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Developing Country Borrowing from a Monopolistic Lender: Strategic Interaction and Endogenous Leadership

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Developing Country Borrowing from a Monopolistic Lender:
Strategic Interactions and Endogenous Leadership*

By

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Abstract

We develop a two-period model with endogenous investment and credit flows. Credit is subject to quantitative restrictions. With an exogenous restriction, we analyze the welfare effects of temporary tariffs. We then consider three scenarios under which a monopoly lender optimally decides the level of credit and a borrower country chooses an import tariff: one in which the two parties act simultaneously and two scenarios where one of them has a first-mover advantage. The equilibrium under the leadership of the borrower country is Pareto superior to the Nash equilibrium but may or may not be to that under the leadership of the lender. If the sequence of moves is itself chosen strategically, leadership by the borrower emerges as the unique equilibrium.

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1 Introduction

The inter-relationship between goods and financial markets is well recognized in economics (see, for example, Mankiw [2002]). This relates as much to international markets as to domestic ones. Problems or distortions in one of the markets is likely to spill over to the other one, compounding the problem. For example, developing countries who are normally borrowers on international capital markets, are most likely to face restrictions and other types of distortions which affect their ability to borrow. These problems in the capital market would distort the allocation of resources in the production of goods and services.

The generalized theory of distortions and welfare tells us that, even in the presence of spill over, the second- or first-best option is to intervene directly in the market which is the source of the distortion (See Bhagwati and Ramaswamy, 1963; Bhagwati, 1971). That is, in our case a tax on borrowing would be the appropriate policy intervention. However, when such an intervention is not possible, we shall show that an intervention in the international goods market can alleviate the distortion to some extent.[1]

Thus, the first part of the paper examines the effects of *temporary* trade intervention — in the form of either a import tariff or export subsidy — when borrowing from overseas is subject to quantitative restrictions imposed from abroad.[2]

We start by analyzing a two-period economy with endogenous investment, which is small in goods markets and has undistorted market structure in both exporting and importing industries, but is subject to exogenous borrowing restrictions from foreign lenders. In this framework, we show that a trade intervention in the first period, either in the form of an import tariff or an export subsidy, is optimal given the credit constraint.[3]

[1] It is indeed true that a tax on overseas borrowing is very rarely used. As we shall point out later on (see footnotes 12 and 13), the main results of the paper will hold if we consider borrowing tax as an instrument rather than temporary tariff. We present the case of temporary tariff simply for the reason that it is a more commonly recognized instrument than borrowing tax.

[2] For an analysis of temporary tariffs in a different context see Djajić [1987].

[3] This result bears some similarity with those in the literature on optimal tariffs, which has established that a large economy can improve its static terms of trade and increase its welfare by an appropriately

After showing the benefits of temporary trade intervention by a borrower country, we go on to examine how such a policy might interact with endogenous credit constraints imposed from the side of a lender.[4] In order to do so, we assume that a private bank in the lending country with monopoly power in overseas lending sets the amount lent to the borrowing country. This scenario would reflect the dominance of large multinational banks in channeling loans to developing countries, particularly through the use of loan syndicates which take in funds from many banks of various sizes but are effectively controlled and administered by one large 'lead' bank.[5] While the government of the borrower country optimally decides the level of a temporary import tariff maximizing the welfare of its representative citizen, the monopoly lender decides on the amount of loan by maximizing its profits. We examine three variants of this overall game. In the first game, both parties act simultaneously to set their respective instruments; in the second one, the borrowing country has a first-mover advantage and in the last game, the monopoly lender does.

In the context of the simultaneous-move game, we show that the Nash equilibrium involves both a binding restriction on the supply of loans and a positive level of the tariff. We also show that a piece-meal reform which raises the supply of credit and lowers the tariff is *strictly* Pareto-improving relative to the Nash equilibrium. This highlights the result that whilst trade intervention and capital controls might be mutual best-responses in a non-cooperative sense, global welfare could be increased by a combined relaxation of both

chosen tariff (see, for example, Johnson [1968]). In our framework, trade intervention has no effects on the country's static terms of trade, and the channel of welfare improvement works through interest rates (the inter-temporal terms of trade); in particular, through changes in the *domestic* interest rates.

[4]Endogenous credit constraints can also arise under scenarios involving adverse selection and costly monitoring by competitive lenders (Stiglitz and Weiss [1983], Williamson [1987]). In such scenarios the results about the welfare-improving nature of tariff intervention would still hold. Since the amount lent is not strategically chosen so our analysis of a strategically chosen constraint will not be applicable. However, one can, in principle, consider adverse selection and costly monitoring even when the lender is a monopolist. Such an extension will complicate our analysis enormously and move us away from our focus on the monopoly distortion in lending and strategic interactions between a monopoly lender and a borrower.

[5]Even if many banks could directly lend to the developing country, there could be circumstances, such as when the loans are channeled through the recipient country's government, that monopoly-like outcomes could obtain in the loan market (see Paasche and Zin [2001]). In any case, we provide an alternative interpretation of the lender in section 5. There we explicitly analyze equilibrium in the second country, whose competitive private sector lends to the competitive private sector of the borrower country. The government of the lender country optimally sets a quota on how much its private sector can lend.

distortions.

In the sequential game, when the government of the borrowing country moves first, the equilibrium tariff is indeed set at a lower level, and the flow of credit is indeed higher, than in the simultaneous-move game. When the monopoly lender moves first, however, while the tariff remains lower than in the simultaneous-move benchmark, the restriction on credit also becomes tighter than in the benchmark case. These comparative results suggest that Stackelberg leadership by the borrower might be the preferred scenario from the Pareto point of view. In other words, if debtor countries take the initiative and demonstrate a credible commitment to reducing policy-induced trade distortions, this could be met by a relaxation of credit constraints by creditor countries – to the benefit of both. We also find that leadership by the borrower can be Pareto superior even to that by the lender, thus making the leadership by the borrower an endogenous outcome as it will be desirable for all parties in such a situation. Furthermore, if the *sequence* of actions (as opposed to the actions themselves) is subject to strategic determination as in a game *a la* Hamilton and Slutsky [1990], we find that leadership by the borrower will be the unique equilibrium.[6]

The first result of this paper, *viz.* that an optimal tariff is positive when an economy faces exogenous borrowing constraints,[7] has also been derived by Edwards and van Wijnbergen [1986]. But Edwards and van Wijnbergen established their result under the assumption that the borrowing constraint falls only on investment and not on consumption. This added a wedge between the interest rate on investment and that on consumption. In our paper, the optimality of trade intervention is established without adding a further distortion in the domestic credit market. The two papers are also very different in other important respects and seek to analyze very different issues; while Edwards and van Wijnbergen examine the relative merits of gradualist and cold-turkey approaches to trade policy reforms for given

[6]For an early treatment of endogenous leadership in a Cournot oligopolistic model with multiple firms, see Ono [1978].

[7]Osang and Turnovsky [2000] analyses the effect of differentiated tariffs on growth and welfare under borrowing constraints.

levels of the credit constraint, we examine the interaction between trade interventions and credit constraints, and the role of credible commitments by one of the players in achieving a Pareto improvement.

The rest of the paper proceeds as follows. In the next section we outline a two-period model in which the level of borrowing is exogenously given, and discuss the welfare effects of a temporary trade intervention. In section 3, the level of borrowing is determined by a monopoly lender in the lender country. In section 3.1, we analyze the case in which the two players act simultaneously; section 3.2 studies the case in which the borrower country acts as a leader and section 3.3, the case in which the lender is the leader. The possibility of endogenous determination of leadership is shown in section 4. Section 5 provides an alternative interpretation of the leader. Finally, section 6 concludes.

2 The case of an exogenous borrowing constraint

We consider an open economy lasting two periods, 1 and 2. It produces two goods per period and is small in world commodity markets, so that the prices of the two goods are exogenous. Goods labeled 1 and 2 are produced during $t = 1$ while goods labeled 3 and 4 are produced during $t = 2$.

In order to focus the exposition, we shall establish the convention that goods 1 and 3 are exportables while goods 2 and 4 are importables. P_i is the world price of good i. Prices are normalized such that $P_1 = 1$.

The economy starts at $t = 1$ with K units of capital. At $t = 1$, it can add to this through investment, I, which becomes available at $t = 2$.[8] The economy faces a binding restriction on how much it can borrow overseas, $\bar{b}$, which applies to both investment and consumption. The credit market and all the product and factor markets are assumed to be

[8]Investment is in terms of the numeraire good 1.

perfectly competitive within the domestic country.[9]

The government employs a temporary specific import tariff denoted by τ_1 in period 1. Tax revenues are transferred to the consumer in a lump-sum fashion. The formal analysis presented below is not affected if we reverse the convention on exportables and importables, and interpret τ_1 as a subsidy on the exports at $t = 1$.

The economy is described by the following equations:

$$\begin{aligned} E\left(1, P_2 + \tau_1, \frac{P_3}{1+r}, \frac{P_4}{1+r}, u\right) &+ I = \\ +R^1(1, P_2 + \tau_1, K) &+ \frac{R^2(P_3, P_4, K+I)}{1+r} + \tau_1\left[E_2 - R_2^1\right] \qquad (1) \\ (1+r)\bar{b} &= R^2 - P_3E_3 - P_4E_4 \qquad (2) \\ R_3^2 &= (1+r). \qquad (3) \end{aligned}$$

Equation (1) represents the economy's intertemporal budget constraint. It states that the total discounted present value of consumption expenditure is equal to the discounted present value of income including tariff revenue. Equation (2) describes the borrowing constraint: total repayment (capital plus interest) in period 2 is equal to income over expenditure in that period. The investment choice is described by (3), and is obtained by setting $(\partial u/\partial I) = 0$ from (1) for a given level of the domestic interest rate, r. Together the three equations determine the three endogenous variables: utility level u; interest rate r, and the level of investment I.

In the above equations, $E(\cdot)$ is the expenditure function, R^1 is the revenue function at $t = 1$, R^2 is revenue at $t = 2$, $R^2 - E_3 - P_2E_4$ is the current account surplus at $t = 2$, and $E_2 - R_2^1$ is the level of imports of good 2 at $t = 1$.[10]

[9] In section 3, the restriction on borrowing is explicitly modeled as the amount lent by a bank which has monopoly power in intermediating funds from the foreign country. This source of credit constraints would be compatible with the domestic credit market itself being perfectly competitive, i.e., private agents in the borrowing country being price takers.

[10] The expenditure function represents the minimum level of expenditure that can possibly attain a given

We assume that all goods are substitutes — both intra- and inter-temporally, and that all goods are normal. Formally,

$$E_{ij} > 0, \quad i \neq j = 1,2,3,4, \quad \text{and} \quad E_{i5} > 0, \quad i = 1,2,3,4.$$

Differentiating (1)-(3), we get:

$$\begin{aligned}
\alpha\ du &= -\frac{H}{(1+r)^2}dr - \beta d\tau_1, &(4)\\
\Delta\ dr &= -(1+r)d\bar{b} - \left[P_3E_{32} + P_4E_{42} - \frac{\beta\gamma}{\alpha}\right]\ d\tau_1 &(5)\\
R^2_{33}dI &= dr, &(6)
\end{aligned}$$

where

$$\begin{aligned}
\alpha &= E_5 - \tau_1 E_{25} > 0,\\
\beta &= \tau_1\left[E_{22} - R^1_{22}\right],\\
G &= \tau_1(P_3E_{23} + P_4E_{24}),\\
H &= (1+r)\bar{b} + G,\\
\Delta &= \bar{b} - \frac{P_3E_{33} + 2P_4E_{34} + P_4E_{44}}{1+r} - \frac{(1+r)}{R^2_{33}} - \frac{\gamma H}{\alpha(1+r)^2} > 0,\\
\gamma &= P_3E_{35} + P_4E_{45} > 0.
\end{aligned}$$

$\alpha > 0$ is known as the Hatta normality condition. It can be shown that if good 1 is normal, then α is indeed positive. Walrasian stability in the credit market ensures that $\Delta > 0$.

Equation (4) shows that an increase in r has two negative effects on welfare.First, since the country is a borrower, it suffers an intertemporal terms-of-trade loss. The second effect

level of utility. A revenue function is the maximum value of total output that can be achieved for given commodity prices, technology and endowments. The partial derivative of an expenditure (revenue) function with respect to the price of a good gives the Hicksian demand (supply) for that good. Moreover, the matrix of second order partial derivatives with respect to the prices of an expenditure (revenue) function is negative (positive) semi-definite. For this and other properties of expenditure and revenue function see, for example, Dixit and Norman [1980]. Since the endowments of factors other than capital do not vary in our analysis, they are omitted from the arguments of the revenue functions. We denote by R_i (E_i) the partial derivative of the revenue (expenditure) function with respect to the ith argument.

is via decreases in tariff revenues: an increase in r makes period 2 consumption relatively cheaper and this reduces period 1 consumption and therefore period 1 imports, resulting in smaller revenues for a given τ_1.[11]

An increase in τ_1, for a given value of r, increases the domestic price of the importable in period 1 and therefore reduces imports and tariff revenues. This is welfare reducing.

An increase in $\bar{b}$ represents an increase in the flow of credit and thus reduces the interest rate, as can be seen from (5). An increase in τ_1 has two opposing effects on the demand for credit and thus on r. First, it makes period 2 prices relatively cheaper reducing excess of income over consumption in period 2 and thus the demand for loans. This reduces the interest rate. An increase in τ_1, for reasons mentioned before, also reduces tariff revenues and thus reduces income in period 1. This increases the demand for loans and thus the interest rate. These two effects are captured by the coefficients of $d\tau_1$ in (5).[12] Equation (6) simply states that an increase in r reduces investment by reducing the present value of its returns.

Substituting (5) into (4), we find that

$$\left.\frac{du}{d\tau_1}\right|_{\tau_1=0} > 0. \tag{7}$$

From (7) and the concavity of the welfare function, it follows that the optimal value of τ_1 is positive. Note that in the alternative interpretation of the model, with good 2 as an exportable, τ_1 would represent a subsidy, since in the expression for T, $\tau_1[E_2 - R_2^1]$ becomes negative when τ_1 is positive and $[E_2 - R_2^1]$ is negative. Our analysis would go through intact

[11]Note that welfare is not directly affected by changes in I, except through its presence in the lump-sum tax, as I is optimally chosen (the envelope property).

[12] If, instead of tariffs, we have a borrowing tax as the instrument, the mechanism via which it would affect the interest rate would be very similar. A borrowing tax would raise the ex-ante domestic interest rate above its no-intervention value (which would already exceed the world interest rate because of the borrowing constraint), lowering the present value of period-2 prices and thus making period-2 prices relatively cheaper. This would in turn, as with the case of tariffs, increase expenditure in period-2 and reduce the demand for loans in period 1. This would succeed in lowering the before-tax domestic interest rate faced by domestic borrowers. A borrowing tax also has a revenue effect as does a tariff. Thus the the effect of a borrowing tax on the interest rate — which is the key variable in our analysis — is qualitatively similar to that of a tariff.

except for some differences in interpretation. Hence, the direction of optimal intervention in trade is to subsidize exports or tax imports.[13] Formally,

Proposition 1: *For a small open economy subject to a binding borrowing constraint, it is optimal either to impose a tariff on imports or a subsidy on exports.*

The main reason why an optimal import tariff or export subsidy is positive has to do with the effect that it has on the domestic interest rate, r. Since $\bar{b}$ is fixed, the level of borrowing cannot be affected directly by any of the instruments. However, they can affect one of its consequences, namely the level of the interest rate.

Recall from above that an increase in τ_1 induces two conflicting effects on the *ex ante* demand for credit at $t = 1$: a negative substitution effect arising from a lower domestic demand for consuming good 2 at $t = 1$ (thus improving the current account at $t = 1$) and a positive income effect arising from the fall in tariff revenues. Starting from $\tau_1 = 0$, the tariff revenue effect is negligible, so an increase in τ_1 reduces the demand for loans and reduces r.

Note that an alternative scenario under which the borrowing country's domestic interest rate could become endogenous is when, instead of a borrowing constraint, the country could borrow as much as it wants but had to pay an endogenous risk premium (above the risk-free world interest rate) on its loans. So long as the premium was positively related to the country's demand for funds, a temporary tariff or export subsidy would have qualitatively similar effects as in the case studied here. This is because such a tariff would lower the country's demand for funds at any given value of the risk premium and this would make the premium itself fall.

[13] If the instrument used was a borrowing tax, one can show that the optimal policy would be to tax, rather than subsidize, borrowing. This is because a tax on borrowing will reduce the demand for loan, thus lowering the equilibrium interest rate and improving the borrowing country's inter-temporal terms of trade.

3 The case of an endogenous borrowing constraint

In the preceding section, we assumed that the borrowing constraint, $\bar{b}$, was determined exogenously. In this section, we introduce a foreign bank which is the only source of loans to the borrowing country and which determines the size of $\bar{b}$ by maximizing its profits, i.e., we assume that a private bank with monopoly power in intermediating loans sets $\bar{b}$. The bank's profits, π, are given by

$$\pi = r(\bar{b})\bar{b} - r^*\bar{b}, \tag{8}$$

where $r(\bar{b})$ is the inverse demand function for loans facing the bank and r^* is the average (marginal) opportunity cost to the bank. We shall assume that the bank takes r^* as given while maximizing its profits. In fact, we shall take it to be exogenous. However, as we shall note later on (see footnote 15), r^* can be endogenous and determined in a competitive loans market in the foreign country.

For future reference, differentiating (8), we obtain:

$$d\pi = (r - r^*)d\bar{b} + \bar{b}\ dr, \tag{9}$$

where dr is as in (5).

We shall now consider three scenarios and compare equilibria across them. In the first scenario, we shall assume that the two players play a Nash game, *i.e.* the home country maximizes its welfare by optimally choosing τ_1 taking the level of $\bar{b}$ as given, and at the same time, the foreign bank maximizes its profits π by optimally choosing $\bar{b}$ taking τ_1 as given. In the second scenario, we shall assume that the borrower country has a first-mover advantage. In particular, we consider a two stage game. In order to obtain a sub-game perfect equilibrium, the game is solved using backward induction. In stage 2 of the game, the foreign bank decides on an optimal value of $\bar{b}$ contingent upon a given value for τ_1. In stage 1, the borrower country optimally decides on the level of τ_1 by taking into account the reaction function of the bank from the second stage. In the final scenario, the order of the game is reversed in the sense that the borrower country is a follower and the bank is the leader. The three scenarios are now considered in turn in each of the following three subsections.

3.1 The Nash game

In this sub-section, we consider a Nash game in τ_1 and $\bar{b}$ between the home country and the foreign bank. From (4), (5) and (9), by setting $\partial u/\partial\tau_1 = 0$ and $\partial\pi/\partial\bar{b} = 0$, we obtain the following first order conditions, which are solved simultaneously to derive the Nash equilibrium values, $(\tau_1^N,\ \bar{b}^N)$:

$$\tau_1 \quad : \quad \beta\Delta = \frac{H}{(1+r)^2}\cdot\left[P_3E_{23} + P_4E_{24} - \frac{\beta\gamma}{\alpha}\right] \tag{10}$$

$$\bar{b} \quad : \quad \epsilon = \frac{r - r^*}{1+r}, \tag{11}$$

where

$$\epsilon = -\frac{d(1+r)}{d\bar{b}}\cdot\frac{\bar{b}}{1+r} > 0;$$

and H and Δ simplify to:

$$\begin{aligned} H &= \tau_1(P_3E_{23} + P_4E_{24}) + (1+r)\bar{b} > 0, \\ \Delta &= \bar{b} - \frac{P_3E_{33} + 2P_4E_{34} + P_4E_{44}}{1+r} - \frac{1+r}{R_{33}^2} - \frac{\gamma H}{\alpha(1+r)^2} > 0, \end{aligned}$$

and other variables are as defined before.

It follows from (4) and (5) that

$$\left.\frac{du}{d\tau_1}\right|_{\tau_1=0} > 0,$$

and from (11) that at the Nash equilibrium $r > r^*$. Since at the first best (*i.e.* when the global welfare is maximized), $\tau_1 = 0$ and $\bar{b}$ is such that $r = r^*$, it is then clear that τ_1^N is higher, and $\bar{b}^N$ lower, than their respective first-best values.

Since $\partial u/\partial \tau_1 = \partial \pi/\partial \bar{b} = 0$ at the Nash equilibrium, from (4), (5) and (9) we get:

$$\alpha\Delta\ du|_{\tau_1=\tau_1^N,\ \bar{b}=\bar{b}^N} = \frac{H}{1+r}\ d\bar{b} \tag{12}$$

$$\begin{aligned}\Delta\ d\pi|_{\tau_1=\tau_1^N,\ \bar{b}=\bar{b}^N} &= -\frac{\bar{b}^N}{1+r^*}\cdot\left[P_3E_{32}+P_4E_{42}-\frac{\beta\gamma}{\alpha}\right]\ d\tau_1 \\ &= -\frac{\bar{b}^N(1+r^*)\beta\Delta}{H}\ d\tau_1.\end{aligned} \tag{13}$$

That is, starting from the Nash equilibrium, a party's welfare is affected only by the actions of the other party. In other words, it is only the international externalities channeled through changes in the interest rate r that matter. It should be clear from the above two equations that the nature of the international externalities are such that a multilateral agreement in which the lender agrees to increase $\bar{b}$ and the borrower country decides to reduce τ_1, will increase the welfare levels of both.

This result is stated formally in Proposition 2.

Proposition 2: *Starting from the Nash equilibrium, a multilateral piecemeal reform of policies such that $d\bar{b} > 0$ and $d\tau_1 < 0$ is strictly Pareto improving.*

The first best, as shown above, in this framework is given by a situation in which $\tau_1 = 0$ and $\bar{b}$ is higher than $\bar{b}^N$. Therefore, the multilateral piecemeal reform proposed in Proposition 2 takes the the two variables toward their respective first-best levels. This has to be globally welfare improving. The international externalities at the Nash equilibrium happens to be such that the reform is in fact strictly Pareto improving.

3.2 The borrower country has a first-mover advantage

In this subsection we consider a two-stage game in which the borrower country acts as the leader.

From the foc for $\bar{b}$ ((11))we get:[14,15]

$$\frac{d\bar{b}}{d\tau_1} = \frac{\frac{\partial r}{\partial \tau_1} \cdot \frac{\bar{b}}{1+r}}{\epsilon}.$$

Substituting (10) into (5), we get:

$$\begin{aligned} \left.\frac{\partial r}{\partial \tau_1}\right|_{\tau_1=\tau_1^N} &= -\left[P_3 E_{32} + P_4 E_{42} - \frac{\beta\gamma}{\alpha}\right] \\ &= -\frac{(1+r^*)^2\beta\Delta}{H} < 0, \end{aligned} \tag{15}$$

therefore from (14) that

$$\left.\frac{d\bar{b}}{d\tau_1}\right|_{\tau_1=\tau_1^N} < 0. \tag{16}$$

The above equation states that, at least in the neighborhood of a Nash equilibrium, the lender's reaction function is downward sloping. The intuition for this best understood by thinking in terms of a small tariff *reduction*: starting from the Nash equilibrium, this will unambiguously decrease the country's demand for funds, so the lender's response will certainly involve an increase in the amount lent.

Finally, from (12) and (16) we find:

$$\alpha \left.\frac{du}{d\tau_1}\right|_{\tau_1=\tau_1^N} = \frac{H}{\Delta} \cdot \left.\frac{d\bar{b}}{d\tau_1}\right|_{\tau_1=\tau_1^N} < 0. \tag{17}$$

From (17) and the concavity of the welfare function it follows that the optimal value of τ_1 is higher in the Nash game than in the game where the borrower country has a first-move

[14]In order to avoid third order derivatives, we assume that ϵ is constant.

[15] When r^* is determined endogenously in a competitive market in the foreign country, equation (14) is modified to

$$\frac{d\bar{b}}{d\tau_1} = \frac{\frac{\partial r}{\partial \tau_1} \cdot \frac{\bar{b}}{1+r}}{\epsilon + \epsilon^*}, \tag{14}$$

where

$$\epsilon^* = \frac{d(1+r^*)}{d\bar{b}} \cdot \frac{\bar{b}}{1+r^*} > 0.$$

advantage. From (5), it can be shown that r is a U-shaped function of τ_1. Furthermore, from (15) it follows that at $\tau_1 = \tau_1^N$, r is a decreasing function of τ_1. Since the optimal value of τ_1 in this case is lower than τ_1^N, it is then evident that in the relevant range for τ_1, r is a decreasing function of τ_1, and therefore from (14) we can tell that $\bar{b}$ is also a decreasing function of τ_1 in that range. Thus, the optimal value of $\bar{b}$ is higher compared to its Nash equilibrium value.

Proposition 3: *Equilibrium τ_1 is higher and $\bar{b}$ lower in the Nash game than in the game where the borrower country has a first-mover advantage.*

By committing itself to a particular value of τ_1, the borrower country can influence the behavior of the lender who is a follower in the present game. By lowering the value of τ_1, it is able to raise the level of loans, and thereby increase its welfare compared to the Nash equilibrium.

3.3 The lender bank has a first-mover advantage

In this section we consider a two-stage game in which the lender bank acts as the leader.

From (4), we get:

$$\alpha \frac{du}{d\tau_1} = -\beta + \frac{H\mu}{(1+r)\tau_1}, \tag{18}$$

where

$$\mu = \frac{d(1+r)}{d\tau_1} \cdot \frac{\tau_1}{1+r}.$$

From (18), the first order condition from the second stage of the game is given by:

$$\tau_1 : \qquad 0 = -\beta\tau_1 + \frac{\mu(P_3E_{23} + P_4E_{24})\tau_1}{1+r} + \bar{b}\mu = f(\tau_1, \bar{b}) \text{ (say)}. \tag{19}$$

Differentiating (19), the slope of the reaction function is obtained as:[16]

$$\frac{\partial f}{\partial \tau_1} \cdot \frac{d\tau_1}{d\bar{b}} = -\frac{\partial f}{\partial \bar{b}} = \frac{\mu(P_3E_{23} + P_4E_{24})\tau_1}{(1+r)^2} \cdot \frac{dr}{d\bar{b}} - \mu. \tag{20}$$

Since $dr/d\bar{b} < 0$ ((5)) and $\partial f/\partial \tau_1 < 0$ (the second order condition for optimality), from (20) we get $d\tau_1/d\bar{b} > 0$, and therefore using the Nash property and (13) we obtain:

$$\begin{aligned} \left.\frac{d\pi}{d\bar{b}}\right|_{\bar{b}=\bar{b}^N} &= \left.\frac{\partial d\pi}{d\bar{b}}\right|_{\bar{b}=\bar{b}^N} + \frac{d\pi}{d\tau_1} \cdot \frac{d\tau_1}{d\bar{b}} \\ &= \frac{d\pi}{d\tau_1} \cdot \frac{d\tau_1}{d\bar{b}} < 0. \end{aligned} \tag{21}$$

From (21) and the concavity of the welfare function it follows that the optimal value of $\bar{b}$ is the lower when the lender is the leader than in the Nash game. Furthermore, since the optimal value of τ_1 is an increasing function of $\bar{b}$, the optimal value of τ_1 is also lower than its Nash equilibrium level. Formally,

Proposition 4: *Equilibrium τ_1 and $\bar{b}$ are both higher in the Nash game than in the game where the lender bank has a first-mover advantage.*

Note that, unlike the reaction function of the lender, the reaction function of the borrower is positively sloped, the import tariff is strategically complementary to the loan size in the borrower's reaction function. So if the lender relaxes the borrowing constraint, the borrowers reacts by setting an even *higher* tariff than before. The intuition for this is strikingly simple: the benefit to the borrower of achieving a unit reduction in the interest rate becomes greater as the amount borrowed becomes larger. In this case, the lender is able to force the borrower country to lower its tariff level by committing itself to a lower (rather than higher) level of lending, and thereby increasing its profits (compared to the Nash equilibrium). Therefore, although the optimal value of τ_1 is lower than τ_1^N irrespective

[16]In order to avoid third order derivatives, we take μ to be constant.

of who has the first-mover advantage, the optimal value of $\bar{b}$ is lower (higher) than $\bar{b}^N$ when the lender (borrower) is the leader.

We conclude this section by making an overall assessment of the relative desirability of the three scenarios. From Proposition 3 we know that when the borrower is able to precommit to its trade policy, the equilibrium is closer to the first-best than is the Nash equilibrium. Applying Proposition 2, we can say that both the lender and the borrower are likely to be better off when the borrower is the leader than when both act simultaneously.[17] However, when the lender has a first-mover advantage, the optimal amount of lending is even lower than its Nash equilibrium value and therefore the borrower is likely to be worse off in this scenario than in the Nash equilibrium, although the lender will definitely be better off. This discussion suggests that the scenario where the borrower country has a first-mover advantage is possibly the most desirable one from the Pareto point of view. That is, if the borrower country can take the initiative and demonstrate a credible commitment to reducing trade policy distortions, this could be met by a relaxation of borrowing constraints by the lending country – to the benefit of both parties compared to the Nash equilibrium.

4 Endogenous leadership

From the analysis above an interesting question that arises is if the issue of leadership can be determined endogenously. For this to happen, we must have a scenario that will be preferred by both the lender and the borrower as compared to the other two scenarios. In this section, we shall show, with the help of diagrams, that leadership by the borrower can under certain circumstances be an endogenous outcome.

Figures 1 and 2 depict the three equilibria under different conditions. The vertical axis represents tariffs (the instrument for the borrower) and the horizontal line the amount

[17]Note that Proposition 2 gives us the effect of small changes in the instruments whereas the difference between the two equilibria can be large. Therefore, our contention is true subject to this qualification. However, figures 1 and 2 in the following section will confirm conclusion here.

of lending (the instrument for the lender). In both figures the lines $R_L R_L$ and $R_B R_B$ are the reactions functions of the lender and borrower respectively. As has been show in the preceding section, the former is downward – and the latter upward – slopping. The differences between the two figures is that in Figure 2 the reaction function of the lender is flatter and that of the borrower steeper, as compared to Figure 1. The intersection of the two reaction functions, point N, is the Nash equilibrium.

[**Figure 1 and 2 in here**]

u_0 and u_1 are the iso-utility curves for the borrower and π_0 and π_1 are iso-profit curves for the lender with the property that further the iso-utility (iso-profit) curves moves to the east (south) higher is the corresponding utility (profit) level for the borrower (lender). The points S_L (S_B) is the equilibrium for the case where the lender (borrower) is the leader. Note that the iso-profit (iso-utility) curve π_1 (u_1) is tangent to the reaction function of the borrower (lender) at the point S_L (S_B), and attains it peak on the reaction function of the lender (borrower). The curves u_0 and π_0 intersect and attain their peaks at the Nash equilibrium point N. The iso-utility (iso-profit) curve through the point S_L (S_B), which are not drawn, would correspond to utility (profit) level of the borrower (lender) under the leadership of the lender (borrower).

As can be seen from both figures, both the lender and the borrower are better off under the leadership of the borrower as compared to the Nash equilibrium — as assertion that was made on the basis of the analysis in the preceding section. It is to be noted that in Figure 1, leadership by the borrower is in fact better for *both* the lender and the borrower even compared to the scenario where the lender is the leader. In other words, the leadership issue will be endogenously determined in Figure 1. In Figure 2 however this is not the case. There the lender will be better off under its own leadership than under the leadership of the borrower.

The essential difference between the cases shown in Figures 1 and 2 lies in the relative slopes of the borrower's reaction functions. Note that the borrower always prefers its own leadership to the other two forms of interaction. So whether endogenous leadership emerges or not depends on the lender's payoffs. In Figure 1, both reaction functions exhibit 'real rigidity', i.e. in each case, a given move by whoever leads is met by a very small response by whoever follows.[18] This is captured by the fact that the lender's reaction function is relatively steep in τ_1-$\bar{b}$ space, indicating a low elasticity of $\bar{b}$ to changes in τ_1, while the borrower's is relatively flat, indicating a low elasticity of τ_1 to changes in $\bar{b}$.

In the case depicted in Figure 1, if the lender leads, it will cut $\bar{b}$ by a lot in order to get a small reduction in τ_1 in response. If the borrower leads, by contrast, it will cut τ_1 by a lot in order to get a small increase in $\bar{b}$. Thus, leadership by the borrower results in a relatively bigger cut in τ_1 with relatively smaller adjustment in $\bar{b}$ by the lender, so the lender's profits are greater.

In the case depicted in Figure 2, both reaction functions are relatively elastic so in each case the follower reacts strongly to a small move by the leader: a small reduction in $\bar{b}$ elicits a relatively large cut in τ_1 (when the lender leads) while a small cut in τ_1 elicits a relatively large increase in $\bar{b}$ (when the borrower leads), so the lender's profits are higher under its own leadership.

The analysis so far, as depicted in Figures 1 and 2, assumes that the *sequence* of actions (as opposed to the actions themselves) is itself not subject to strategic determination. But, following Hamilton and Slutsky [1990], suppose that at the very outset of $t = 1$, each party decides on *when* within that period they will make their move with respect to their respective instrument. Each party can decide whether to move immediately (at, say, stage 1 of $t = 1$) or with a delay (at stage 2 of $t = 1$). If both borrower and lender decide to move

[18] The concept of 'real rigidity' is used in the literature on menu costs to describe how one monopolistically competitive firm adjusts prices in response to a price change by others, the more inelastic the response, the greater the 'real rigidity'. See Romer [1996,ch 6.12] for more details.

at stage 1 or both decide to move at stage 2, a Nash game ensues with respect to the choice of instruments. If one party decides to move at stage 1 and the other decides to move at stage 2, then the corresponding Stackelberg game ensues.

The payoffs from each combination of moves is as follows (the borrower's actions are in boldface, the lender's in italics):

	Stage 1	*Stage 2*
Stage 1	u^N, π^N	u^B, π^B
Stage 2	u^L, π^L	u^N, π^N

where u^N, u^B and u^L are the borrower's payoffs under Nash, borrower leadership and lender leadership respectively, while π^N, π^B and π^L have similar interpretations for the lender's payoffs. It can now be shown that Stackelberg leadership by the borrower is the unique Nash equilibrium of the endogenous move game. This is because $u^B > u^N$, and $u^N > u^L$, so moving at Stage 1 is a dominant strategy for the borrower. Under iterated dominance, the second row can be deleted from the payoff matrix; thus, since $\pi^B > \pi^N$, the lender will choose to move at Stage 2. This result is stated as the following proposition:

Proposition 5: *Borrower leadership is the unique outcome of the game in which the sequence of moves is itself chosen strategically by each player.*

5 An alternative interpretation of the lender

In this section we provide an alternative interpretation of the monopoly lender and of equation (9). We do so by introducing a foreign country whose private sector is the only source of loans to the borrowing country and whose government determines the size of $\bar{b}$ by imposing a quota on its private sector lenders.

The equations for the foreign country are given by:

$$
\begin{aligned}
E^*\left(1, P_2, \frac{P_3}{1+r^*}, \frac{P_4}{1+r^*}, u^*\right) \quad &+ \quad I^* = \\
+R^{1*}(1, P_2, K^*) \quad &+ \quad \frac{R^{2*}(P_3, P_4, K^*+I^*)}{1+r^*} + \frac{(r-r^*)\bar{b}}{1+r^*} && (22) \\
(1+r)\bar{b} \quad &= \quad P_3E_3^* + P_4E_4^* - R^{2*} && (23) \\
R_3^{2*} \quad &= \quad (1+r^*) && (24)
\end{aligned}
$$

The above equations are analogous to (1)-(3) for the home country. We only need to explain the last term on the right hand side of (22). As just mentioned, we assume that the foreign country imposes a quota on the amount of lending to the home country. This leads to an excess demand for loans in the home country and drives a wedge between the interest rates of the two countries.

Following the convention in the trade theory literature, we assume that the foreign country government applies competitive loan licensing and thereby collects a quota rent amounting to $(r-r^*)\bar{b}$. The reader will immediately realize that our treatment of the credit constraint is akin to the treatment of voluntary export restraints (VERs) in the trade theory literature. There is an important difference, however, between the standard treatment of VERs in the literature and the way we deal with the credit constraint here, and this arises because of the inter-temporal nature of borrowing. In particular, one needs to make some assumption about the time period when the quota rent is actually collected. Since the possible rent from lending arises only in period 2 when the loan is repaid, we assume that the government also collects the license fee from private lenders in period 2, and this quota rent is returned to the household in a lump-sum fashion.

Differentiating (22)-(24), we obtain:

$$(1+r^*)E_5^*\ du^* = (r-r^*)d\bar{b} + \bar{b}\ dr, \tag{25}$$

where dr is as in (5). Note that the right hand side of (25) is the same as that of (9).[19]

6 Conclusion

For a whole host of reasons, many developing countries are unable to borrow as much as they would like from international capital markets. While such countries might benefit from direct interventions such as a tax on borrowing or other controls which help lower domestic demand for foreign funds, such interventions are rarely observed in practice. For such economies, the question arises as to whether they can ameliorate the capital market distortion through the indirect means of trade intervention.

The first part of the paper analyzes the effects of the above policy option in a two-period, multi-good model with endogenous investment by a borrower country which is subject to a credit constraint from a lender country. We find that it can indeed be optimal to intervene in trade, either through a subsidy on exports or a tariff on imports, imposed in the first period, both of which tend to improve the ex-ante current account and thereby lower the demand for funds from overseas.

In the second part of our analysis, we consider a number of different scenarios in which the size of the borrowing constraint is strategically determined by a monopoly banker of the lending country while the borrower country's government chooses the level of the trade intervention. To be precise, we consider three games. In the first, the borrowing country and the lending bank act simultaneously in a Nash fashion and in the other two they act sequentially. We find the level of the tariff is lower in both the sequential games than in the Nash game. However, the level of lending is higher in the game in which the borrower is the leader, and lower in the game in which the lender is the leader, than in the Nash game. In other words, when the borrower is the leader, the equilibrium is closer to the first best.

[19] The second term on the right hand side of (25) gives the terms-of-trade effect. Since the foreign country is the lender, it benefits when the interest rate rises. The first term gives the change in the quota rent for given levels of the interest rates.

This is not the case when the lender is the leader. Therefore, if the borrower country can commit credibly to a lower level of trade intervention, the lender country is likely to respond by relaxing credit controls making both countries better off.

We also find two sets of circumstances under which leadership by the borrower can be an endogenous outcome. First of all, for *some* configurations of payoffs, both the borrower and the lender will be better off under borrower leadership than under that of the lender In such cases, both parties would unanimously agree to letting the borrower move first. Second, if the sequence of moves is itself chosen strategically, leadership by the borrower emerges as the unique equilibrium for *any* configuration of payoffs.

Figure 1: Unanimity in Leadership

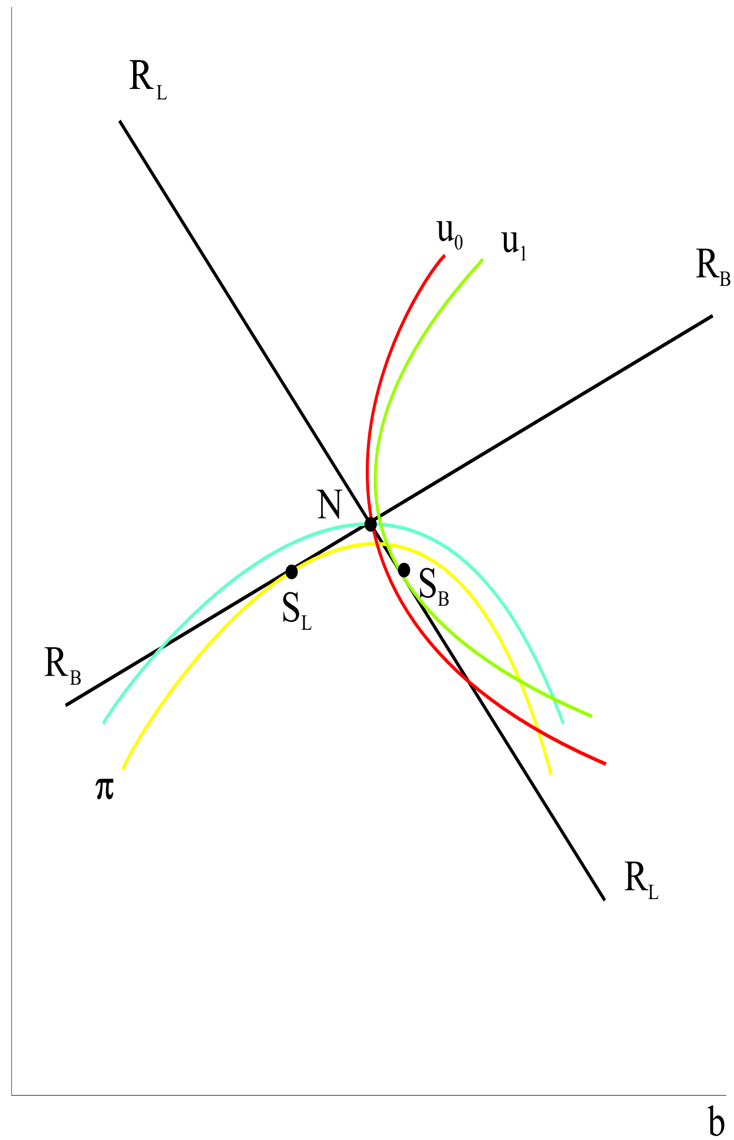
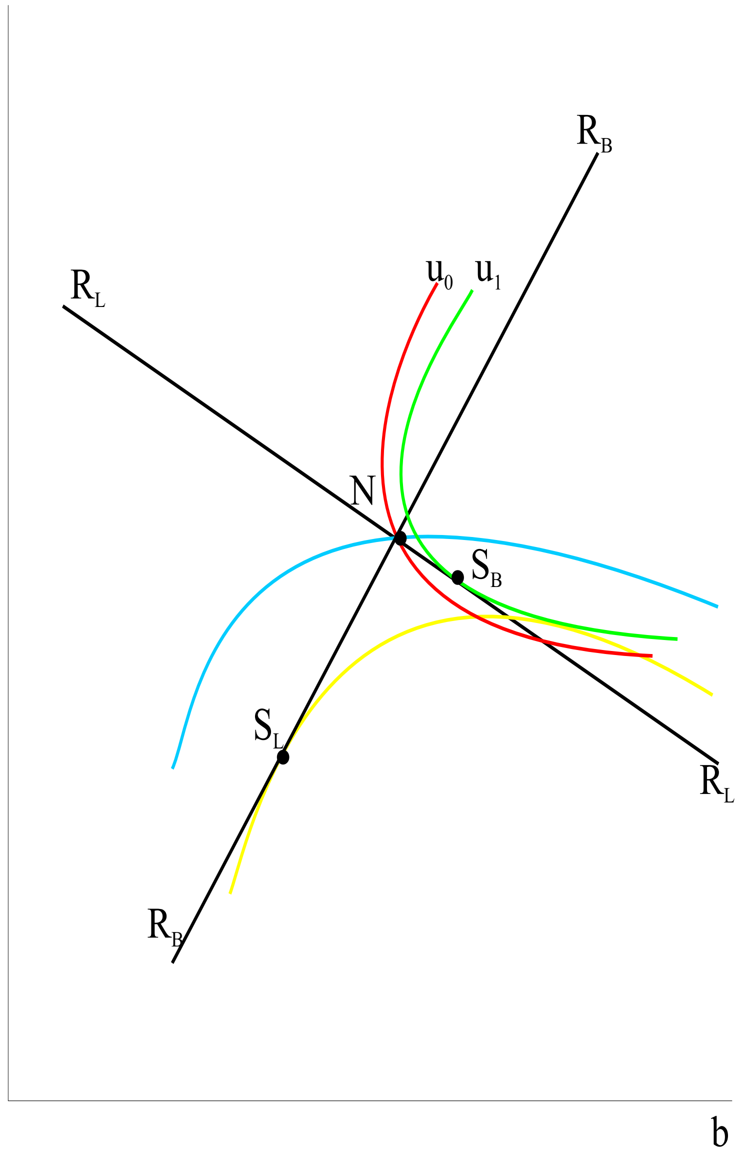


Figure 2: Potential Conflict for Leadership



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