i
\bar{k}_i^f	=	foreign borrowing ceiling for each project
m	=	number of firms which invested fraudulently-obtained foreign funds abroad (Section I) number of firms which invested their own funds abroad (Section II)
n	=	number of total potential investment projects
P	=	penalty imposed on country for uncompensated private loan default
q_i	=	value of output of i
R	=	government's net financing requirements from n investment projects
r	=	gross risk-free interest rate charged by foreign lenders
ρ_i	=	foreign interest rate, i.e. return on investment abroad
\tilde{r}	=	interest rate charged by foreign lenders given an extrinsic source of uncertainty of repayment
S	=	borrower's total debt service obligation
s_i	=	borrower's cost of foreign borrowing; gross interest rate
T	=	additional tax revenue required
t_i	=	tax on project i
\underline{t}	=	minimum tax on domestic funded projects given default on others
x	=	exogenous random determinant of return on investment; value 0 or 1
Y^e	=	expected national income generated by projects
α_i	=	coefficient of return on investment in i (linear technology function)
β_i	=	disutility of managerial effort in project to borrower

- $\Psi =$ maximum after-tax income for domestic investor ($\Psi_m < 0$)
- $\phi =$ commonly observed random process outcome in set Φ for value of loan before investment allocation decision
- $\pi =$ probability that lenders correctly assign outcomes implying a normal equilibrium (i.e. domestic investment and loan repayment)
- $\lambda_j =$ probability that $x = 1$

NOTES

1. More recent data provided by Dooley (1986), Cuddington (1986), and Cumby and Levich (1986) support the conclusion that capital flight from these countries has been substantial.
2. Stiglitz and Weiss (1981) model the potential for moral hazard in the design of debt contracts.
3. The interdependence of private borrower decisions created by public loan guarantees resembles that among depositors in Diamond and Dybvig's model of "bank runs" (1983). In both cases the interdependence of investment decisions leads to the possibility of contagion and an inferior equilibrium. They interpret their model as supporting government deposit guarantees. In contrast, in this model government guarantees are the source of the problem.
4. Diwan (1986) develops a model in which capital flight emerges as a response to the limitation that credit rationing by foreign lenders places on the risk-sharing opportunities available to domestic residents through borrowing.
5. Making the tax obligation a function of output or income does not affect the analysis substantially, although it introduces some inessential complications.
6. Relaxing this assumption gives rise to the possibility of credit rationing at the aggregate level, many implications of which have been analyzed elsewhere. Introducing the potential for aggregate credit rationing here complicates the analysis substantially, without affecting most basic results.

7. A third equilibrium is one in which $m = \tilde{m}$ where \tilde{m} is defined by the condition $\Psi(\bar{k}, k^f, s, R, \tilde{m}) = \rho(\bar{k} + k^f)$. It is unstable and hence I assign it a zero probability of occurring.
8. Risk aversion would provide a motive to invest aboard even if the borrower intends to expend effort on his own project. As risk aversion introduces a number of complications that are largely irrelevant to the basic point, I continue to assume that borrowers are risk neutral.
9. The next section demonstrates that it is optimal for the government to charge domestic borrowers a nominal interest rate just sufficient to cover foreign loan obligations in the normal equilibrium.
10. There remains, however, avoidance or evasion of tax obligations. This feature of the flight equilibrium is essential to both versions of the model.

Table 1. Capital Flight, Domestic Investment and Nationalization of the Debt: Selected Countries (1974-1982)

Country	Total change in external debt (1)	Total implicit capital outflow (2)	Total capital flight in external debt (3)	Capital flight: Percentage change in external debt (4)	Percentage change in gross DFCF (1980/81-1982/84) (5)	June 1982: Share of US bank exposure owed by the public sector (6)	Sept. 1984: Share of US bank exposure owed by the public sector (7)
Argentina	32.6	20.2	15.3	47.0	-36.0	31.1	49.5
Brazil	93.5	11.4	0.2	0.0	-20.0	29.1	47.0
Chile	15.4	0.0	-1.9	-1.3	-34.0	18.2	37.9
Korea	33.6	5.9	0.6	2.0	n.a.	n.a.	n.a.
Mexico	82.6	36.3	32.7	40.0	-27.0	35.2	50.3
Peru	10.7	3.1	1.2	11.0	-17.0	n.a.	n.a.
Phillippines	19.9	3.9	n.a.	n.a.	n.a.	n.a.	n.a.
Venezuela	27.0	25.5	10.8	40.0	-23.0	42.4	49.0

Notes:

a: DFCF = gross domestic fixed capital formation
b: 1980-1981 average to 1982-1984 average

Sources:

Column

- 1, 2 Dooley et al. (1986), reported in Khan and Haque (1985)
3, 4 Gunnington (1987), reported in Khan and Haque (1985)
5, 6 ECLAC, reported in Sachs (forthcoming)
6, 7 Keefe Nationwide Bankscan, February 19, 1985, reported in Sachs (forthcoming)