Economics Bulletin

Volume 33, Issue 3

Should Easier Access to Credit Replace Foreign Aid? A Trade-theoretic Analysis

Subhayu Bandyopadhyay
St. Louis Fed

Sajal Lahiri
Southern Illinois University Carbondale

Javed Younas
American University of Sharjah

Abstract

We develop a two-period trade-theoretic model for a recipient country with credit constraints and develop a necessary and sufficient condition for replacing foreign aid by credit to be welfare improving.

Citation: Subhayu Bandyopadhyay and Sajal Lahiri and Javed Younas, (2013) "Should Easier Access to Credit Replace Foreign Aid? A Trade-theoretic Analysis", *Economics Bulletin*, Vol. 33 No. 3 pp. 2320-2327.
Contact: Subhayu Bandyopadhyay - Subhayu.Bandyopadhyay@stls.frb.org, Sajal Lahiri - lahiri@siu.edu, Javed Younas - jyounas@aus.edu.
Submitted: April 22, 2013. **Published:** September 11, 2013.

1. Introduction

Given the age-old controversy about the effectiveness of foreign aid, some alternatives to foreign aid as an instrument to help developing countries have been suggested. One such suggestion has been to replace foreign aid by a better access to markets for the developing countries in the developed world. Based on this idea, a small trade-theoretic literature developed (see, for example, Johnson 1967, Thirwall 1976, Yassin 1982, Kemp and Shimomura 1991, Kemp 1992 and Lahiri and Raimondos-Møller 2000).

A second suggestion has been that foreign aid should be replaced by unfettered access to international private loans and investments (see, for example, Friedman 1958 and Bauer 1971). This second suggestion has not been analyzed in the literature of international trade theory, and that is what we do in this paper.

We construct a two-period, trade-theoretic model of a recipient country which is subject to a binding borrowing constraint. The recipient country receives foreign aid in period 1, and spends a certain fraction of foreign aid for a public input and the rest is given back to the consumers as lump-sum payments. This fraction is chosen optimally by the recipient government. In this framework, we compare the effect of a relaxation of the borrowing constraint with an equivalent amount of foreign aid on the recipient welfare, and develop a necessary and sufficient condition for replacing foreign aid by credits to be welfare improving.[1]

2. The Theoretical Model

There are two periods and a small open economy which is the recipient of foreign aid. In period 1, the recipient country receives T amount of foreign aid, allocates a proportion of it (λ) for the provision of a public input and the rest is given as lump-sum payments to consumers. The amount of public input is denoted by g. In addition to the proportion λ of foreign aid, an amount $\bar{L}$ obtained by lump-sum taxation of its nationals is used to pay for the public input g, which increases production in period 2. Given the difficulties in most countries with lump-sum taxation, we shall take $\bar{L}$ to be exogenous. In each period there are n private goods produced and consumed. The consumption side of the economy is represented by the inter-temporal expenditure function of a representative consumer: $E(p, p/(1+r), u)$, where u is the utility level, and r the interest rate, and the nx1 vector p is the given vector of prices.[2] The revenue functions — which represent the total value added — in the two periods are given by $R^1(p, \bar{K})$ and $R^2(p, \bar{K}+I, g)$ where $\bar{K}$ is the level of initial capital stock

[1] This paper has some similarity with Bandyopadhyay et al. (2013) in terms of the formal model structure. However, the level of foreign aid is endogenously determined by the donor country in Bandyopadhyay et al. (2013), and the substantive issue considered there is the effect of a relaxation of the borrowing constraint on the level of foreign aid.

[2] The partial derivative of an expenditure function with respect to the price of a good is the compensated demand function of that good. For this and other properties of the expenditure function see, for example, Dixit and Norman (1980).

in the recipient country,[3] I is the level of investment made in period 1, and $R^2_{33} \leq 0$, and $R^2_{22} < 0$. We also assume that private capital and public input are complements ($R^2_{23} \geq 0$).

The inter-temporal budget constraint for the representative consumer is:

$$E(p, p/(1+r), u) + I = R^1(p, \bar{K}) + \frac{R^2(p, \bar{K}+I, g)}{1+r} - \bar{L} + f((1-\lambda)T), \tag{1}$$

where $(1-\lambda)T$ is the part of foreign aid that is returned to the representative consumer in recipient country as a lump-sum transfer. It is assumed that the production of one unit of the public input costs one unit of the numeraire good in period 1, and this cost is paid for by lump-sum taxation of the representative consumer. Since $R^1(p, \bar{K})$ includes all factor incomes in period 1, the income generated in the production of the public input is included in the first term of the right-hand side.[4]

Following Lahiri and Raimondos-Møller (1997), we consider the possibility of diminishing return to the part of foreign aid that is returned to the consumers in a lump-sum fashion, and this is represented by the function $f(\cdot)$ with $f' > 0$ and $f'' \leq 0$.[5] This consideration allows us to accommodate the findings in the recent literature that show that, due to a whole host of reasons, the marginal effect of a large flow of foreign aid can be negligible or negative (see Mavrotas (2006) for a discussion of the issues).

The budget constraint for the government is:

$$g = \bar{L} + \lambda T, \tag{2}$$

i.e., public input is financed by a fixed lump-sum taxation and a proportion of foreign aid.

The level of investment in the recipient country is determined optimally by the representative consumer. It is done by setting $\partial u/\partial I = 0$, taking r as given. This gives:

$$1 = R^2_2/(1+r). \tag{3}$$

The left-hand side is the marginal cost of investment in the sense of consumption foregone, and the right-hand side is the present value of the marginal return to investment.[6]

[3]Endowment other than capital are omitted as they do not vary in our analysis. The partial derivative of a revenue function with respect to the price of a good is the output supply function of that good, and the partial derivative with respect to the endowment of a factor gives the price of that factor.

[4]Alternatively, but equivalently in our case, we can define, following Abe (1992), $R^1(p, g)$ as the total factor income from production of private goods and rewrite equation (1) as

$$E(p, p/(1+r), u) + I = R^1(p, g) + (\bar{L} + \lambda T) + R^2(p, \bar{K}+I, g)/(1+r) - \bar{L} + f((1-\lambda)T), \tag{1'}$$

where the second term on the right-hand side represent factor incomes from the production of the public good. Since $-R_g$ is the unit cost of production of the public good, $g = \bar{L} + \lambda T$ and we assume R_g to be unity, total differentiation of (1) and (1′) yield the same result.

[5]As a special case, we shall also consider $f' \equiv 1$, i.e., $f'' = 0$.

[6]For a similar derivation, see, for example, equation (6) on p. 144 in Edwards and van Wijnbergen (1986).

We assume that the representative consumer in the recipient country is subject to a binding borrowing constraint. He/she can borrow only the amount $\bar{B}$ in period 1 and repay this amount with interest in period 2. This constraint is given formally by:[7]

$$B(r,T,\lambda) \equiv p'E_1 + I - \left[R^1 - \bar{L} + f((1-\lambda)T)\right] = \bar{B} = \frac{R^2 - p'E_2}{1+r}, \tag{4}$$

where $B(\cdot)$ is the demand for loans in period 1 in the recipient country.[8]

Since borrowing constraint plays an important role in our analysis, a few words on it's micro-foundation is in order. The easiest way is to think of a private bank in a lending country with monopoly power in overseas lending, which sets the amount lent to the representative consumer of the borrowing country as in Jafarey and Lahiri (2009). A relaxation of the borrowing constraint is then a situation where the bank is given some incentive by the government of the lending country to lend more. This scenario reflects the dominance of large international banks in giving loans to the private sector in developing countries, particularly through the use of loan syndicates which take in funds from many banks of various sizes but are administered by one large 'lead' bank.[9] When banks 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). Credit constraints can also arise under scenarios involving adverse selection and costly monitoring by competitive lenders (Stiglitz and Weiss 1981, Gale and Hellwig 1985 and Williamson 1987).

This completes the description of the basic model. It has four equations in (1)-(4) and four endogenous variables u, g, I and r.

We shall first consider the optimal determination of the proportion λ allocated for the provision of public input g. Having done so, we shall then compare the effect of a change in the level of foreign aid with that of a relaxation of the borrowing constraint.

Differentiating (1)-(2) and using (3) and (4), we get:

$$E_3\, du = -\frac{\bar{B}}{1+r} \cdot dr + \left[\frac{\lambda R_3^2}{1+r} + (1-\lambda)f'\right] dT + T\left[\frac{R_3^2}{1+r} - f'\right] d\lambda, \tag{5}$$

where E_3 is the reciprocal of the marginal utility of income. It is also well-known that $E_{33} > 0$ implying diminishing marginal utility of income.

The first term on the right-hand side of (5) is the intertemporal terms-of-trade effect: an increase in the rate of interest lowers the welfare of the borrower. For a given level of the interest rate, an increase in foreign aid raises the welfare of the recipient in two ways: (i) it

[7]For the treatment of borrowing constraints in similar way see, for example, Djajić (2010).

[8]E_i is the partial derivative with respect to the ith argument of the expenditure function. For example, E_1 is the vector of period-1 consumptions. All vectors are column vectors and for a vector x, its transpose is denoted by x'.

[9]According to Todd (1988, p.27), nine money center banks accounted for 66% of the total debt held by US banks in the 15 most indebted (mainly Latin American) countries.

increases the provision of the public input and thus welfare and this effect is proportional to λ (the proportion of aid allocated for public input provision), and (ii) it increases the lump-sum income of the recipient and this is proportional to the proportion of aid not allocated for public input provision. An increase in λ has a positive effect on recipient welfare (via increase in the provision of public input) and a negative effect (a decrease in the lump-sum income out of foreign aid).

Differentiating (3), we get:

$$R_{22}^2 dI = -R_{23}^2 dg + dr. \tag{6}$$

That is, an increase in public input g increases the level of investment because of the complementarity between the public input and private capital, and an increase in the rate of interest r reduces investment by reducing the present value of the rate of return on investment.

Differentiating (4), and using (5), (2) and (6), we find:

$$\begin{aligned} -\frac{\bar{B}\epsilon}{1+r}\cdot\ dr &= d\bar{B} + \left[-c_y^1\left\{\frac{\lambda R_3^2}{1+r} + (1-\lambda)f'\right\} + \frac{\lambda R_{23}^2}{R_{22}^2} + (1-\lambda)f'\right] dT \\ &\quad -T\left[\frac{c_y^1 R_3^2}{1+r} - \frac{R_{23}^2}{R_{22}^2} + f'(1-c_y^1)\right] d\lambda, \end{aligned} \tag{7}$$

where c_y^1 is the marginal propensity to spend on period 1 consumption, *i.e.*,

$$1 > c_y^1 = \frac{\partial(p'E_1)}{\partial u}\cdot\frac{1}{E_3} = \frac{p'E_{13}}{E_3} > 0,$$

and ϵ is the absolute value of the loans demand elasticity with respect to the interest rate:

$$\epsilon = -\frac{\partial B}{\partial(1+r)}\cdot\frac{1+r}{\bar{B}} > 0.$$

A relaxation of the borrowing constraint $\bar{B}$ increases the supply of loans and thus reduces the rate of interest. An increase in T increases utility of the recipient and thus the level of private consumption in period 1. This increases the demand for loans and thus the equilibrium interest rate. This effect is given by the first term in the coefficient of dT in (7). An increase in T increases the provision of public input making investments more profitable. This increases the demand for investment expenditure and, thus, the demand for loans, increasing the equilibrium interest rate. This is the second term. An increase in T increases the lump-sum income of the recipient in period 1, reducing the demand for loans and, thus, the equilibrium interest rate. This effect is given by the third term in the coefficient of dT. An increase in λ, like an increase in T, has three effects on the rate of interest. The only difference is that an increase in λ reduces the lump-sum income of the recipient in period 1 and this increases the demand for loans and the equilibrium interest rate.

Finally, substituting (7) in (5), we get:

$$\begin{aligned} E_3\ du &= \frac{1}{\epsilon}\cdot d\bar{B} + T\left[\left\{\frac{R_3^2}{1+r} - f'\right\}\left\{\frac{\epsilon - c_y^1}{\epsilon}\right\} + \frac{R_{23}^2}{\epsilon R_{22}^2} - \frac{f'}{\epsilon}\right] d\lambda \\ &+ \left[\left\{\frac{\lambda R_3^2}{1+r} + (1-\lambda)f'\right\}\left\{\frac{\epsilon - c_y^1}{\epsilon}\right\} + \frac{\lambda R_{23}^2}{\epsilon R_{22}^2} + \frac{(1-\lambda)f'}{\epsilon}\right] dT \end{aligned} \tag{8}$$

A relaxation of the borrowing constraint (*i.e.*, an increase in $\bar{B}$) increases welfare by reducing the interest rate. The effects of T and λ on u now have, in addition to the ones discussed after (5), the effects via induced changes in the interest rate.

After setting $\partial u/\partial\lambda = 0$ and some simplifications, we get the first order condition for the recipient government's optimization problem:

$$u_\lambda(\lambda, T, \bar{B}) = \left[\epsilon - c_y^1 - \frac{\epsilon_{23}}{\epsilon_{22}}\right] R_3^2 - (1+r) f'\left(1 + \epsilon - c_y^1\right) = 0, \tag{9}$$

$$\begin{aligned} \text{where} \quad \epsilon_{23} &= \frac{\partial R_3^2}{\partial(\bar{K}+I)} \cdot \frac{\bar{K}+I}{R_3^2} = R_{23}^2 \cdot \frac{\bar{K}+I}{R_3^2} > 0, \\ \epsilon_{22} &= -\frac{\partial R_2^2}{\partial(\bar{K}+I)} \cdot \frac{\bar{K}+I}{R_2^2} = -R_{22}^2 \cdot \frac{\bar{K}+I}{R_2^2} = -R_{22}^2 \cdot \frac{\bar{K}+I}{1+r} > 0. \end{aligned}$$

There are two groups of effects from a rise in λ on the welfare of the recipient. The first is via an increase in the public input provision and these effects are given by the first term in (9). The second group of effects comes via a reduction in the lump-sump income out of foreign aid (induced by an increase in λ), and these effects are given by the second term in (9).

Substituting (9) into (8) we get

$$E_3\ du = \frac{1}{\epsilon} \cdot d\bar{B} + f' \left[1 + \frac{1 - c_y^1}{\epsilon}\right] dT. \tag{10}$$

Interestingly, we find that foreign aid can never be immiserizing in our model. In the presence of borrowing constraint, such immiserization is possible as foreign aid can raise the rate of interest (see, for example, Djajić et al. 1999). After, equation (7) we have explained why foreign aid can raise the rate of interest. Since in our model the part of aid allocated for the production of the public good is chosen optimally by the recipient government, the negative effect of aid cancels out due to the envelope property.

We now examine the effect of replacing foreign aid with foreign loan on recipient welfare. Substituting $dB = -dT$ (replacing aid by loan), equation (10) reduces to:

$$\epsilon E_3\ du = \left[\left(1 - c_y^1 + \epsilon\right) f' - 1\right]\ dT, \tag{11}$$

from which the following result follows:

Proposition 1 *Replacing foreign aid by loan ($dB = -dT > 0$) reduces welfare if and only if $(\epsilon + 1 - c_y^1) f' > 1$.*

From the above proposition it follows that in the special case of $f' = 1$, the necessary and sufficient condition reduces to $\epsilon > c_y^1$. A reduction of aid reduces welfare and the magnitude

of the reduction is proportional to the propensity to spend on period 1 goods c_y^1, and increase in loan increases welfare and the magnitude of the increase is proportional to the demand elasticity for loan ϵ. Thus, replacing aid by the same amount of loan increases welfare if and only if $\epsilon > c_y^1$.

In reality, as discussed before, we know that f' (marginal effect of aid) is small at high levels of foreign aid. Thus, we would expect that in such situations replacing foreign aid by loan would increase welfare. At the other end, there is some evidence to suggest that for small amount of credits, the elasticity of demand is close to unity.[10] Furthermore, propensity to spend c_y^1 satisfies $0 < c_y^1 < 1$ and, at low levels of foreign aid, transaction costs are likely to be limited (i.e., $f' \simeq 1$) and therefore, according to the above proposition, replacing aid by loan will harm the recipient country at low levels of financial transfer (aid or loan).

3. Conclusion

In this paper we developed a two-period trade theoretic model to examine if replacing foreign aid by foreign loan can be welfare improving for the recipient country. We develop a necessary and sufficient condition for that to happen.

References

Abe, K. (1992) "Tariff reform in a small open economy with public production" *International Economic Review* 33, 209-222.

Bandyopadhyay, S., Lahiri, S. and Younas, J. (2013) "On the Substitutability between Foreign Aid and International Credit" *Economics Letters* 118, 255-257.

Bauer, P.T. (1971) *Dissent on Development*, London: Widenfeld and Nicolson.

Dixit, A. K. and Norman, V. (1980) *Theory of International Trade*, Cambridge: Cambridge University Press. Djajić, S. (2010) "Investment Opportunities in the Source Country and Temporary Migration" *Canadian Journal of Economics* 43, 663-682.

Djajić, S., Lahiri, S. and Raimondos-Møller, P. (1999) "Foreign Aid, Domestic Investment and Welfare" *Economic Journal* 109, 698707.

Edwards, S. and van Wijnbergen, S. (1986) "The welfare effects of trade and capital market liberalization" *International Economic Review* 27, 141-148.

Friedman, M. (1958) "Foreign Economic Aid: Means and Objectives" *Yale Review* 47, 500-516..

[10]See, Salazar et. al. 2010.

Gale, D. and Hellwig, M. (1985) "Incentive compatible debt contracts" *Review of Economic Studies* 52, 647-664.

Jafarey, S. and Lahiri, S. (2009) "Developing Country Borrowing From A Monopolistic Lender: Strategic Interactions And Endogenous Leadership" *The Japanese Economic Review* 60, 191-207.

Johnson, H.G. (1967) *Economic Policies Towards Less Developed Countries*, Washington, D.C.: The Brookings Institute.

Kemp, M. C. (1992) "The Static Welfare Economics of Foreign Aid: A Consolidation" in *Equity and Efficiency in Economic Development: Essays in Honor of Benjamin Higgins*, by D. Savoie and I. Brecher, eds., Montreal: McGill-Queens University Press.

Kemp, M.C. and Shimomura,m K. (1991) "Trade or Aid?" in *Trade Policy and International Adjustments*, by A. Takayama, M. Ohyama and H. Ohta, eds., San Diego: Academic Press.

Lahiri, S. and Raimondos-Møller, P. (1997) "Competition for aid and trade policy" *Journal of International Economics* 43, 369-385.

Lahiri, S. and Raimondos-Møller, P. (2000) "Should aid be replaced by better access to trade?, *International Journal of Development Planning Literature* 15, 135-146.

Mavrotas, G. (2006) "Scaling up of foreign aid and the emerging new agenda," in *Theory and Practice of Foreign aid (Frontiers of Economics and Globalization, Volume 1)*, by S.Lahiri, ed., Lndon: Emerald Group Publishing Limited.

Paasche, B. and Zin, S.E. (2001) "Competition and intervention in sovereign debt markets", *NBER Working Paper 8679*.

Salazar, G., Bogany, V. and Turveyz, C. (2010) "The Elasticity of Demand for Microcredit" Working Paper, Cornell University.

Stiglitz, J. E. and Weiss, A. (1981) "Credit rationing in markets with imperfect information" *American Economic Review* 71, 393-410.

Thirwall, A.P. (1976) "When is Trade more Valuable than Aid?" *Journal of Development Studies* 12, 35-41.

Todd, W.F. (1988) "Developing country lending and current banking conditions" *Economic Review*, Federal Reserve bank of Cleveland, 27-36.

Williamson, S. D. (1987) "Costly monitoring, loan contracts, and equilibrium credit rationing" *Quarterly Journal of Economics* 102, 135-146.

Yassin, I.H. (1982) "When is Trade more Valuable than Aid?: Revisited" *World Development* 10, 161-6.