

## LINKING TRADE AND EXTERNAL DEBT STRATEGIES

Ishac DIWAN\*

*The World Bank, S-8027, Washington, DC 20433, USA*

Received March 1989, revised version received April 1990

Despite the productive inefficiencies generated by policies of export promotion and of import substitution, such development strategies can improve welfare when used in conjunction with a debt strategy. Export promotion can increase the availability of foreign finance, and import substitution can reduce debt service. When the latter strategy is optimal, partial debt forgiveness increases the creditor group's payoff. Import substitution is more profitable with a large inherited debt, high world interest rate, low terms of trade, and when creditors fail to reduce inherited debt.

### 1. Introduction

When a country's external debt exceeds some safe limit, new loans dry up, and default becomes more attractive. The inability to borrow creates an intertemporal distortion that generates conflicting incentives: to increase creditworthiness with a view to returning to the financial market to finance valuable investment opportunities; and to reduce creditworthiness in an attempt to get better terms in an eventual debt settlement that includes debt relief. In both cases – as in second-best situations in general – it is optimal to create another distortion to improve welfare.

The focus of this paper is on the intertemporal, self-imposed distortions that arise when investment funds have to be allocated between an export sector and an import-competing sector. If one accepts the view that creditworthiness is positively linked to the extent of the gains that the debtor country derives from international trade,<sup>1</sup> a competitive allocation of investment funds will not be efficient from a social point of view when the foreign debt ceiling is binding. Instead, two mutually inconsistent strategies – involving attempts to either increase or decrease gains from trade – become

\*I am indebted to Stijn Claessens, Daniel Cohen, Stanley Fisher, Ken Froot, Elhanan Helpman, Aasim Hussain, Ken Kletzer and the referees of this journal for useful comments, and to Albert Fishlow and Dani Rodrik for suggestions that led to significant improvements in the paper. The views expressed here do not necessarily reflect those of the World Bank.

<sup>1</sup>This approach is taken by Gersovitz (1983), Diwan and Donnenfeld (1986), and Aizenman (1988) in models involving unilateral defaults, and by Bulow and Rogoff (1989a) in a bargaining model.

tempting. Think of the debtor as trying to maximize net income – GNP minus debt repayments. When good investment opportunities exist and the supply of new funds responds well to greater openness, an export promotion (EP) strategy can increase net income by allowing the debtor to regain market access and increase external borrowing, thereby relaxing the intertemporal liquidity distortion. But net income can also be raised by bargaining to reduce debt repayments, and this is best achieved through an import substitution (IS) strategy: by reducing trade, the debtor gets a better debt settlement, albeit at the cost of increased productive inefficiency.

In the early 1980s a series of negative shocks in the international economy seriously affected the perceived creditworthiness of many developing countries. As a result, new loans dried up, and the debt crisis locked creditor groups and many debtors in a bargaining game over the amounts of debt repayment and over the adjustments in their economies that would be needed to make those transfers feasible. Whereas the debt crisis of the 1930s witnessed massive defaults, a breakdown of international trade relations, and the beginning of IS-oriented development strategies, the experience of the 1980s has so far been quite different. There have been relatively few cases of repudiated debts, and many debtor countries have been making the required adjustments in their economies to regain creditworthiness. In general, adjustment has involved reducing current expenditures and switching production toward the export sectors, in some cases with a major focus on EP.<sup>2</sup>

This paper attempts to explain this difference in the reaction of debt policies to exogenous shocks. The important variables in the analysis are the size of the initial shock, the expected future terms of trade, world interest rates, the way in which creditors are organized, and the availability of commitment mechanisms.

The notion that economic policy can be used to support a debt strategy is not new. Many economists have analyzed the debtor's ex post underinvestment incentives while bargaining to reduce debt repayment; Sachs (forthcoming), Krugman (forthcoming), Corden (1989), and Helpman (1989) are examples. These authors (and others) derive 'debt Laffer curves' by assuming the default penalty to be a share of income.<sup>3</sup> But ex ante expectations of future shirking behavior reduce the supply of funds. The benefit of ex ante precommitments to increase the supply of funds has been discussed in terms of commitments to increase directly the default penalty [Eaton and Gersovitz (1981)], to increase investment [Claessens and Diwan (forthcoming)], or to increase investment in 'openness' [Aizenman (1988)].

<sup>2</sup>Case study examples are Turkey and Korea.

<sup>3</sup>As discussed below, a weakness of this approach is its implicit assumption that increased aggregate investment raises creditworthiness. As pointed out by Gersovitz (1983), this is not always true; for example, increased investment in the IS sector can reduce creditworthiness.

In contrast, this paper develops a model that allows the debtor country to choose rationally between both types of behavior in a two-sector model with real trade. The model can be used to address important related issues. In particular, I show that aggregate investment does not necessarily decrease with indebtedness as predicted by the one-sector debt Laffer curve models. With respect to the optimality of debt forgiveness, I show that when IS is optimal, it is in the interest of the creditors to forgive some debt in order to induce the debtor to choose an EP strategy and avoid a costly debt settlement. The extent of necessary debt relief decreases with the terms of trade.

The paper is organized as follows. In section 2, a simple two-period trade model under certainty is developed. Section 3 analyzes the joint optimal debt and investment strategies and the determinants of the optimal reaction to exogenous shocks. Section 4 presents concluding remarks.

## 2. A simple model

The simplest set-up needed is a two-period, two-sector, certainty model of a small economy that is populated by a representative agent with some inherited external debt. A central planner is in charge of foreign borrowing and repayment decisions. The focus is on optimal investment, both from a private and a social point of view. Investment occurs in the first period,  $t_1$ . An investment plan is a pair  $(K + L, \alpha)$  that allocates domestic savings ( $K$ ) and new foreign loans ( $L$ ) between the two sectors in the proportion  $\alpha$  and  $(1 - \alpha)$ , respectively. Foreign borrowing – if any – also takes place in  $t_1$ . Trade, consumption, and debt repayment take place in the second period,  $t_2$ .

Denote the production of the exportable good by  $x$  and of the importable good by  $m$ . International prices are given by  $(p, 1)$ , with the price of the importable good normalized to unity. If no trade occurs, the domestic price of the exportable good is given by  $p^A$ . I assume that  $p^A < p$  in order to guarantee that the first good is indeed exported and the second is imported in the trade regime. The supply side of the economy can now be summarized by a revenue function:

$$\begin{aligned}
 Y(p, \alpha, K + L) \\
 = \max_{(x, m)} \{px + m \text{ s.t. } x \leq f[\alpha(K + L)], m \leq g[(1 - \alpha)(K + L)]\}, \quad (1)
 \end{aligned}$$

where  $f(\cdot)$  and  $g(\cdot)$  are concave production functions that use capital as their only input. The revenue function has the convenient envelope properties:

$$Y_x = (pf' - g')(K + L); \quad Y_k = \alpha pf' + (1 - \alpha)g'; \quad Y_p = x. \quad (2)$$

If it is assumed that the representative agent's preferences for consumption of the two goods can be represented by a concave utility function  $U(\cdot)$ , the demand side of the economy can best be summarized by an expenditure function,  $E(U, p)$ , that indicates the least income that is needed to achieve a utility level  $U$  at the relative price  $p$ .

### 2.1. The repayment decision

Denote by  $D_i$  the country's foreign liability at the end of  $t_i$ ,  $i=1,2$ . For simplicity, I assume that all loans are due at the end of  $t_2$  and that they carry an interest rate of  $(r-1)$ . Thus,  $D_2 = (D_1 + L)r$ .

Let us first analyze the repayment decision at  $t_2$  and then the borrowing decision at  $t_1$ . The planner can repay the full amount due,  $D_2$ ; default unilaterally; or she can bargain with creditors for a partial repayment of  $B < D_2$ .<sup>4</sup> The creditors can threaten to impose various sanctions in case of unilateral default. Although those sanctions are partially trade-related [Kaletsky (1985)], I will assume for analytical tractability that a country that defaults on its foreign obligations is completely cut-off from international trade markets. In this event, the country will have to consume its own production  $(x, m)$ , leading to an autarkic welfare level,  $U^A = U(x, m)$ , that is determined by two equilibrium conditions:

$$E(p^A, U^A) = Y(p^A, \alpha, K + L), \quad (3)$$

$$E_p(p^A, U^A) = Y_p(p^A, \alpha, K + L), \quad (4)$$

which determine  $U^A$  and  $p^A$  as functions of  $\alpha$ ,  $K$ , and  $L$ . When the debt burden is large, the debtor prefers autarky and default to trade with full repayment.

But such a resolution is ex post inefficient because potential gains from trade are lost. Both sides of the debt contract can end up better off with a bargain. Thus, there will exist a bargaining equilibrium in which the debt contract will be renegotiated, debt relief will be granted to allow for a partial repayment  $B < D_2$ , but sanctions will not be imposed and trade will take place [Bulow and Rogoff (1989a), Fernandez and Rosenthal (1988)]. Without modeling the bargaining process, I will take the implicit form of the debt contract to be given by a repayment function  $R$  of the form:

$$R = \min [B, D_2]. \quad (5)$$

<sup>4</sup>In the presence of debt owed by the private sector, partial defaults can be implemented with the planner collecting all the debt service due and returning the surplus to consumers in the form of lump-sum transfers.

If creditors do not gain (or lose) from sanctions, they would accept any positive repayment to settle. But the repayment that a debtor is willing to make to avoid autarky and retain its trade option must produce a welfare level that is not below  $U^A$ . The maximum that the debtor is willing to repay is given by its trade surplus,  $B^U$ , with:

$$E[p, U^A] = Y(p, \alpha, K + L) - B^U(x, p, K, L), \quad (6)$$

so that net income [ $Y(\cdot) - B^U(\cdot)$ ] can finance enough expenditure in the international market to produce the utility level,  $U^A$ . Eq. (6) determines  $B^U$  as a function of  $x, p, K$ , and  $L$ .

In general,  $B$  will be bounded below by zero and above by  $B^U$ , the debtor's gains from trade, with the exact amount determined by bargaining. For simplicity, however, I take  $B$  to equal  $B^U$ . This assumes that the creditor's coalition is in a monopoly situation in the sense that it can extract all the borrower's surplus.<sup>5</sup> Although  $B$  is the repayment that leaves the country indifferent between defaulting (and not trading) and repaying (and trading), when such a choice is available, I will assume that the country prefers to repay  $B$  and to trade rather than to default and not trade.<sup>6</sup> Thus, international trade will always take place in equilibrium.

The relationship between  $B$  and the exogenous variables can be derived by solving for  $B$  in eq. (6) and differentiating. Using the fact that the marginal utility of the second good is equal to the marginal utility of income because of the price normalization, after slight manipulations, one gets:<sup>7</sup>

$$B_x = \alpha(p - p^A)f' > 0; \quad B_z = (K + L)(p - p^A)f' > 0; \quad B_p = x - E_p > 0. \quad (7)$$

The model is illustrated in the output space in fig. 1. Available capital ( $K + L$ ) determines the production possibility frontier,  $PP$ . Suppose that the investment mix  $\alpha^F$  that maximizes income at world prices  $p$  is chosen, leading to a production vector depicted as  $F$ . The dotted indifference curve that passes through  $F$  represents the autarkic or reservation level of utility  $U^A$ , given  $K, L$ , and  $\alpha^F$ . But instead of consuming  $F$  and defaulting unilaterally, the debtor is as well off by trading at  $p$ , consuming  $C'$ , and repaying  $B_3$ . Thus, the distance between the budget lines (at prices  $p$ ) that go through  $F$  and  $C'$  determines the maximum repayment the debtor will make to be allowed to trade,  $B(p, \alpha^F, K + L) = B_3$ . Now suppose that the same amount of capital is invested instead according to an investment mix  $\alpha^{IS} > \alpha^F$ , leading to

<sup>5</sup>For a model in which this occurs as an equilibrium of a bargaining game, see Fernandez and Rosenthal (1988).

<sup>6</sup>This does not entail any loss of generality since the country can be made to prefer strictly the trade regime if it is required to repay  $(B - \epsilon)$ , with  $\epsilon > 0$  and infinitely small.

<sup>7</sup>The derivation of eq. (7) is similar to that of eq. (A.1) in the appendix.

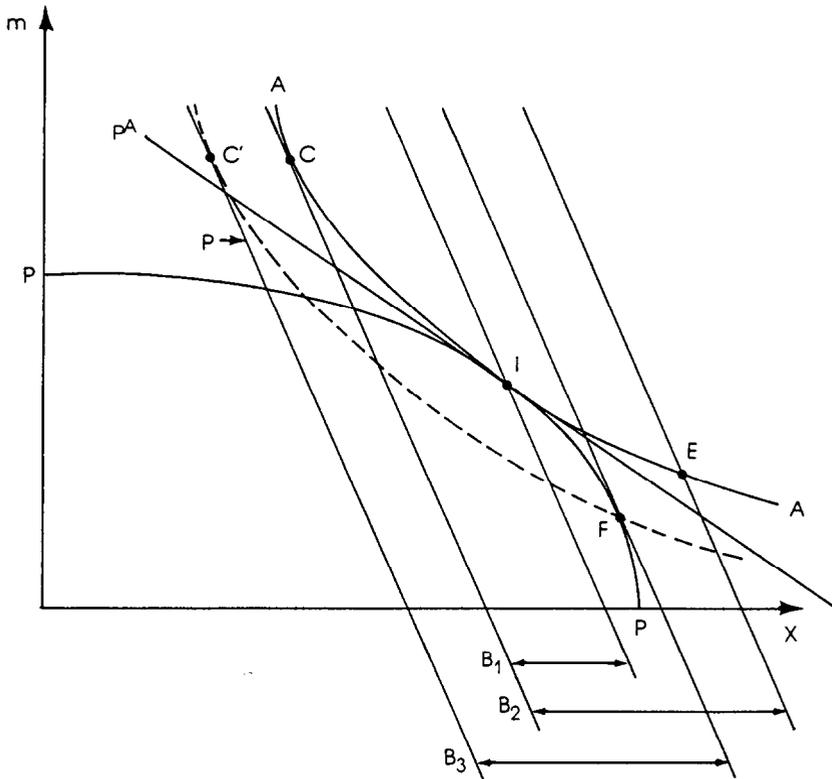


Fig. 1. Debt repayment in the output space.

the production vector  $I$ . The maximum debt repayment is now  $B_1 < B_3$  with consumption at  $C$ . Finally, suppose that a production mix  $\alpha^{EP} > \alpha^F$  that is relatively more concentrated in the export sector allows for a larger capital base  $(K + L^N)$ , with  $L^N > L$ , and a production of  $E$ . The debtor is indifferent between consuming  $E$  and trading at prices  $p$  to consuming  $C$  and repaying  $B_2 > B_3$ . In what follows, I explore the determinants of the choice between these strategies.

2.2. Credit ceiling and new borrowing

Assume that the debtor can commit to an investment program before a new loan is made. The maximum repayment that the creditors – old and new – can expect to receive in  $t_2$  is given by the gains from trade,  $B(\alpha, p, K, r)$ . This implies a ceiling on total safe debt,  $D^{\max}$ , given by the loan size that

makes the debtor indifferent between giving up its gains from trade,  $B$ , or paying the contractual repayment,  $rD^{\max}$ . Competitive new lenders are willing to advance a loan  $L$  only when they expect to earn with certainty a return equal to their cost of capital,  $r$ . With equal treatment between new and old creditors, the new loan will be repaid according to the contractual schedule only when the inherited debt is also fully serviced.<sup>8</sup> Thus, new lenders either lend at an interest rate  $r$  or refuse to lend altogether.<sup>9</sup>  $D^{\max}$ , and the corresponding maximal safe new loan,  $L^{\max}$ , can therefore be characterized by:

$$rD^{\max}(\alpha, p, K, r) = B^U(K + L^{\max}, \alpha, p), \quad (8)$$

$$L^{\max}(\alpha, p, K, r, D_1) = \max(D^{\max} - D_1, 0), \quad (9)$$

which determine  $D^{\max}$  as a function of  $(\alpha, p, K, r)$ , and  $L^{\max}$  as a function of the same variables plus  $D_1$  (see the appendix for a proof). Together with eq. (5), these relations imply that when  $D_1 > D^{\max}$ , no new lending is forthcoming ( $L^{\max} = 0$ ), and there is a settlement with debt relief ( $R = B$ ).<sup>10</sup> Creditworthy countries that can get new loans ( $L^{\max} > 0$ ), however, are expected to repay their debts in full ( $R = D_2$ ).

It is useful at this stage to analyze the relationship between the credit ceiling and the other variables. Differentiating eq. (8) and solving yields:

$$\begin{aligned} \partial D^{\max} / \partial \alpha &= B_\alpha / (r - B_k) > 0, \\ \partial D^{\max} / \partial p &= B_p / (r - B_k) > 0, \\ \partial D^{\max} / \partial K &= B_k / (r - B_k) > 0, \\ \partial D^{\max} / \partial r &= -D^{\max} / (r - B_k) < 0, \\ \partial D^{\max} / \partial D_1 &= -1, \end{aligned} \quad (10)$$

which can be signed using eq. (7) and the fact that the denominator must be positive at the fixed point,  $D^{\max}$  (see the appendix).  $D^{\max}$  increases in  $\alpha$ ,  $p$ , and

<sup>8</sup>If new loans could be made senior to old loans, international lending would break down. This argument has been used to explain the existence of various clauses in debt contracts to ensure that new lenders are not treated better than old ones (for example, cross-default, negative pledge, and sharing clauses).

<sup>9</sup>This is due to the certainty assumption. Otherwise, the supply function will not be L-shaped, but a credit ceiling will usually exist [see Kletzer (1984) and Eaton, Gersovitz and Stiglitz (1986)].

<sup>10</sup>That there are no new loans when a country does not fully service its obligations is not due to a reputation motive. In this model sanctions are real and derive from the ability of lenders to seize the defaulting country's exports [as in Bulow and Rogoff (1989a, 1989b)]. There are no new loans because, due to the bargaining technology, the debt settlement consumes all the resources the debtor is willing to pay out.

$K$  and decreases in  $r$ . When it is positive,  $L^{\max}$  behaves as  $D^{\max}$ , and it also decreases (one to one) in  $D_1$  [using (9)]. Otherwise,  $L^{\max}$  is zero and is not affected by marginal changes in  $\alpha$ ,  $p$ ,  $K$ , and  $r$ .

These features of the model are quite intuitive. The credit ceiling,  $D^{\max}$ , is large when the gains from trade are large. But a country that is less dependent on trade is less dependable; it will not pay much to be allowed to trade, and its credit ceiling will consequently be low. A rise in the terms of trade,  $p$ , increases the gains from trade and thus the credit ceiling. As more gets invested in the export sector, the gains from trade and  $D^{\max}$  increase (but at a decreasing rate). An increase in domestic savings expands investment and trade, and therefore it also increases  $D^{\max}$ . When discounted at a higher interest rate, future gains from trade translate into a lower debt ceiling; in addition, the service of a larger inherited debt takes up a larger share of the credit ceiling, reducing the supply of new loans.

In the model, the credit ceiling,  $D^{\max}$ , can exceed  $D_1$  for some values of  $D_1$ ,  $\alpha$ ,  $p$ ,  $r$ , and  $K$ . This does not need to rely on irrationality on the part of past lenders.<sup>11</sup> In a model with uncertainty,  $D^{\max}$  would depend on the distributions of  $r$  and  $p$  as well as on the expected level of the endogenous variables,  $\alpha$  and  $K$ . Subsequent negative interest rate and terms of trade shocks can then reduce the credit ceiling below inherited debt.<sup>12</sup> When the credit constraint becomes binding, countries find themselves in a world of second-best choices. In such a situation, welfare can be improved by the introduction of intratemporal distortions.

### 3. Optimal intervention

The investment decision is taken in  $t_1$ . There are two aspects to it: the amount of investment ( $K + L$ ), and the allocation of investment between the two sectors. To contrast private and social optimal investment, assume that in both cases the planner borrows abroad and that, under *laissez-faire*, she distributes the new loan to the private sector through a market mechanism, with the gains or losses passed to consumers in a lump-sum fashion in  $t_2$ .<sup>13</sup>

#### 3.1. Trade policy, debt repayment, and new borrowing

When the sectoral allocation is determined by profit maximization and is free of government distortions, individual producers do not perceive the effect

<sup>11</sup>But when IS becomes optimal, given  $D_1$ ,  $r$ , and  $p$ , it is in the collective interest of current lenders to offer debt relief in exchange for an EP strategy. See subsection 3.3.

<sup>12</sup>That lenders perceived as a possibility the occurrence of negative shocks that would lead to partial repayments is reflected by the risk premiums charged on loans.

<sup>13</sup>When the socially optimal investment policy is different from the decentralized one, the planner either directly implements the optimal mix, or it is reached through the use of taxes and subsidies. These can take the form of differential production taxes, different interest rates charged on loans by government agencies, or trade-related taxes.

of their action on aggregate debt repayment and the credit ceiling. The free trade investment mix,  $\alpha^F$ , is then given by the usual marginal condition:

$$p = (g'/f')(\alpha^F, \cdot), \quad (11)$$

which determines the optimal free trade production vector,  $\alpha^F$  – point  $F$  in fig. 1 – as a function of  $(K + L)$ . It is easy to show that  $\alpha^F$  increases in  $p$ .

But would a benevolent central planner choose the investment mix  $\alpha^F$ ? In this setting such a choice is not guaranteed. Of course, any deviations from that rule will reduce income when new borrowing and debt repayment are kept constant. But the choice of an investment mix can have an important impact – on both the availability of new lending and on the amount of debt payment – because the gains from trade are affected. Sometimes these externalities are large enough to offset the productive inefficiency from intervention.

In this section I analyze the planner's joint optimal debt and investment strategies and discuss the factors that affect the interactions between these concerns. By affecting private investment incentives, the planner can either increase borrowing above the free trade credit ceiling by precommitting to larger future repayment or bargain for a better debt settlement and maximize bargaining strength with a production mix that minimizes gains from trade. In both (mutually exclusive) cases, productive inefficiencies are traded off against gains on debt.

Formally, the planner's problem is to determine a pair  $(L^*, \alpha^*)$  that maximizes welfare  $U$ , given  $(K, r, D_1, p)$  and subject to the borrowing constraint  $L^* \leq L^{\max}(\alpha^*, \cdot)$ .  $U$  is implicitly defined by the equilibrium condition:

$$E(p, U) = Y(p, \alpha, K + L) - R(\cdot) \equiv NI. \quad (12)$$

The small-country assumption ensures that the maximization of  $U$  is equivalent to the maximization of expenditure, and thus of net income ( $NI$ ) – the right-hand side of eq. (12). A central result can now be stated (a proof is provided in the appendix):

*Proposition 1.*  $L^*$  and  $\alpha^*$  are characterized by one of the following set of constraints:

- (i)  $L^* < L^{\max}(\alpha^*, \cdot)$  and  $\alpha^* = \alpha^F$  [liquidity unconstrained (LU) solution];
- (ii)  $L^* = L^{\max}(\alpha^*, \cdot) > 0$  and  $\alpha^F < \alpha^* < 1$  [export promotion (EP) solution];
- (iii)  $L^* = L^{\max}(\alpha^*, \cdot) = 0$  and  $0 < \alpha^* < \alpha^F$  [import substitution (IS) solution].

To understand the intuition behind Proposition 1, it is helpful to use the following experiment: fix  $\alpha$ , optimize over  $L$ , and then ask whether  $\alpha$  is

optimal. Part (i) of Proposition 1 says that if the credit constraint is not binding when  $\alpha$  is set equal to  $\alpha^F$ , then free trade must be optimal, i.e.  $\alpha^*(LU) = \alpha^F$ . To see why, consider a marginal movement of  $\alpha$  on either side of  $\alpha^F$ . At the margin, favoring either the export or the IS sectors would respectively increase or reduce the credit ceiling but would leave optimal borrowing below  $D^{\max}$  because investment is not liquidity constrained. Similarly, the debt repayment remains equal to its contractual value because  $D_2 < B$  must hold when the credit ceiling is not binding. Therefore, the only effect of trade policy in this case is to generate production inefficiencies that reduce net income.

But if the credit ceiling is binding when  $\alpha$  is set equal to  $\alpha^F$ , investment must be liquidity constrained. In this case, free trade cannot be optimal, and  $\alpha^* \neq \alpha^F$ . Two distinct subcases [that correspond to the solutions (ii) and (iii) in Proposition 1] need to be examined:

- The credit ceiling,  $D^{\max}(\alpha^F, \cdot)$ , is larger than inherited debt,  $D_1$ , and there is some new lending, but at  $L = L^{\max}$  the marginal return of capital remains above the cost of capital,  $r$ , in both sectors [case (ii) in Proposition 1].
- The other possibility is that  $D^{\max}(\alpha^F, \cdot)$  is below  $D_1$  and there is no new lending [case (iii) in Proposition 1]. Note that in this case, investment is liquidity constrained because the demand for funds is always positive. This is because when a debtor is not creditworthy, the marginal cost of funds,  $B_k = \alpha f'(p - p^A)$ , is always smaller than the marginal benefit  $Y_k = \alpha p f' + (1 - \alpha)g'$ ; thus, marginal net income,  $NI_k = Y_k - B_k$ , is always positive, no matter how profitable investment is by world standards.

In subcase (ii), a marginal increase of  $\alpha$  above  $\alpha^F$  (that is, a marginal policy of EP) increase welfare: it trades off losses from productive inefficiencies (close to zero at  $\alpha^F$ ) against finite intertemporal gains from a rise in the supply of funds that allows new borrowing and total investment to be scaled up. Thus, net income must reach a maximum at some  $\alpha^*$  satisfying  $\alpha^*(EP) > \alpha^F$ . This can be illustrated in fig. 1. Consider that the production possibility frontier,  $PP$ , corresponds to a capital base of  $[K + L^{\max}(\alpha^F)]$ . Free trade leads to the production of  $F$  and a payment  $B_3$ . By shifting investment from the import to the export sector,  $L^{\max}$  and  $L^*$  increase, shifting the frontier up and leading to the production of  $E$  and to a welfare level larger than in  $F$ .

In subcase (iii), inherited debt is above the credit ceiling when  $\alpha$  is set equal to  $\alpha^F$ . Thus, a marginal increase in  $\alpha$  does not help, since the supply of new loans remains zero. However, a marginal policy of IS that reduces  $\alpha$  marginally below  $\alpha^F$  increases net income because it trades off some inefficiencies in production (close to zero at  $\alpha^F$ ) against some finite savings in debt repayment. Therefore,  $\alpha^*(IS) < \alpha^F$ . Another way of making this point is to note that in this case  $U = U^A$ , because all the gains from trade will have to be paid to creditors. But  $U^A$  is only affected by  $\alpha$  directly, since  $L^{\max} = 0$ .

Thus,  $\alpha^*(IS)$  maximizes autarkic income,  $Y^A$ , and therefore it must solve  $p^A = (g'/f')(\alpha^*, \cdot)$ , implying that  $\alpha^* < \alpha^F$  [using eq. (11) and  $p^A < p$ ]. This solution can also be illustrated in fig. 1. Consider that the production possibility frontier,  $PP$ , corresponds to a capital base of  $K$ . The free trade production vector is at  $F$ , with a repayment of  $B_3$ . Repayment is minimized (and  $U^A$  maximized) when the vector  $I$  is produced. Vector  $I$  is thus given by the tangency point between  $U^A$  and the production possibility frontier, and it involves overproduction of imports. Moreover,  $B_1 < B_3$ .

### 3.2. Reaction to exogenous shocks

Starting from a situation where free trade is optimal, unexpected large changes in  $r$  and  $p$  can shift the optimal trade and debt strategies to either an IS or an EP strategy, with an IS strategy chosen when the shocks are very large. In effect, exogenous shocks affect maximum welfare in each of the three possible extrema. As a result, the global maximum can shift from one of the extremum to another, with large enough negative shocks necessarily making IS optimal.

Consider first the effect of small exogenous shocks to  $p$  and  $r$  on maximum net income,  $NI^*(i)$ , in the three possible regimes  $i = (LU, EP, IS)$ . The effect of marginal shocks can be evaluated for each extremum by plugging into the definition of  $NI$  [eq. (12)] the characteristics of this extremum [using Proposition 1 and eqs. (5) and (6)], differentiating, and simplifying the resulting expressions using envelope properties:

- In the LU regime, a marginal rise in  $p$  increases net income by  $NI_p^*(LU) = x$ , and a marginal rise in  $r$  reduces net income by  $NI_r^*(LU) = D_1 + L^*$ .
- In the EP regime, there is an additional supply of funds effect that magnifies the shocks. A marginal rise in  $p$  increases net income by  $NI_p^*(EP) = x + (Y_k - r)(\partial L^{\max}/\partial p) > NI_p^*(LU)$  – because  $Y_k > r$ , by eq. (A.4), and  $\partial L^{\max}/\partial p > 0$ , by eq. (10). Similarly, since  $L^{\max}$  decreases in  $r$ , a rise in  $r$  reduces net income by  $NI_r^*(EP) = (D_1 + L^*) - (Y_k - r)(\partial L^{\max}/\partial r) > NI_r^*(LU)$ .
- Finally, in the IS regime, the effect of the shocks is reduced compared with the LU regime:  $r$  does not affect  $NI$  because  $NI_r^*(IS) = 0 < NI_r^*(LU)$ ;  $p$  affects net income through its effect on  $U^A$ ; and  $NI_p^*(IS) = E_p < x = NI_p^*(LU)$ .

Therefore, shocks are magnified in the EP regime and reduced in the IS regime, when the comparison is with the unconstrained regime.<sup>14</sup> What does

<sup>14</sup>But there is a tradition in development economics that argues the opposite [see, for example, Gillis et al. (1987)]. IS countries import almost exclusively capital and intermediate goods that have no close substitutes at home. When imports fall, the domestic economy suffers a big shock. EP countries, in contrast, have more flexible production structures and a greater capacity to adapt.

this imply for the optimal reaction to large shocks? If a country starts with an optimal free trade and full repayment strategy, large enough unfavorable shocks to  $p$  and  $r$  reduce the credit ceiling,  $D^{\max}(\alpha^F, \cdot)$ , to a level lower than inherited debt,  $D_1$ . Consequently, free trade can no longer be optimal (by Proposition 1). Moreover, a large enough drop in  $p$  or rise in  $r$  is bound to make IS ultimately the global optimal because  $NI^*(IS)$  does not decrease by as much as  $NI^*(EP)$ . However, smaller negative shocks can shift the optimal strategy from free trade to EP if a debtor becomes liquidity constrained but inherited debt is not too large relative to the free trade credit ceiling and if potential gains from trade are large. Collecting these results, one has:

*Proposition 2. Starting from a situation where free trade and full debt repayment are optimal, a large enough rise in  $r$  or drop in  $p$  can make EP optimal and a large rise in  $r$  or drop in  $p$  necessarily makes IS optimal.*

A comparison between the debt crises of the 1930s and 1980s provides a good illustration. In both historical circumstances, inherited debt clearly went over the credit ceiling for safe lending in many debtor countries because of unfavorable external shocks. In the 1930s, the Great Depression and a wave of protectionism in the industrial countries led to the collapse of international trade.<sup>15</sup> In contrast, external shocks during the 1980s appear to have been more modest for the middle-income countries, and they took place in an environment of expanding world trade.<sup>16</sup> Thus, in the 1930s default was a logical policy choice because defaulting countries were not threatened by large sanctions. Moreover, IS-led development strategies helped to secure better debt settlements. In the 1980s, however, EP policies and attempts to regain creditworthiness were more frequent. Other factors also contributed to these differences. In the 1930s, lending was mediated by the bond markets; in the 1970s and 1980s, by the commercial banks. The mechanism for negotiating debt adjustments also differed. In the 1930s, arrears were widespread, negotiations frequently broke down, and final debt settlements in some cases took over two decades to arrange; in the 1980s, serial reschedulings and other expedients have prevented a significant spread of arrears, at least until

<sup>15</sup>For example, from 1929 to 1932 the index of prices of commodities entering world trade fell by 56 percent for raw materials and 48 percent for foodstuffs. This fall was exacerbated by the contraction in export volume: during the same period, world trade in foodstuffs fell by 11 percent, and trade in raw material fell by 19 percent [Lewis (1949, p. 56), cited in Eichengreen and Portes (1989)].

<sup>16</sup>It is true that the real interest rates charged on these countries' floating rate debt increased from -5 percent in 1980 to 20 percent in 1983 [World Bank (1988, p. xii)], but it is doubtful that this was perceived as a permanent change. Terms of trade deteriorated sharply, but volumes and values expanded. For example, between 1980 and 1988, Latin American exports increased 15 percent in value and 56 percent in volume, and their price decreased by 26 percent [CEPAL (1988)].

1987. The rise of such supranational agencies as the World Bank and the International Monetary Fund also greatly changed the global financial scene.

### 3.3. Debt relief and creditors' payoffs

When unexpected financial and trade-related shocks are large enough to create incentives for IS policies, potential gains from trade are lost. In such circumstances, debt relief can increase the creditors' payoffs.

Consider that the terms of trade  $p$  deteriorate so much that  $p = p^A(\text{IS})$ : when IS is chosen, there are no gains from trade, that is  $B[\alpha^*(\text{IS}), p, K] = 0$ , and consequently the creditors get nothing. However, it is optimal for the debtor to play the IS strategy, given the bargaining technology. In this case the creditors cannot lose by granting complete debt forgiveness, and they can gain if they can convince the debtor to move away from IS in exchange for partial debt forgiveness. In particular, creditors would collectively gain if they granted the smallest debt relief  $[D_1 - D^*]$  necessary to make the debtor indifferent between IS and LU policies. Indeed, if the debtor sets  $\alpha = \alpha^F$  instead of  $\alpha = \alpha^*(\text{IS})$ , output would rise by  $Y(\alpha^F) - Y[\alpha^*(\text{IS})]$  because productive inefficiencies are eliminated. The debtor would accept a settlement that gives part of those gains to its creditors. Moreover, if the creditors can make take-it-or-leave-it offers, they would be able to extract all the improvement  $Y(\alpha^F) - Y[\alpha^*(\text{IS})]$ , and in this case  $D^*$  would be set equal to this quantity. It is important to note that the optimality of debt relief depends on sectoral and not aggregate investment considerations. Debt relief is optimal in the presence of overinvestment in the import sector, a situation that is consistent with either overinvestment or underinvestment at the aggregate level. This may explain why the empirics of the aggregate investment-based 'debt Laffer curve' have offered such discouraging results [see Borenstein (1989)].

The argument extends to the more general case  $p > p^A(\text{IS})$ . In fact, more gains are possible if the debtor is credit constrained at  $\alpha^F$ . Because the debtor can then gain by committing to an EP policy, borrowing new capital,  $L$ , at the competitive rate,  $r$ , and increasing the production scale, the initial creditors can obtain part of this surplus by simultaneously offering relief and new loans in a take-it-or-leave-it offer. It can also be shown that less debt relief is necessary the higher is  $p$ , since IS is more distortionary when the terms of trade are favorable (see the appendix).

Here again, the experiences of the 1930s and the 1980s diverge. In the interwar crisis, bondholders could not behave as a coordinated group. As a result, debtors had to settle claims with individual lenders, debt relief was not granted up-front, and IS policies became prevalent. In the first part of the 1980s, however, limited relief (often in the form of involuntary lending at below-market rates) prevented the wholesale adoption of IS policies.

There are two main reasons why creditors may not offer sufficient relief, even when it is in their own interest to do so: coordination failures and the expectation of public bailouts [see, respectively, Sachs (1989) and Bulow and Rogoff (1988)]. After 1986, it appears that these two reasons reinforced each other and ultimately led to a partial bailout by the international financial institutions (IFIs). The IFIs' interest in a settlement goes beyond their own position as major creditors because their preferences strongly favor the extension of world trade and the prevention of isolationist policies that increase the stress on the world financial system. Initially the IFIs favored rescheduling agreements, helped to organize the creditors in a coordinated coalition, and sought limited relief in the form of involuntary lending at below-market rates. But by 1988 it became clear that the safe credit limits could not be easily brought close to the inherited debt. Bargaining for debt reduction was becoming so tempting that over 17 high-debt countries were running arrears on their commercial debt service.<sup>17</sup> In response, the IFIs decided in June 1989 to subsidize debt reductions on a case-by-case basis in the context of the Brady plan, on the condition that debtors pursue EP strategies.

#### **4. Concluding remarks**

I have argued that, for countries with a binding credit ceiling, a policy of trade intervention increases welfare. The choice between export promotion (EP) and import substitution (IS) depends on whether it is more profitable to increase the credit ceiling above inherited debt in order to borrow more, or to reduce it below inherited debt in order to repay less. The important determinants of this choice of a joint trade and debt strategy are the stock of inherited foreign debt, the level of the world interest rate, the terms of trade, and the behavior of creditors. The IS policy is more profitable with a large inherited debt, a high interest rate, and low terms of trade, and it becomes relevant when creditors fail to reach a bargain to reduce inherited debt. It is important to note that when IS policies are implemented, investment rises in the import sector and falls in the export sector; but overall, there is no particular reason to expect lower aggregate investment, in contradiction of a major tenet of the debt Laffer-curve literature [see, for example, Sachs (forthcoming) and Krugman (forthcoming)].

If investment reversal were not costly, a commitment to increase future trade in exchange for new loans, or to reduce trade in order to reach a more favorable debt settlement, would not be credible. Instead, creditors would reasonably expect countries to do what is in their ex post interest – in

<sup>17</sup>At the end of 1988 the following countries were in arrears to their commercial lenders: Argentina, Bolivia, Brazil, Costa Rica, Cote D'Ivoire, Dominican Republic, Ecuador, Guyana, Honduras, Liberia, Nicaragua, Nigeria, Panama, Peru, Sudan, Zaire, and Zambia.

particular, to avoid distorting investment. But these strategies are somewhat credible when investment reversals are costly, and commitment mechanisms can be provided by International Financial Institutions (IFIs) in the form of 'conditionality'.<sup>18</sup>

The importance of time consistency is again well illustrated by a comparison of the experiences of the crises of the 1930s and the 1980s. In the 1930s, it took more than a decade of IS policies and protracted negotiations with frequent breakdowns to convince (individual) creditors to reach a settlement with debtors. Ultimately, debtors repaid on average about 20 cents on the dollar, and their weak integration in the world economy barred them from accessing the international credit markets until late 1960s and early 1970s, when commodity prices and new borrowings boomed [Eichengreen and Portes (1989)]. By contrast, in the 1980s the IFIs' early intervention in the form of trade-biased adjustment lending was a boost to EP-type solutions. Because of the marked preference of these institutions for larger world trade, they have generally refused to support (and provide a commitment technology to) countries that attempt to pursue IS strategies and that adopted confrontational debt postures (Peru for example). But it is clear by now that for this strategy to ultimately work in deflecting the present debt crisis, large amounts of debt reduction will need to be achieved.

## Appendix

### A.1. Credit ceiling: Existence

Eq. (8) determines  $D^{\max}(\alpha, p, r, K)$ . I show existence when  $D_1 = 0$ , so that  $D^{\max} = L^{\max} = B/r$  by eq. (9). (The proof easily extends to the case  $D_1 > 0$ : at the other extreme, when  $D_1 = \infty$ ,  $L^{\max} = 0$  and  $D^{\max} = B/r$ ). Plug eq. (6) into eq. (8) to get:  $rL^{\max} = Y(K + L^{\max}, \cdot) - E[U^A(K + L^{\max}, \cdot)]$ . Because the left hand side increases in  $L$  at a rate  $r$ , sufficient conditions for eq. (8) to have a fix point are that its right-hand side be (i) positive at  $L = 0$  and (ii) concave in  $L$ . Condition (i) is insured by  $p > p^A$  because the expenditure needed to reach  $U^A$  at price  $p$  is always lower than income with trade. To see when condition (ii) holds, differentiate eq. (8) with respect to  $L$  and use eq. (2) and the fact that  $U_m$  is equal to the marginal utility of income:

$$\begin{aligned} \partial B / \partial L &= \alpha p f' + (1 - \alpha) g' - (\partial E / \partial U^A) [U_x f' \alpha + U_m g' (1 - \alpha)] \\ &= \alpha p f' + (1 - \alpha) g' - [p^A f' \alpha + g' (1 - \alpha)] = (p - p^A) f' \alpha > 0, \end{aligned} \quad (\text{A.1})$$

$$\partial^2 B / \partial L^2 = \alpha^2 (p - p^A) f'' - \alpha f' (\partial p^A / \partial L). \quad (\text{A.2})$$

<sup>18</sup>See Claessens and Diwan (forthcoming) for an intertemporal version of the model in this paper that analyzes conditionality by IFIs.

Eq. (A.2) is negative when the second term on its right-hand side is either positive, or negative and small. But  $\partial p^A/\partial L = (\partial p^A/\partial Y^A)(\partial Y^A/\partial L)$ , where  $Y^A$  is revenue evaluated at the autarkic price,  $p^A$ . This expression is zero with homothetic preferences and positive when the first good is normal. Note that at  $D^{\max}$ ,  $B$  intersects  $rD$  from above, and therefore  $B_k < r$  must hold.

### A.2. Proof of Proposition 1

The problem is to find  $(L^*, \alpha^*)$  that maximizes:  $NI = Y(p, \alpha, K + L) - \min[(D_1 + L), Y(p, \alpha, K + L) - E(p, U^A)]$  subject to  $L^* \leq L^{\max}(\alpha^*, \cdot)$ . The first-order conditions of this problem yield:

$$NI_L = Y_k - r = 0, \quad \text{if } R = D_2 \text{ and } L^* < L^{\max}, \quad (\text{A.3})$$

$$= Y_k - r > 0, \quad \text{if } R = D_2 \text{ and } L^* = L^{\max} > 0, \quad (\text{A.4})$$

$$= \alpha p^A f' + (1 - \alpha)g' > 0, \quad \text{if } R = B \text{ and } L^* = L^{\max} = 0; \quad ((\text{A.5}))$$

$$NI_\alpha = Y_\alpha = 0, \quad \text{if } R = D_2 \text{ and } L^* < L^{\max}, \quad (\text{A.6})$$

$$= Y_\alpha + (\partial L^{\max}/\partial \alpha)(Y_k - r) = 0, \quad \text{if } R = D_2 \text{ and } L^* = L^{\max} > 0, \quad (\text{A.7})$$

$$= (p^A f' - g')(K + L) = 0, \quad \text{if } R = B \text{ and } L^* = L^{\max} = 0. \quad (\text{A.8})$$

When  $L^* < L^{\max}$ , the supply constraint is not binding and  $NI_L(L^*, \cdot) = 0$ . When  $L^* = L^{\max}$ ,  $NI_L(L^*, \cdot) > 0$ . In the first case, (A.6) implies that  $\alpha^* = \alpha^F$  [see eq. (11)]. In the second case, there are two possible subcases: (i)  $L^* = L^{\max} > 0$  and (ii)  $L^* = L^{\max} = 0$ . To determine  $\alpha^*$  in subcase (i), set (A.7) equal to zero. Eqs. (A.4) and (10) insure that the right-hand side of eq. (A.7) is positive, and thus  $Y_\alpha < 0$ . Therefore, using eq. (2) one has  $p < (g'/f')(\alpha^*, \cdot)$ . From (11), this implies that  $\alpha^* > \alpha^F$ . In subcase (ii), set (A.8) equal to zero to get  $p^A = (f'/g')$ , implying that  $\alpha^* < \alpha^F$  given (11).

### A.3. Optimality of debt relief when $\alpha^* = \alpha(\text{IS})$

Without a write-off, the best the debtor can do leads to a utility level  $U^A(\text{IS})$  at  $\alpha^*(\text{IS})$  – which is independent of  $D_1$ . But when  $\alpha = \alpha^*(\text{EP})$ , debt repayment brings the debtor's utility to a level  $U^A(\text{EP})$ , which depends on  $D_1$  and  $p$  (through their effect on  $L^{\max}$ ). Thus, for the EP strategy to become marginally tempting, the debtor is willing to repay at most  $D^*$ , such that

$$U^A(\text{IS}) = U^A(\text{EP})[D^*, p], \quad (\text{A.9})$$

which can be solved for  $D^*$  as a function of  $p$ . Now, from (A.9),  $D_p^* = -[\partial U^*(EP)/\partial p]/[\partial U^*(EP)/\partial D]$ . The numerator is positive because a rise in  $p$  improves welfare through the direct price effect and the indirect supply effect. The denominator is negative because a rise in  $D$  reduces welfare by reducing the supply of new loans. Thus,  $D_p^* > 0$ , implying that when terms of trade are higher, less debt relief is necessary to get the debtor to switch from IS to EP. Without debt relief, the creditors will be able to collect  $B(EP) = Y^*(EP) - E(p, U^*(EP)[D^*, p])$ . If the creditors write off  $[D_1 - D^*]$  and lend  $L^*$  in  $t_1$ , they would collect  $B(IS) = Y^*(IS) - E[p, U^*(IS)]$ . Using (A.9), creditors gain when

$$Y^*(IS) < Y^*(EP)[D^*(p), p] - rL^*(p). \quad (\text{A.10})$$

As shown in the text, (A.10) holds for  $p = p^A(IS)$ . But the right-hand side of (A.10) rises in  $p$  – the derivative can be easily calculated using envelope properties and is given by  $[Y_p + (Y_k - r)(\partial L^*/\partial p)] > 0$  by (2), (A.4) and (10) – while its left-hand side is unaffected by  $p$ . Thus, it holds true for any  $p > p^A$ .

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