The Japanese Economic Review
Vol. 46, No. 4, December 1995

THE STRATEGIC ROLE OF INTERNATIONAL CREDIT AS AN INSTRUMENT OF TRADE*

By KAUSHIK BASU† and ASHWINI DESHPANDE‡
†Cornell University and ‡Delhi School of Economics

This paper is an investigation of the role of international credit as a factor influencing the donor countries' exports. Based on standard techniques of microeconomic theory, our model examines this relationship under different market structures in the industrialized donor country (North). Under monopoly and perfect competition, the availability of credit increases the North's exports; under oligopoly, within a class of parametric configurations, this relationship is reversed. We also find that, under certain conditions, if a developing country (South) takes recourse to international credit to finance its imports, it would end up worse off, that is the availability of international credit can be welfare-decreasing for the borrowing nation.

1. Introduction

The use of international credit by the donor country to boost its exports and exports earnings has been extensively discussed in the literature on political economy and in the recently emerging literature on loan pushing.[1] Indeed, this was one of the tenets of the critique of the industrialized-country behaviour *vis-à-vis* the Third World in several radical writings and is also often used by conservative policy makers in the North to justify the giving of aid. The objective of this paper is to examine this thesis rigorously and by using standard techniques of modern microeconomic theory. It turns out that the relation between credit and exports is more complicated than appears at first blush.

Since most Third World nations have non-convertible currencies, when they receive a loan from the rich nation in the rich nation's currency, they will use the loan for the direct buying of goods from the donor country. If the rich donor country's currency is easily convertible with another rich country's currency, the direct demand would be generated for both these countries' goods. So there may be some externality in demand. Donor nations have often used tied-in credit to minimize such externality and to ensure that each country's credit would be used for their own products.[2] So indeed there is a prima facie case for believing that there is a close link between international credit and donor exports. However, the nature of this relation needs careful exploration.

---

* We are grateful to Jonas Bjornerstedt, Avinash Dixit, Ashok Guha, Henrik Horn, Dilip Mookherjee, Bob Rowthorn, Partha Sen, Nick Stern, Eric Thorbecke and an anonymous referee for comments and suggestions. We also benefited from discussions at seminar presentations of this paper at the Indian Statistical Institute, New Delhi, Stockholm University, the London School of Economics, the University of Cambridge and Cornell University.

1) See, for example, Winkler (1929), Hyson and Strout (1968), Gwyne (1983), Taylor (1985), Darity and Horn (1988), Basu (1991).

2) Bhagwati (1967) is one of the pioneering works on this question; Jepma (1991) contains a review of the theory and practice of aid-tying. For a model of tied-in credit in a monopoly market, see Besley (1988). Besley's model, however, pertains to an indigenous market with domestic credit.

Published by Blackwell Publishers, 108 Cowley Road, Oxford OX4 1JF, UK.

The link between international credit and international trade is not a recent phenomenon; it has been argued that such a relationship can be traced back to the colonial period. For instance, Rothermund (1981), while analysing the British trade policy in India during the Great Depression, concludes that the British evolved a package of measures (like imperial preferences, a high exchange rate of the rupee that acted as an import bonus and so on) to ensure their dominance in Indian markets. Similarly, in the context of US aid, in particular that of aid disbursed by the Agency for International Development (AID), Hyson and Strout (1968) observe how by 1966, as a consequence of aid-tying policy, "$9 out of every $10 of foreign commodity expenditures financed by AID went to US suppliers."

Much writing on aid and aid policy, by radical writers and others,[3] argued that while aid was ostensibly given out of humanitarian concerns, the actual motives were considerations of political, military and economic advantage for the donors. Ohlin (1966) reports that in 1963, 84 per cent of development assistance was bilateral (rather than multilateral) and argues that tied aid was inspired by hopes of returns—whether in the form of political advantage or economic advantage to donors. Tendler (1975) points out that the availability of aid exclusively for foreign exchange costs of a project also resulted in a larger problem, namely, the priorities of the recipient country invisibly rearranged themselves around foreign exchange intensive projects. In the 1970s, aid gradually declined in importance and international credit took the form of private loans from the large money centre banks in the advanced industrialized countries.

The purpose of this paper is to develop a model which can be used for analysing the link between this form of international credit and trade. It turns out that the relation between credit and trade is much more varied than has been believed by earlier writers. "Pathologies" can occur easily. For instance, making more credit available to a developing country can cause a shrinkage in the quantity of donor exports to the recipient country. It can also cause a fall in the profits of the exporting firms.

The models developed in this paper deliberately stay away from theoretical problems concerned with the role of money. It is but natural that in studying the links between international credit and trade, some of the same problems of money-in-general-equilibrium will arise. Those are deep problems and for a paper like the present one the best strategy is to look away from them. So we begin by assuming that a poor country needs hard currency or "foreign" exchange to purchase goods from an industrialized country and that its own hard currency reserves are inadequate.

Though it is a well known fact that most LDCs cannot pay for their imports with their own currency but must pay with some hard currency, it may be questioned why this is so. While we do not wish to enter into a detailed analysis (and we are content to treat this "fact" as an axiom throughout this paper), it may be pointed out that a clue to the answer may lie in asymmetric information.

It is arguable that if India buys goods from Japan and pays for these in Indian rupees, India would have a better idea of what the rupees will be able to buy than the Japanese. However if India pays in US dollars, it is not clear that India would be better placed than Japan to know what the dollars can buy. We should, however,

3) See, for instance, Ohlin (1966), Hayer (1971), Wall (1973), Payer (1974), Tendler (1975).

clarify here that our formal model is not dependent on the convertibility assumption. An alternative assumption which would suffice is that the foreign exchange available with the South is explicitly-tied credit, that is, money which the South *has* to spend on the North's products.

In Section 2 the method of our analysis is introduced by considering the simple case of a monopolist exporter in an industrialized country. The effect on his profit and sales of making credit available to a poor country is analysed and nothing surprising happens here. It merely serves as a benchmark for the rest of the paper. It may be noted that all the models developed in this paper are partial equilibrium, microeconomic models. In other words, this paper ought not to be treated as an exercise in international trade which is usually cast in general equilibrium terms.

Section 3 shows that "pathologies"—indeed it is not clear that these can be called pathologies—can easily arise in the relation between exports and profits, on the one hand, and international credit, on the other, once we allow for oligopoly among exporters.[4] In Section 4 the donor country bank is introduced as a strategic profit-making agent which first decides how much to lend and at what terms; then the exporters move into action. The subgame perfect equilibrium of this game is characterized. We also find that there exist states in which the recipient country is worse off as a result of international credit being made available to it to finance its imports of manufactured goods. We call this the "Adverse Effect Theorem" and given its counter-intuitive nature it is a theorem of some significance. It is a standard belief that even if international credit is used by the donor for his own benefit, from the point of view of the Third-World recipient nation it is always better to have credit available than not. Pincus (1963), for instance, writes, "In practice, the United States and most other donors do tie their aid, and this custom, whatever its disadvantages, is clearly preferable to no aid at all." What our theorem shows is that this claim is not valid.

The proof of this theorem occurs in Section 5. A few concluding remarks are offered in Section 6.

2. Credit and exports: a first view

Throughout this paper we restrict attention to a two-country world. The North is an industrialized nation, exporting a manufactured good produced by large firms; its currency is called the hard currency. The South is an underdeveloped country,[5] where many consumers buy or (wish to buy) the manufactured good from the

4) The interesting debate in the 1980s on the transfer problem (see, for instance, Chichilnisky (1980), Dixit (1983) and de Meza (1983)), which revisits an old controversy, is focused on the adverse movement (from the recipient's point of view) in the terms of trade as a consequence of receiving aid or credit. But the model there was entirely non-strategic, with all agents engaged in price-taking behaviour. In our model, the interaction is strategic and, as will be evident from the sections that follow, this entails a very different kind of analysis.

5) Although much of the lending during the seventies was sovereign lending, we make no distinction between the debt contracted by the government in the South or by individual corporations in the South. The distinction is immaterial from the point of view of the model because even if the loan is taken by, say, a corporation in the Southern country, its government can back the loan, thus obliterating any useful distinction between the two agents.

North. Its currency is called the soft currency. A Northern producer will refuse to sell his goods against soft currency; he insists on being paid in hard currency. This could be because of the exchange rate being pegged at a non-market clearing level or expectations of uncertainty in the South or informational asymmetries of the kind discussed in Section 1.

The South suffers from a shortage of hard currency. Suppose the South possesses R units of hard currency. What we mean by a shortage is that if the South had more hard currency, it would have demanded more manufactured goods. Since this weakness of demand is caused by a shortage of hard currency and not by a shortage of money in general (i.e. income) what is implicitly being assumed is that in the future the South expects to have adequate foreign exchange or equivalently to have a freely convertible currency. So if it can get a (hard currency) loan now it would be able to pay it back later.

To formalize this, suppose that the South's demand function for the manufactured good from the North, assuming that it has no foreign exchange constraint, is given by:

$$x = x(p), \tag{1}$$

where $x(p)$ is a usual, downward-sloping demand curve. The inverse of this is given by:

$$p = p(x). \tag{2}$$

However, this demand function is not necessarily the effective one because all foreign goods have to be bought in hard currency and the South has only R units of hard currency. Let the exchange rate be e.[6] That is, each unit of hard currency can be converted to e units of soft currency. Hence, since price, p, is given in soft currency, the actual demand function is given by:

$$x = \min\{x(p), eR/p\} \tag{3}$$

This demand function is illustrated in Figure 1. The thick line is the actual demand curve.

A word clarifying possible assumptions underlying the demand function in (3) is useful. We could either assume that the borrowing country has one consumer who is nevertheless a price-taker (somewhat in the manner of the price-taking agents we depict in the two-person Edgeworth Box) or that the borrowing country has many identical price-taking agents and the limited foreign exchange is distributed equally among the consumers. Either of these assumptions would justify using (3). An interesting future exercise could be to develop models of the kind presented here but with different rules for rationing out the limited foreign exchange available with a developing country. This could help determine what the "best" rationing rule is from the point of view of the developing nation.

Let us, as a benchmark, see what would happen if the Northern manufacturing industry was a monopoly. Let the monopolist's cost of production be linear with

6) This being a partial equilibrium model, e and R are exogenous, and it is their effect on the demand for the manufactured good that is being discussed. However, in some LDCs, the demand for an imported manufactured good can have important feedback effects on e and R through trade. For instance, an increase in the quantity of x could lead to an increase in South's exports and hence in R, at the given exchange rate.

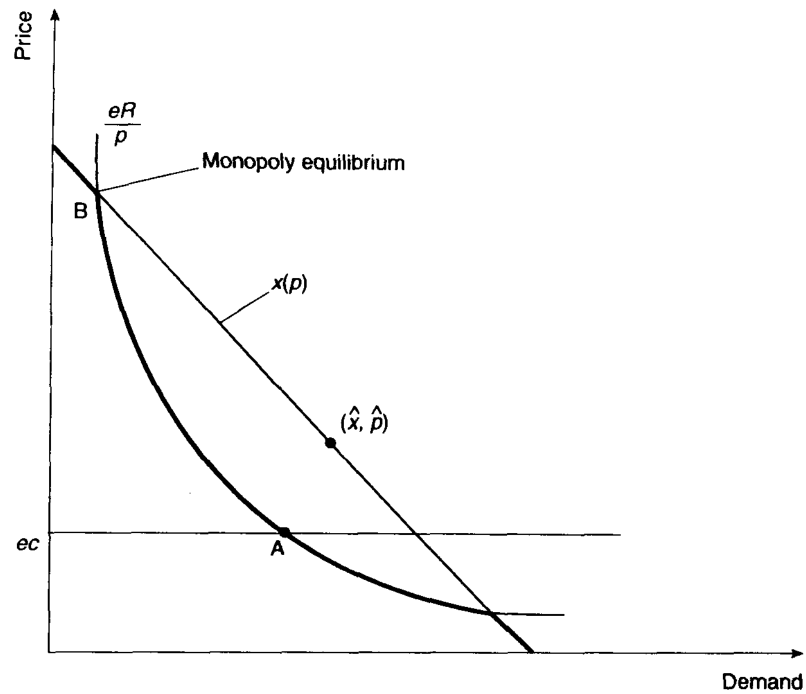

FIGURE 1.

per-unit cost fixed at ec in soft currency units. To see where the equilibrium will be, let us, initially, work out the monopoly equilibrium assuming that the foreign-exchange constraint does not exist. In that case the amount sold by the monopolist is

$$\hat{x} = \operatorname{argmax}\,[p(x) - ec]x,$$

and the equilibrium price is $\hat{p} = p(\hat{x})$.

Now to characterize the monopolist's equilibrium, when he confronts the actual demand curve, (3), is simple. Check if at $(\hat{x}, \hat{p})$ the foreign-exchange constraint is binding or not. Consider first the case when it is not binding, that is, $\hat{x}\hat{p} < eR$. In that case, $(\hat{x}, \hat{p})$ is a point on the thickened part of the $x(p)$ curve in Figure 1. Since that is feasible, that is the monopoly equilibrium point. Next suppose $\hat{x}\hat{p} > eR$. This is when the foreign exchange constraint is binding. This case is illustrated in Figure 1. In that case (given that (3) is the demand curve), the marginal revenue curve will have a discontinuity below point B (which marks the left-hand intersection of $x(p)$ and eR/p). Thereafter, marginal revenue coincides with the horizontal axis. Hence the monopoly equilibrium occurs at B.

The impact on exports of giving international credit to the South is now easy to study in the case where equilibrium is at B, to start with. If a loan of L units of hard currency is given, the curve eR/p will shift to the right. The new curve will be $e(R + L)/p$. Hence, the monopoly equilibrium point will move down the $x(p)$ curve. In other words, the Northern exports will rise, both in real and value terms and the price of the good will fall. This is as would be expected. However, this proposition hinges critically on the market structure being that of a monopoly. Also, in the polar case of perfect competition, where all firms have a production cost of c

units in hard currency, an increase in international credit invariably increases donor exports. In such a case the equilibrium shifts from A to the right, along the marginal cost curve.

Interestingly all this depends critically on the polar assumption of either monopoly or perfect competition. As soon as we consider a more realistic (and intermediate) market structure, to wit, that of oligopoly, the response to an increase in R changes. Before analysing this, let us quickly check what happens if the exchange rate, e, is changed.

In the competitive case when equilibrium is at A, a rise in e raises the marginal cost curve and the rectangular hyperbola eR/p by the same amount, hence the quantity of x bought remains unchanged. In the monopoly case, as e rises, the point $(\hat{x}, \hat{p})$ moves upwards along the $x(p)$ curve (assuming that the marginal revenue curve associated with $x(p)$ is downward-sloping) and the rectangular hyperbola moves to the right. Hence B moves downwards along $x(p)$. Therefore, as long as devaluation, that is the rise in e is moderate (in other words, as long as B does not cross over $(\hat{x}, \hat{p})$, a devaluation increases the amount of goods bought from the North in both real and value terms. However, if the rise in e continues beyond a certain point these movements are reversed.

3. Oligopolistic markets, international credit and trade

In this section we consider the case where there are two exporting firms in the North. The generalization to the case of n firms is trivial. These firms are Cournot oligopolists. They choose quantities and the price is determined by the market. We do not bring the domestic market of the North into the model not because these products are not sold in the North but because marginal costs are constant and price discrimination between countries is assumed to be possible. This separates the markets of the North and the South (see, e.g., Dixit (1994)) and allows us to focus exclusively on each of these. Before characterizing the Cournot equilibrium for a model where the demand curve is given by (3), above, we make some simplifying assumptions; and for this it is convenient to introduce some new terms.

If the oligopolists face a demand curve given by eR/p, we shall refer to the Cournot equilibrium as the R-Cournot equilibrium; and, similarly, the reaction functions, iso-profit curves, etc., as R-reaction functions, R-iso-profit curves, etc. If, on the other hand, the demand curve were $x(p)$, then the equivalent concepts will be referred to as the x-Cournot equilibrium, x-reaction functions and x-iso-profit curves. When we talk of the real problem, that is, with the demand curve given by (3), then we simply drop the letters R and x from the above terms.

It will be assumed throughout that there is a unique x-Cournot equilibrium, that each firm's x-profit function is strictly concave and the x-reaction functions are downward sloping.

In setting out to characterize the Cournot equilibrium of the model it is useful to first describe the R-Cournot equilibrium. Note that if the demand function faced by the oligopolists is given by eR/p, then each firm's profit function is:

$$\pi_i(x_1, x_2) = [eR/(x_1 + x_2) - ec]x_i, \tag{4}$$

where x_j is the output produced by firm $j \in \{1, 2\}$.

The first-order condition for maximizing π_i is given by

$$\partial\pi_i/\partial x_i = eR/(x_1 + x_2) - x_i eR/(x_1 + x_2)^2 - ec = 0.$$

To check the second-order condition note that

$$\partial^2\pi_i/\partial x_i^2 = [2eR/(x_1 + x_2)^2][x_i/(x_1 + x_2) - 1] < 0.$$

The first-order condition above implies the following:

$$x_i = \sqrt{Rx_j/c} - x_j, \qquad j \neq i \tag{5}$$

If (x_1^R, x_2^R) satisfy (5) for $i = 1, 2$, then (x_1^R, x_2^R) is an R-Cournot equilibrium.

It is easy to see that an R-Cournot equilibrium is unique. Note that (5) implies that

$$x_i + x_j = \sqrt{Rx_j/c} \qquad j = 1, 2$$

or

$$x_1 + x_2 = \sqrt{Rx_j/c} \qquad j = 1, 2.$$

Hence $x_1^R = x_2^R$.

Let us denote x_1^R by x^R. Equation (5) implies that

$$x^R = R/4c.$$

It follows that the equilibrium price, p^R, is:

$$p^R = eR/2x^R = 2ec.$$

Observe that equilibrium price does not depend on R. Hence as the foreign-exchange reserves with the South rise from R^0 to R^1, the R-equilibrium point shifts from E^0 to E^1 in Figure 2.

Next we need to establish a lemma on the taxonomy of equilibria with intersecting demand curves. Let us work this out in general terms before relating it to our exercise in hand.

Let $x = y(p)$ and $x = z(p)$ be two downward-sloping demand curves. Consider separately the cases where our duopolists confront each of these as the aggregate demand curve. Following in an obvious way, the terminology introduced earlier, let us assume that the Cournot equilibrium is unique in each of the y-case and the z-case, that it is stable, that each firm's y-profit function and z-profit function are strictly concave and that the y-reaction function and the z-reaction function of each firm is downward sloping. Suppose now that the two firms confront the demand curve $\phi(p) = \min\{y(p), z(p)\}$. Given the alternative descriptions of the y-Cournot and z-Cournot equilibria in Figure 3 we wish to characterize the Cournot equilibrium or to be more explicit, the ϕ-Cournot equilibrium.[7)]

Let us first take up the case where the y- and z-Cournot equilibria are located as shown in Figure 3(a). It can be shown that in this case there is a unique ϕ-Cournot equilibrium and that this coincides with the z-Cournot point. To prove this, first check that the z-Cournot point is indeed a ϕ-Cournot point. To see this, suppose

7) More complicated cases can arise if the demand curves intersect more than once. These are easy to analyse using the method used below and, moreover, there will be no occasion in this paper to consider such complications. It is therefore adequate here to focus on Figure 3.

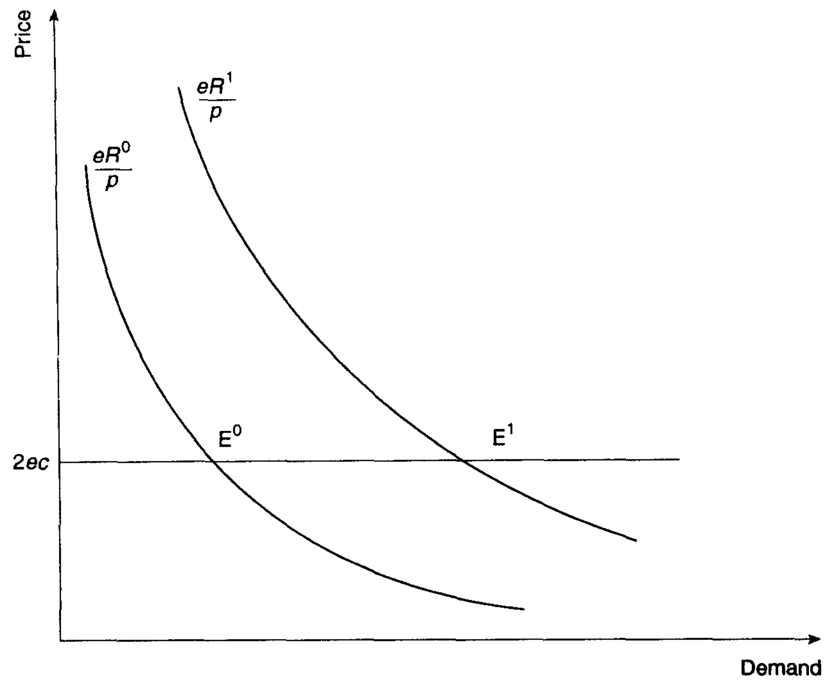

FIGURE 2.

that the two firms are playing the ϕ-duopoly game but producing the z-Nash equilibrium output, (x_1^z, x_2^z). Thus price is given by p^z. These are illustrated in Figure 3(a). Without loss of generality, consider deviations by firm 1. If this produces more, they move down along the $z(p)$ curve. Since such a move was not worthwhile for firm 1 in the z-case (recall that (x_1^z, x_2^z) is a Nash equilibrium), it cannot be worthwhile in the ϕ-case. What if firm 1 cuts back production? For a small cut back they move up along $z(p)$ and this cannot increase firm 1's profit. For a large cutback they begin to move up from A, along $y(p)$. This cannot increase firm 1's profit because moving up along $z(p)$ does not increase profit and moving up along $y(p)$ gives less profit than points vertically above $y(p)$ and on $z(p)$.

Next we have to show that a point like B cannot be a ϕ-equilibrium. This is easily done by using an argument similar to the above one and premised on the fact that B is not a y-Cournot point.

It is a little more complicated to show that A is not an equilibrium. Assume the two firms are producing outputs so that the aggregate price-output configuration is at A. The aggregate output here is less than the aggregate output at the z-Cournot point. Since the z-reaction functions are downward-sloping and z-profit functions are strictly concave, it follows that at least one of the two firms can increase its profits by increasing production. Hence, A is not a ϕ-Cournot equilibrium. This establishes that the ϕ-Cournot equilibrium is unique and coincides with the z-Cournot equilibrium.

Consider now the case illustrated in Figure 3(b) where the z- and y-Cournot equilibria are marked by dots. Observe that neither of these dots are on the demand curve. Hence neither can qualify as the ϕ-Cournot equilibrium. Now consider any

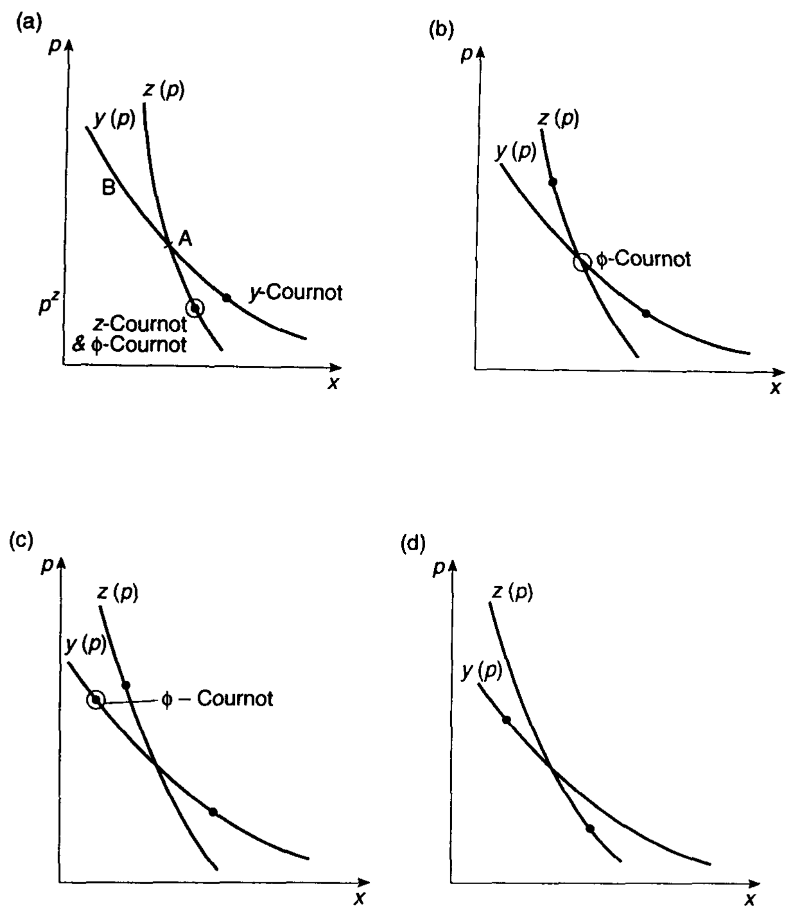

FIGURE 3.

point on the $y(p)$ curve above the point of intersection marked by a circle. A duopoly will tend to move away from such a point since the y-Cournot equilibrium occurs elsewhere. However, the duopoly cannot proceed past the intersection point, since beyond this point the $y(p)$ curve ceases to be the demand curve. For a similar reason the ϕ-Cournot equilibrium cannot occur on the $z(p)$ curve, below the intersection. It follows that the unique ϕ-Cournot equilibrium occurs at the point of intersection, marked by the circle. The case illustrated in Figure 3(c) with the z- and y-Cournot equilibria marked by dots, is symmetric to Figure 3(a). Hence, the ϕ-Cournot equilibrium coincides with the y-Cournot equilibrium and is marked by a circle.

Finally, what about the case illustrated in Figure 3(d)? It can be checked that this case cannot arise under the restrictions stated above. What happens is that one of the two Nash equilibria in 3(d) has to be unstable. This can be the basis of some interesting investigation but it is not relevant to the present paper and so 3(d) is ignored here.

We shall now establish some propositions concerning the link between international credit availability and the performance of industry in the donor country.

Proposition 1: *It is possible that as more international credit is made available to the Southern country, the South's demand for the Northern good may fall.*

Since such perverse responses can occur in other ways (for instance Giffen goods), it is important to appreciate the *manner* in which this is happening here. To demonstrate, consider the case illustrated in Figure 4.

Let the x-Cournot equilibrium be as shown. Consider an R such that the rectangular hyperbola $x = eR/p$ looks like RR in the figure. The Cournot equilibrium is clearly at point A since the configuration we have is that of Figure 3(c). As R increases, the Cournot equilibrium moves horizontally as shown by the arrow. This happens up to point B. From here onwards, further increases in R, creates the configuration in Figure 3(b) and so, as R increases, the Cournot-equilibrium point begins to move up along the $x(p)$ curve as shown. This is the region where the claim in Proposition 1 occurs. In this region, if the industrialized country wishes to push exports on to the developing country it will be in its interest to limit the foreign-exchange reserves of the developing country!

If the R-constraint is binding we have an equilibrium which is best described as one of *implicit excess demand*, because though there is no open excess demand, any increase in R translates into increased demand.

In the context of Proposition 1, above, it is of course arguable that an industrialized nation's primary objective is not the *quantity* of exports but profitability. Our next proposition pertains to this.

Proposition 2: *There exist situations where making more international credit available with the South lowers the profit of the Northern manufacturing industry.*

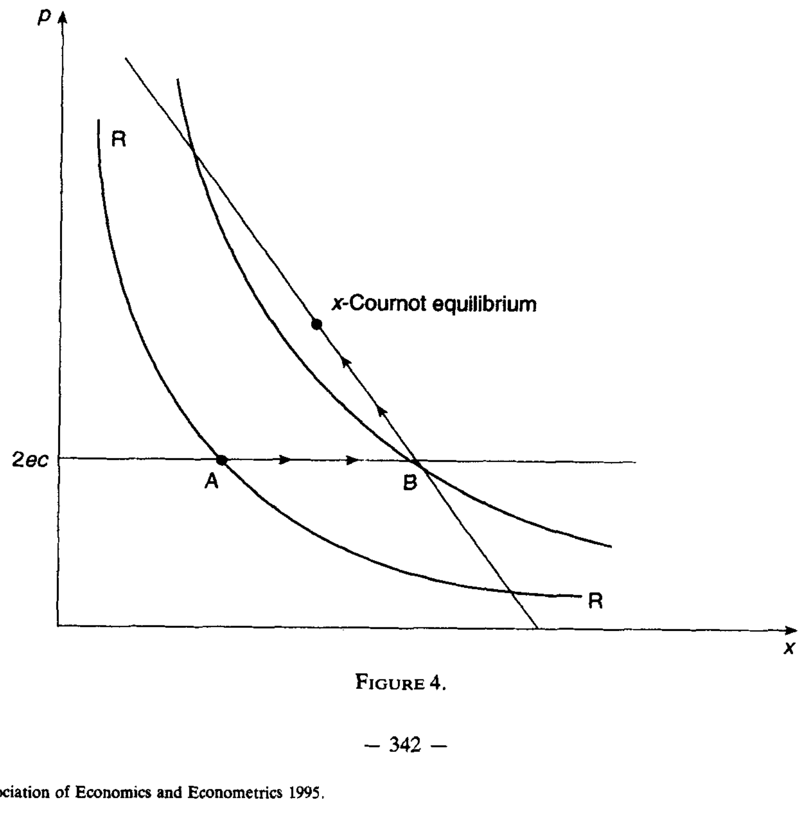

FIGURE 4.

The proof of Proposition 2 is obvious from Figure 5. As R increases, starting from R', equilibrium moves from A, through B, towards the x-Cournot equilibrium. This can be checked by comparison with Figure 3. Up to point B we have a situation like that in Figure 3(a). Then onwards we get the case illustrated in Figure 3(b). As the equilibrium traverses from A through B towards the x-Cournot equilibrium, clearly profit rises up to point M and then declines.

Note that if the industrial sector firms have influence over their government's credit-giving institution, they will try to control the credit and use it as a device to help establish a collusive outcome. They will then ideally give credit so that the total foreign exchange with the South is just right to sustain a monopoly equilibrium. Hence, the government in the North could act as a collusion-facilitating device ensuring, through the suitable control of credit, that the Northern manufacturers earn monopoly profits from the South.

It may be useful to end this section with an example which illustrates the two propositions.

Assume, $e = c = 1$ and inverse demand (2) is given by:

$$x = 3 + B - Bp.$$

Check that at the x-Cournot equilibrium—

$$x_1 = x_2 = 1,$$

$$p = (1 + B)/B.$$

At the R-Cournot equilibrium, $p^R = 2$.

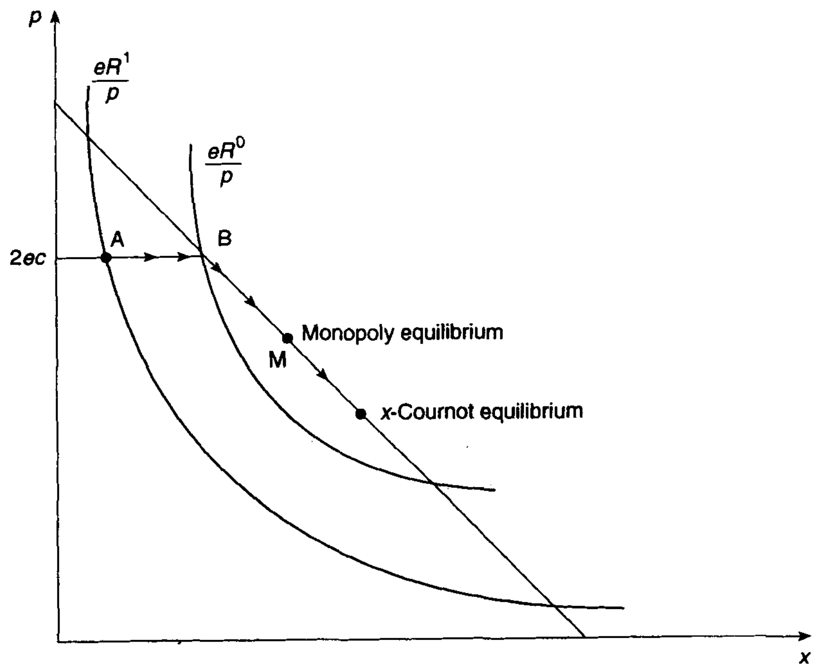

FIGURE 5.

The reader may check that the critical value of B is 1. If $B < 1$, Proposition 1 is true. If $B > 1$, Proposition 2 is true. The cases of $B = 1/2$ and $B = 2$ are illustrated in Figure 6.

It is time now to go a step further and instead of varying the international credit as if it were an exogenous variable we now model the donor country bank and endogenize the amount of credit given to the South.

4. The equilibrium amount of international credit

In this section we consider a two-period model in which in period 1 the Northern bank decides how much credit to give or what interest rate to charge and in period 2 the Northern firms sell their products in the Southern market. We analyse the subgame perfect equilibrium of this interaction.

Assume for the time being that every time goods are bought by the South from the North, the Southern government has first to borrow hard currency from the Northern bank at a *net* interest rate of i. If this is passes on to the Southern consumers, then when the price of the good is p, the effective price (or consumer price) faced by the Southern consumer is $(1 + i)p$. Hence, the demand function is given by:

$$x = x((1 + i)p) \tag{6}$$

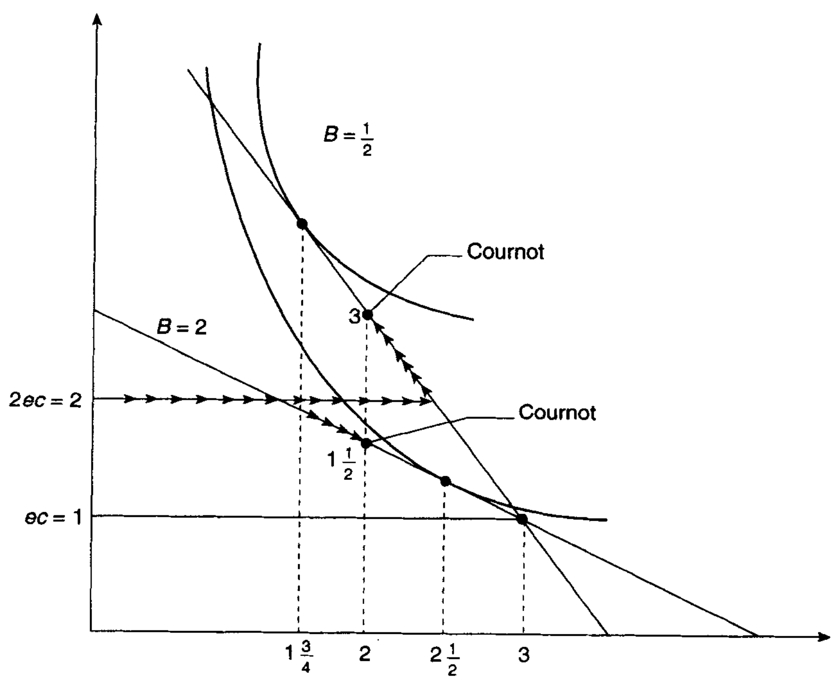

FIGURE 6.

That is, if international credit always had to be acquired by paying a premium, i, over and above the price, then we could use (1) but the argument would be $(1 + i)p$, as in (6), instead of p, as in (1). The interest, i, enters in the same way as an *ad valorem* tax.

The amount of money the South actually has to borrow is given by:

$$L = \max\{0, (px/e) - R\}.$$

Note that if R was so large that the South did not have to borrow any money from the Northern bank, then the demand function for x would be given by (1) above. So (1) is the demand for manufactures when there is no foreign-exchange constraint. We shall in this section assume that the income effect associated with this good is zero. This is simply to enable us to do welfare analysis later without having to contend with several competing notions of consumer's surplus.

Comparing (6) and (1) it is clear that if AB, in Figure 7, is the x-demand function (i.e. (1)), then in the case where foreign exchange has to be borrowed at an interest of i to buy the good the new demand curve will be like CB, the vertical gap between the two demand curves being ip. We shall refer to this as the i-demand function. If i rises, CB will pivot at B and become flatter. The Cournot equilibrium on this demand curve will be called the i-Cournot equilibrium.

Recall that the demand function (6) (and therefore also CB) was derived under the assumption that $L > 0$. But if the amount spent on x is less than eR, then there is no need to borrow money, and $L = 0$. To take this into account superimpose the rectangular hyperbola represented by $x = eR/p$ on Figure 7. This is shown by the curve DE in Figure 7. To the right of the rectangular hyperbola DE, $L > 0$ and the demand curve is given by the relevant part of CB. Not so to the left of DE.

Hence, the overall demand function that emerges is given by the thickened line,

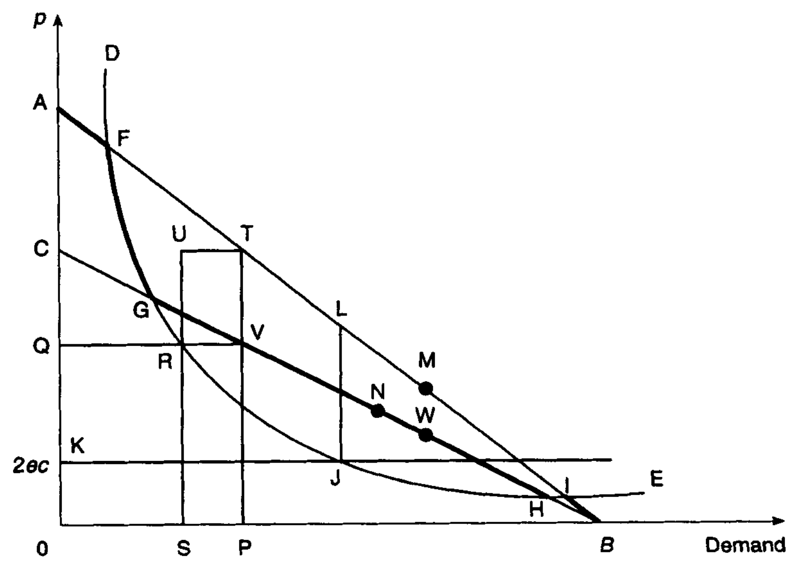

FIGURE 7.

AFGHIB. In terms of algebra, the demand function we are now considering is given by:

$$x = \operatorname{mid}\{x(p),\ eR/p,\ x((1 + i)p)\}, \tag{7}$$

where $\operatorname{mid}\{a, b, c\}$ is the middle largest number among a, b, c.

With this demand curve that we have developed,[8] we can prove a proposition about the welfare of the South if it has to borrow foreign exchange which enables it to buy the manufactured good from the North. We shall refer to this as the adverse effect theorem.

Proposition 3: *There exists a class of parametric configurations in which the welfare of the South is reduced if international credit is made available to it by a profit-maximizing international bank.*

The next section proves the adverse-effect theorem. Before going to that it may be worthwhile to clarify the meaning of the theorem and the formal set up in which this observation is being made. Essentially we are considering a game in which the international bank in period 1 fixes the interest rate i and offers credit to the South. In period 2 the South, aware that it can borrow any hard currency it needs (over and above the R units it already has), confronts the two Northern producers, and the usual Cournot oligopoly game is played. The adverse effect theorem is a comment on the subgame perfect equilibrium of the above game. It says that the Southern consumers might be better off if there were no Northern bank lending money to them and they were forced to make do with their existing foreign-exchange balance, R, than in the subgame perfect equilibrium of the above game involving the international bank.

In the next section we also try to demonstrate that the adverse-effect theorem is not just a logical possibility but may well arise in natural situations. This is demonstrated at the end of the next section with an example and suggestions of how this may be generalized to a *class* of examples.

5. Proof of the adverse-effect theorem

To prove the adverse-effect theorem, above, begin by inspecting Figure 7. The new demand curve has been formed through the juxtaposition of three separate demand curves: the x-demand curve, the i-demand curve and the eR/p curve (the rectangular hyperbola). Using the terminology developed earlier, let the x-Cournot equilibrium be given by point M and the R-Cournot equilibrium by point J.

If the demand curve that the South faces is given by (3), i.e. $\min\{x(p), eR/p\}$, then (as proved in Section 3) the Cournot equilibrium will be given by J, and the consumers' surplus of the South will be KJLA. This is a situation where the South

8) Despite the sophistication of this demand function, it leaves out many features of reality. We do not, for instance, go into the nature of the market for this good in period 2. Moreover, there may exist more than one good for the purchase of which hard currency is needed. Hence a limited amount of fungibility would occur here and the ideal way to work out the problem may be by using two budget constraints. While we do not go into this here, we have worked much of this out for ourselves. The main results of this paper remain unaffected.

does not borrow in order to buy the manufactured good. However, as has been established earlier, if the South has to take recourse to international credit, the demand curve that it faces is AFGHIB. Thus to prove our contention we need to prove that the consumers' surplus in the latter case can be smaller than KJLA.

From Figure 7 it is clear that this will certainly be the case if the Cournot equilibrium on the new demand curve (i.e. AFGHIB) is to the left of point J, say, at V. At V, the foreign exchange that the South has is sufficient to enable it to buy only QR units of the good at the market price (OQ). Thus to buy the remaining quantity, it borrows at an interest rate i with demand being given by CB. The consumers' surplus here is smaller for two reasons: the South is buying a smaller quantity at a higher price, and the price now also includes the interest payment to the bank, with the consumers' surplus being reduced by the amount of profit that the bank makes. By making a loan of RVPS, the profit of the bank will be RVTU.[9] Thus the consumers' surplus will be ATURQ, which is smaller than KJLA.

Now we need to establish that there does exist a situation where this will be so, that is, there exist circumstances under which the equilibrium on the new demand curve will lie to the left of J. Consider the demand curve given by (3). Clearly, there can be a configuration such that the R-Cournot equilibrium lies vertically below the x-Cournot equilibrium. Let us assume that the amount of foreign exchange with the South is such that this configuration obtains.

Next note that, whenever the x-, and the i-demand curves are linear, the i-Cournot equilibrium will always lie to the left of the x-Cournot equilibrium, as established in the next paragraph. Thus by our assumption, the i-Cournot equilibrium will lie to the left of the R-Cournot equilibrium as well.

Let the x-demand curve be given by:

$$x = a - bp.$$

Then the inverse demand curve would be:

$$p = a/b - x/b.$$

For duopolists 1 and 2, with identical costs of ec per unit, the Cournot equilibrium works out to be:

$$x_i = (a - bec - x_j)/2 \qquad j \neq i, i = 1, 2.$$

Thus

$$x_1 = x_2.$$

Thus

$$x_1 = (a - bec)/3 = x_2.$$

The total industry output will be

$$x = 2(a - bec)/3.$$

This will be sold at

$$p = a/3b + 2ec/3.$$

9) The opportunity cost of lending is being treated as zero. This causes no loss of generality.

This point is shown by E_1 in Figure 8.

When the South takes a loan to buy the good (i.e., it is operating on the i-demand curve), for each unit of the good, it not only pays the price but also an interest on the loan. Thus the inverse demand curve would now be modified as follows:

$$p + ip = a/b - x/b,$$

or,

$$p = a/(1 + i)b - x/(1 + i)b.$$

The Cournot equilibrium for this curve would be

$$x = 2(a - (1 + i)bec)/3$$

and

$$p = a/3(1 + i)b + 2c/3$$

which is shown as E_2 in Figure 8.

It is clear from the above that E_2 will always be to the left of E_1.

Now look at Figure 7 again. If V is the i-Cournot equilibrium, we have to ascertain how this will shift when the demand curve is AFGHIB instead of CB. Theoretically this could shift to any part of the new demand curve, but given that the international lending is done by a profit maximizer, it follows that the equilibrium must lie on the linear stretch GH, corners excluded. If i is chosen so

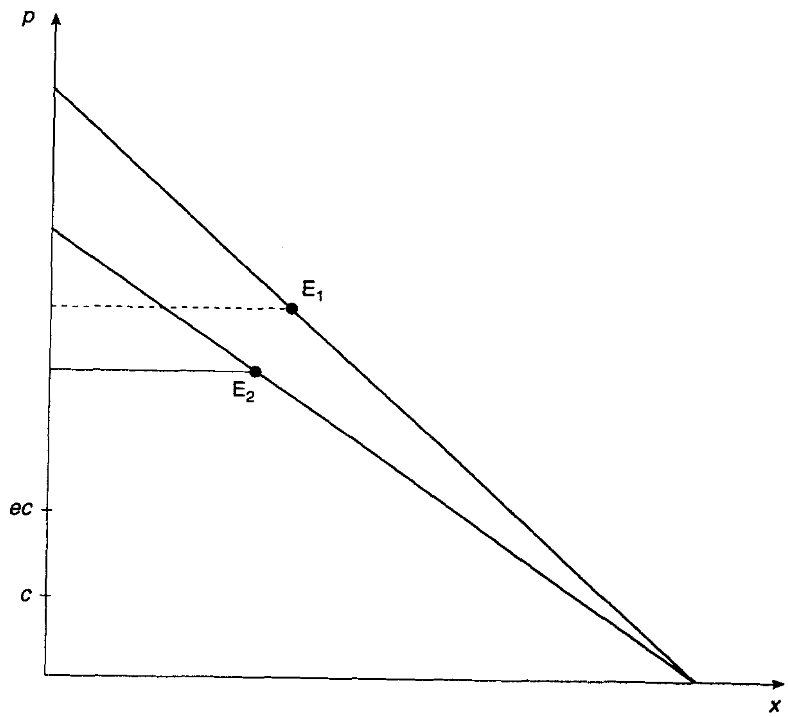

FIGURE 8.

that the equilibrium lies on AF, FG, HI or IB, the lender's profit would be zero and this would be irrational for the lender. It can be demonstrated quite easily that if the Cournot equilibrium remains on the line segment GH, corners excluded, after the demand curve changes from CB to AFGHIB, then the Cournot equilibrium point must continue to be at V (i.e. the i-Cournot equilibrium point).

To see this, imagine a situation when the equilibrium on the new demand curve shifts to a point like W. This means that at least one of the duopolists can increase his profits by moving away from V towards W. But W was available even earlier, which was rejected, and V was chosen as the Cournot equilibrium point. Thus W cannot be an equilibrium point now. Thus V will continue to be the Cournot equilibrium on the new kinked demand curve.

The proof of our proposition is now complete. To summarize, under certain assumptions, we know that the i-Cournot equilibrium will lie to the left of the R-Cournot equilibrium (the latter being the original equilibrium in the absence of international lending). With international lending, if the equilibrium continues to be at the i-Cournot point, it will necessarily lie to the left of the original equilibrium. When international lending is done by a profit-maximizing bank, final equilibrium must be an i-Cournot equilibrium. This situation, as we have seen, results in a smaller consumers' surplus for the South. This is the state under which the welfare of the South is reduced by resorting to international borrowing.

To see how the adverse-effect theorem may be relevant in the kinds of contexts that are used by economists to describe problems of oligopoly, we begin by constructing a numerical example.

$$\text{Let } x = 10 - p,\ c = 1,\ e = 1,\ R = 12.$$

This is a case where the R-Cournot equilibrium lies vertically below the x-Cournot equilibrium. From the method of proof of the adverse-effect theorem used above it will be transparent that the adverse effect indeed occurs in the above case.

It is easy to see that the example is generic. Virtually all the parameters in the above example can be generalized to a class where the adverse effect occurs. Let us, for instance, take the case of R. Note that if $R > 12$, the R-Cournot equilibrium will be to the right of the x-Cournot equilibrium. However, if $R \geqslant 24$, then the foreign exchange constraint ceases to be binding. Hence, as long as $24 > R \geqslant 12$, the adverse effect does occur. The other parameters may be generalized in a similar manner.

6. Concluding remarks

Our theoretical analysis leads us to conclude that the commonly held notion that credit boosts donor exports holds true under certain conditions, namely, under market structures of monopoly and perfect competition in the donor (North). If the Northern manufacturing industry is oligopolistic, the results are varied—if international credit is given beyond a certain level, it can lead to a fall in the donor exports. Also, we find that there is an optimum amount of credit that maximizes the profits of the Northern oligopolists.

This highlights the important role of credit, as a strategic variable, from the point of view of the North. Insofar as this analysis is valid, the oligopolists can reach an understanding with the lending institutions in order to ensure that the amount of credit given is optimal from the former's point of view. The literature on loan pushing suggests that, in fact, such an understanding has taken place on many occasions.

We have also demonstrated the possibility of the South being worse off as a result of international borrowing. This happens as a consequence of strategic interaction between the agents involved, to wit, the Southern consumers, the Northern manufacturers and the Northern lending bank.

Final version accepted May 27, 1995

REFERENCES

Basu, K. (1991) "The International Debt Problem, Credit Rationing and Loan Pushing: Theory and Experience," *Princeton Studies in International Finance*, No. 70,

Besley, T. (1988) "Tied-in Credit with a Monopoly Product Market," *Economics Letters*, Vol. 28, pp. 105–108.

Bhagwati, J. (1970) "The Tying of Aid," in J. Bhagwati and R. Eckaus, eds. (1970), *Foreign Aid*, Harmondsworth: Penguin Books.

Chichilnisky, G. (1980) "Basic Goods, the Effect of Commodity Transfers and the International Economic Order," *Journal of Development Economics*, Vol. 7, pp. 505–519.

Darity, W., Jr. and B. Horn, (1988) *The Loan Pushers: The Role of the Commercial Banks in the International Debt Crisis*, Cambridge, Mass.: Ballinger.

De Meza, D. (1983) "The Transfer Problem in a Many Country World: is it Better to Give than to Receive?," *Manchester School*, Vol. 51, pp. 266–275.

Dixit, A. (1983) "The Multicountry Transfer Problem," *Economics Letters*, Vol. 13, pp. 49–53.

— (1984) "International Trade Policy for Oligopolistic Industries," *Economic Journal* (Supplement), Vol. 94, pp. 1–16.

Gwyne, S. C. (1983) "Adventures in the Loan Trade," *Harper's Magazine*, September, pp. 22–26.

Hayter, T. (1971) *Aid as Imperialism*, Harmondsworth: Penguin Books.

Hyson, C. D. and A. M. Strout (1968) "Impact of Foreign Aid on U.S. Exports," *Harvard Business Review*, Vol. 46, pp. 63–71.

Jepma, C. (1991) *The Tying of Aid*, Paris: OECD.

Ohlin, G. (1970) "The Evolution of Aid Doctrine," in J. Bhagwati and R. Eckaus, eds. (1970) *Foreign Aid*, Harmondsworth: Penguin Books.

Payer, C. (1974) *The Debt Trap*, New York: Monthly Review Press.

Pincus, J. A. (1963) "The Cost of Foreign Aid," *Review of Economics and Statistics*, Vol. 45, pp. 360–367.

Rothermund, D. (1981) "British Foreign Trade Policy in India During the Great Depression, 1929-1939," *Indian Economic and Social History Review*, Vol. 18, pp. 349–376.

Taylor, L. (1985) "The Theory and Practice of Developing Country Debt: An Informal Guide for the Perplexed," *Journal of Development Planning*, No. 16, pp. 195–277.

Tendler, J. (1975) *Inside Foreign Aid*, Baltimore: Johns Hopkins University Press.

Wall, D. (1973) *The Charity of Nations: the Political Economy of Foreign Aid*, New York: Basic Books.

Winkler, M. (1929) *Investments of US Capital in Latin America*, Boston: World Peace Foundation Pamphlets.