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Logic of Aid in an Intertemporal Setting

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TABLE OF CONTENTS

Page

1. Introduction. 15
2. The framework of analysis 17
3. The effects of aid. 19
   3.1. Potential Pareto improvement 21
   3.2. Strict Pareto improvement 22
   3.3. Transfer paradox 25
4. Concluding remarks. 26
   References. 29

ABSTRACT

This paper studies the welfare implications of temporary foreign aid in the context of a simple two-country model of trade. In addition to its usual effects, a transfer of income in one period is assumed to influence the pattern of consumption of the recipient country in the following period. The implied change in the terms of trade is consistent with a number of possible outcomes with respect to the intertemporal welfare of the donor, the recipient, and the world as a whole. Particular attention is devoted to the conditions for strict Pareto improvement, the only case consistent with the presumption that the acts of giving and receiving aid are voluntary.

1 Introduction

One of the classic topics in international economics is that of the transfer problem. Of its many dimensions, the one which has attracted the most attention concerns the conditions for the occurrence of the transfer paradox and other related outcomes such as potentially and strictly Pareto improving transfers. A necessary (but not sufficient) condition for the manifestation of these different welfare scenarios is the presence of a distortion. The emphasis on distortions, in all the subtle ways of defining them, has been central to the analysis of transfers over the last decade.[1]

It is remarkable that most of the literature on the transfer problem has evolved within the static framework of analysis.[2] This concentration on static models may be explained by noting that a dynamic model of trade can be reduced to a static one under the assumption of undistorted international lending and borrowing. However, as the latter assumption may not always hold – particularly when considering the economic relations between rich and poor nations – a focus on the static analysis of transfers and foreign aid overlooks a potentially important intertemporal distortion.

Another element which may be important in the analysis of foreign aid, yet overlooked in a static setting, is the possibility that aid may have effects which manifest themselves only later on in time. In some cases aid may serve to increase the donor's influence over foreign as well as domestic policies of the recipient. Exercise of such influence can yield significant future benefits for the donor. Similarly, aid in the form of infrastructure projects, technical assistance and training programs can alter the recipient country's production possibilities over time in a way that increases future demand for the donor's exports or raises the future supply of its imports. Another

[1] Kemp (1992) surveys a range of issues related to the transfer paradox and provides references to the literature. See also Bhagwati, Brecher and Hatta (1983, 1985) for a lucid discussion on the role of distortions in the analysis of the transfer problem.

[2] The exceptions are Galor and Polemarchakis (1987) and Haaparanta (1989), which employ an overlapping generations model and Kimbrough (1986) which looks at the macro implications of foreign aid from the perspective of a small-open economy. See also Djajic, Lahiri and Raimondos-Møller (1995) for an intertemporal analysis of transfers in the context of a two-sector model with endogenous investment.

possibility emerges in the case of an intertemporal consumption externality, *viz.* habit formation.[3] A transfer of aid in the first period will increase the recipient country's first-period consumption which may, *ceteris paribus*, affect its consumption pattern in the second period. From this perspective, aid can be seen as an instrument with the power to influence future consumption of the recipient in a direction that is beneficial to the donor.[4]

In studying the welfare implications of aid in the presence of such links between the present and the future, we focus on the simplest case in which the behavior of consumers of the recipient country is characterised by an intertemporal consumption externality. We utilize a basic two-country, two-period model of trade, where aid is given only in the first period. If we confine our analysis strictly to this first period, the standard (non-paradoxical) results emerge with the donor country losing and the recipient country benefiting from the transfer. However, a look at the two economies over time reveals other possibilities. Due to either the 'good will' impact of aid or habit formation, the aid-related increase in the recipient's consumption in the first period is transmitted to the next, generating a period-two terms-of-trade effect. Under certain conditions, this effect improves the donor's welfare in the second period at the expense of the recipient, giving rise to a number of possible outcomes with respect to the intertemporal welfare of the donor, the recipient, and the world as a whole. The paper proceeds to derive the conditions for world (potential Pareto) welfare improvement, individual country (strict Pareto) welfare improvement, and the transfer paradox.

The case of strict Pareto improvement is of particular significance. It is the only one consistent with the notion that the acts of giving and receiving aid are voluntary. Analysis of the conditions for strict Pareto improvement provides some interesting insights related to the circumstances under which a transfer of aid is likely to occur.

[3] Mansoorian (1993) and Obstfeld (1992) are recent examples of interest in the implications of habit formation for macro behavior and economic policy.

[4] According to the United States General Accounting Office (1995), 'The most common argument given for using foreign assistance to promote donor exports is that it will win political support for aid programs by demonstrating a direct benefit to the donor's economy.' (p.22)

2 The framework of analysis

Let us consider a two-period model in which two countries exchange in each period two goods. International lending and borrowing is assumed to be prohibited. In what follows, we use capital letters for first-period variables, lower case letters for second-period variables and an asterisk (*) for the variables of the foreign country. In our analysis of a transfer, it is assumed that the foreign country is the donor, home country is the recipient, and the transfer is temporary in the sense that it occurs only in period one. The transfer is financed in the foreign country by means of a lump-sum tax and distributed in the home country in the form of a lump-sum subsidy.

The budget constraints and the equilibrium condition pertaining to the first period are described below using standard expenditure (E) and revenue (R) functions, where the relative price of the non-numeraire good (P) and the domestic and foreign utility levels (U and U^*) enter as arguments:

$$E(1, P, U) = R(1, P) + T \tag{1}$$

$$E^*(1, P, U^*) = R^*(1, P) - T \tag{2}$$

$$E_P(1, P, U) + E_P^*(1, P, U^*) = R_P(1, P) + R_P^*(1, P). \tag{3}$$

Equations (1) and (2) are the budget constraints for the representative consumer in each country, reflecting a transfer amounting to T units of the numeraire from the foreign to the home country. Equation (3) is the market-clearing condition for the non-numeraire good, equalizing the world demand to the world supply.[5] The market-clearing condition for the numeraire good is omitted due to Walras' Law.

In the second period there are no transfers and the two countries only exchange goods with each other. However, we assume that there is an intertemporal consumption externality that allows first period aid to affect the recipient's preferences in

[5] Partial derivative of the revenue (expenditure) function with respect to price gives the supply (compensated demand) function for the good.

the second period. The aid-induced increase in period-one consumption of the non-numeraire good, which is the donor's export good, is assumed to shift the recipient's second-period preferences in favor of that commodity. This shift may reflect a number of different phenomena related to a transfer of aid. One possibility is that aid given in period one contributes to an atmosphere of 'good will' which may be instrumental in attracting consumers of the recipient country to the donor's export good in period two. Alternatively, the aid-related increase in period-one consumption of the donor's export good may, due to increased exposure to and familiarity with that good, have a similar effect on the recipient's preferences in the second period. In what follows, we describe the process more precisely and refer to it as 'habit formation'.

The equilibrium conditions for the second period can be written as follows:

$$e(1,p,u;E_P) = r(1,p), \quad \text{where} \quad \begin{array}{l} e_E = 0,\ e_{uE} = 0 \\ e_{1E} < 0,\ e_{pE} > 0 \end{array} \tag{4}$$

$$e^*(1,p,u^*) = r^*(1,p) \tag{5}$$

$$e_p(1,p,u;E_P) + e_p^*(1,p,u^*) = r_p(1,p) + r_p^*(1,p). \tag{6}$$

As indicated in (4), due to habit formation, an increase in the period-one consumption of the non-numeraire good tends to shift the period-two expenditure of the recipient (at any given level of utility and prices) away from the numeraire commodity and towards the non-numeraire.[6] Equations (5) and (6) are, respectively, the period-two budget constraint for the foreign country and the market-clearing condition for the non-numeraire commodity in period two.

Finally, the intertemporal utility functions for the two countries $W(U,u)$ and $W^*(U^*,u^*)$ are assumed to take the following form:

$$W(U,u) = U + \frac{u}{1+\delta} \tag{7}$$

$$W^*(U^*,u^*) = U^* + \frac{u^*}{1+\delta^*}, \tag{8}$$

[6] Alternatively, if we were to model the 'good will' effect of period-one aid, we would write (4) as $e(1,p,u;T) = r(1,p)$ where $e_T = e_{uT} = 0$ and $e_{1T} < 0, e_{pT} > 0$.

where δ and δ^* are the (constant) rates of time preference of the recipient and the donor country, respectively. Equations (1) to (8) can be solved for the eight endogenous variables of the model $(U, U^*, u, u^*, W, W^*, P, p)$ as functions of T. The next section examines the implications for these variables of a small change in T.

3 The effects of aid

Total differentiation of (1) and (2) yields:

$$E_U dU = -M dP + dT \tag{9}$$

$$E_U^* dU^* = M dP - dT \tag{10}$$

where $M = E_P - R_P$ $(= -M^*)$ is the recipient's excess demand for the non-numeraire good which we assume to be positive. Thus, for each country there is an indirect terms-of-trade effect and a direct income effect of a transfer. The former effect can be derived from (1)-(3) as follows:

$$\bar{Z} dP = (C_Y^* - C_Y) dT, \tag{11}$$

where $\bar{Z} = Z + Z^* - MC_Y + MC_Y^* < 0$ is the Walrasian stability condition for the first period equilibrium;[7] $C_Y \equiv E_{PU}/E_U > 0$ (thus PC_Y is the marginal propensity to consume the non-numeraire commodity in the first period), and $Z = E_{PP} - R_{PP} < 0$ is the (inverse of the) slope of the compensated excess demand function for the non-numeraire good in the recipient country. C_Y^* and Z^* are similarly defined. Equation (11) confirms the standard result that the donor's terms-of-trade improve if and only if the recipient's marginal propensity to consume the non-numeraire commodity is larger than that of the donor, i.e., $dP/dT > 0$ if and only if $C_Y^* - C_Y < 0$.

Making use of (11) we can now rewrite (9) and (10) as follows:

$$E_U dU = \frac{Z + Z^*}{\bar{Z}} dT \tag{12}$$

[7] Local Walrasian stability is assured when the slope of the world uncompensated excess demand function is negative.

$$E_U^* dU^* = -\frac{Z + Z^*}{\bar{Z}} dT \tag{13}$$

Thus, regardless of the magnitude and direction of the terms-of-trade effect, in a stable world economy, aid always benefits the recipient and harms the donor in the first period. In other words, the transfer paradox cannot occur in this one-period world.

However, the transfer in the first period also has a second period effect due to habit formation. Having assumed that $e_B = 0$, welfare is affected only through changes in second-period prices.[8] From (4) and (5) we obtain:

$$e_u du = -m dp \tag{14}$$

$$e_u^* du^* = m dp \tag{15}$$

where $m = e_p - r_p = -m^* > 0$ is the recipient's second period excess demand function for the non-numeraire commodity.

From (6), and using (14) and (15), we can solve for the second period terms-of-trade effect relating dp to dE_p. With the aid of (3) and (11) to (13), we can then express dE_p as a function of dT to obtain:

$$\bar{z} dp = -\frac{e_{pE}}{\bar{Z}} \left[C_Y (Z + Z^*) + E_{PP} (C_Y^* - C_Y) \right] dT \tag{16}$$

where $\bar{z} = z + z^* - mc_y + mc_y^* < 0$ is the stability condition in the second period, $c_y \equiv e_{pu}/e_u > 0$ (so that pc_y is the second period marginal propensity to consume the non-numeraire good), and $z = e_{pp} - r_{pp} < 0$ is the (inverse of the) slope of the second period compensated excess demand function, with similar notation used for the foreign country. Assuming that the non-numeraire good is normal, the bracketed

[8] While we assume that $e_E = 0$, it is important to note that, in general, consumption experience in one period may affect the value of e necessary to attain a particular level of utility at any given set of prices. Thus Mansoorian (1993) and Obstfeld (1992) assume that, at a given level of utility, e is an increasing function of the habitual standard of living. Alternatively, if consumption experience serves to enlighten the consumer by revealing beneficial characteristics of a commodity, it may serve to *lower* the amount of expenditure needed to attain a given level of utility. Our assumption that $e_E = 0$ enables us to focus on the benchmark case where a transfer affects welfare, as in the traditionl setting, only through its direct income and terms-of-trade effects. If we assumed, instead, $e_E < 0$ ($e_E > 0$) we would be stacking the cards in favor of (against) a welfare improvement for the recipient country and the world economy as a whole.

term on the right hand side is negative.[9] The existence of the habit formation effect ($e_{pE} > 0$) then results in a terms-of-trade improvement for the donor in period two, i.e. $dp/dT > 0$. Recalling equations (14) and (15), it follows that a grant of aid in the first period benefits the donor and harms the recipient in the second period.

In order to simplify the notation in what follows, let us write (16) as $\bar{z}dp = -HdT$, where

$$H = \frac{e_{pE}}{\bar{Z}}[C_Y(Z + Z^*) + E_{PP}(C_Y^* - C_Y)] > 0, \tag{17}$$

assuming normality of the non-numeraire commodity. The value of H measures the impact of a unit transfer in period one on the recipient's demand for the non-numeraire good in period two at any given value of p.

It remains to determine the effect on the intertemporal welfare of the two economies. What we know so far is that the recipient definitely gains in the first period and loses in the second period, while the opposite happens to the donor country. Differentiating (7) and (8) and using (12)-(17) we derive the following intertemporal welfare effects:

$$E_U\frac{dW}{dT} = \frac{Z + Z^*}{\bar{Z}} + \frac{mH}{(1+\rho)\bar{z}}, \tag{18}$$

$$E_U^*\frac{dW^*}{dT} = -\frac{Z + Z^*}{\bar{Z}} - \frac{mH}{(1+\rho^*)\bar{z}}, \tag{19}$$

where

$$\rho = \frac{(1+\delta)e_u}{E_U} - 1 \quad \text{and} \quad \rho^* = \frac{(1+\delta^*)e_u^*}{E_U^*} - 1$$

are the market-clearing real rates of interest at home and abroad. Due to the assumed absence of international lending and borrowing, ρ is generally not equal to $\rho*$.

3.1 Potential Pareto improvement

Having derived the basic welfare equations, we shall now examine the necessary and sufficient conditions for aid to be: (i) potentially Pareto improving, in the sense of

[9] Simple substitution of Z will demonstrate that $C_Y(Z+Z^*)+E_{PP}(C_Y^*-C_Y) = C_Y(Z^*-R_{PP})+E_{PP}(C_Y^*)$. Positive values of C_Y^* and C_Y guarantee that this expression is negative.

increasing the sum of the individual country welfare, (ii) strictly Pareto improving, and (iii) donor enriching and recipient immiserizing.

We start with the case of world welfare improvement, i.e., potential Pareto improvement. Summing up equations (18) and (19) we obtain:

$$E_U \frac{dW}{dT} + E_U^* \frac{dW^*}{dT} = \frac{mH}{\tilde{z}} \left(\frac{1}{1+\rho} - \frac{1}{1+\rho^*} \right). \tag{20}$$

Since $mH/\tilde{z} < 0$, Proposition 1 follows directly from the above equation.

Proposition 1. *In the presence of habit formation, as defined above, an income transfer between countries increases world welfare if and only if the real rate of interest of the recipient country is greater than that of the donor country. Formally,*

$$E_U \frac{dW}{dT} + E_U^* \frac{dW^*}{dT} > 0 \qquad \text{iff} \qquad \rho > \rho^*.$$

The intuition behind this result is rather simple. What matters for world welfare are only the gains and loses in the second period. This is because the first-period welfare changes of the two countries sum to zero (see (12) and (13)). In period two we know that the donor gains and the recipient loses and that the *undiscounted* sum of the two equals zero (see (14) and (15)). However, in the presence of international borrowing and lending constraints, the real rates of interest are generally different in the two economies, i.e. $\rho \neq \rho^*$, making the discounted value of the gains and loses different. Obviously, if the donor country has a lower real rate of interest than the recipient, the discounted gains enjoyed by the donor in period two are larger than the discounted loses of the recipient, giving rise to a possibility of a potential Pareto improvement due to a transfer.

3.2 Strict Pareto improvement

When it comes to transactions involving temporary aid, the condition under which there is a strict Pareto improvement, allowing both the donor and the recipient to

benefit, is of particular interest. It is the only case consistent with the presumption that both parties engage in the transaction on a voluntary basis. Recalling equations (18) and (19), we arrive at Proposition 2.

Proposition 2. *In the presence of habit formation, as defined above, an income transfer results in a strict Pareto improvement, i.e.* $\frac{dW}{dT} > 0$ *and* $\frac{dW^*}{dT} > 0$, *if and only if the following relation holds:*

$$\frac{1}{1+\rho^*} > A > \frac{1}{1+\rho}, \tag{21}$$

where

$$A = \frac{(Z+Z^*)/\bar{Z}}{-mH/\bar{z}} > 0.$$

The variable A, defined in proposition 2, is the ratio of the recipient's first period gain to the current value of the second period loss associated with the transfer. Correspondingly, from the point of view of the donor, A is the ratio of the period-one loss to the current value of the period-two gain.

In assessing the possible range of magnitude of A, we note that the value of the numerator is positive (assuming stability), but could be either greater or smaller than unity, depending on whether the period-one terms-of-trade effect favors the recipient or the donor. In the denominator, H measures the impact of a unit transfer in period one on the recipient's demand for the non-numeraire good in period two at any given value of p. As noted earlier, assuming the non-numeraire commodity is normal, $H > 0$. Moreover, it is proportional to the magnitude of the habit-formation effect (e_{pE}). Finally, the expression $-m/\bar{z}$ measures the decline in current income of the home country in period two as a result of the terms-of-trade deterioration caused by a (habit-induced) unit increase in its period-two demand for the non-numeraire good. This expression is positive, assuming stability, and may be written as $1/[\eta+\eta^*+p(c_y-c_y^*)] > 0$, where $\eta > 0$ and $\eta^* > 0$ are, respectively, the home country's compensated elasticity

of demand for imports and the foreign country's compensated elasticity of supply of exports. Under the reasonable assumption that $c_y^* > c_y$, the denominator of A increases without limit as the value of $\eta + \eta^*$ becomes smaller, approaching $p(c_y^* - c_y)$. Accordingly, A can be either smaller or larger than unity and its value is inversely related to the magnitude of the habit-formation effect and directly related to the home country's elasticity of demand for imports and the foreign elasticity of supply of exports.

Let us now turn to condition (21) as a whole and ask under what particular circumstances is it likely to be satisfied. Clearly, the probability of a potential aid project satisfying this criteria is larger, the larger the gap between the real rates of interest of the two countries. A given aid project which is beneficial to the donor, satisfying $1/(1+\rho^*) > A$ is more likely to benefit the recipient, the higher the real rate of interest in the recipient country, i.e., the greater the scarcity of present goods in relation to the expected scarcity of future goods. In reality this type of environment is typically observed in less developed countries following a crop failure (or some other natural or man-made disaster) which suddenly creates a shortage of present goods. Lack of marketable assets, particularly those which can be traded internationally, prevents the damaged economy in such cases from acquiring goods from abroad, except through aid. Each unit of aid is then of precious value to the recipient, at least in relation to a unit of output in the future when production is expected to return to normal. That is, disasters experienced by populations lacking tradable assets drive the real rate of interest to high levels, approaching infinity in some extreme cases. But then A is necessarily greater than $1/(1+\rho)$, making the recipient of temporary aid better off, even if the current value of the period-two loss is very large in relation to the period-one gain.

This disaster environment presents an ideal opportunity for a potential donor country with a low real rate of interest to offer temporary aid to the recipient in exchange for 'future income'. The modality of shifting future income back from the

recipient to the donor can take many different forms. One which is consistent with the example developed in this paper involves a period-two terms of trade improvement for the donor as temporary aid helps cultivate a friendly and receptive market for its exports in the recipient country. Corresponding to these benefits are the period-two losses of the recipient which have a low present value when discounted using the recipient's high real rate of interest. From this perspective, temporary aid is essentially a vehicle for exchanging present for future income between countries with different discount rates when other more efficient mechanisms for intertemporal trade are absent.

By contrast, if a country with a low real rate of interest and a large stock of tradable assets experiences a natural disaster, the scope for mutually beneficial international aid transfers is much more limited. In that case, profitable intertemporal trading opportunities have already been arbitraged away through international capital flows. Offers of temporary aid in the aftermath of a natural disaster are then likely to be rejected by the potential recipient on the grounds of being too costly (that is, if the donor country has done its calculations correctly).

3.3 Transfer paradox

We consider next the case of the transfer paradox, whereby a temporary transfer enriches the donor at the expense of the recipient.

Proposition 3. *In the presence of habit formation, as defined above, an income transfer will lead to the transfer paradox, i.e.* $\frac{dW}{dT} < 0$ *and* $\frac{dW^*}{dT} > 0$, *if and only if the following relation holds:*

$$\frac{1}{1+\rho^*} > A \quad \text{and} \quad \frac{1}{1+\rho} > A. \tag{22}$$

The first inequality states that the discounted magnitude of the period-two gain for the donor must exceed the period-one loss. That is, provision of aid in period

one must be 'productive' from the point of view of the donor, in the sense of yielding a rate of return which is higher than that available domestically. From the point of view of the recipient, as indicated by the second inequality, the present value of the period-two loss must be greater than the benefits arising from the transfer in period one. For any value of A that satisfies the first inequality, the transfer paradox is more likely to emerge the narrower the real interest differential between the recipient and the donor, i.e., the narrower the scope for gains from intertemporal trade for the two economies.

4 Concluding Remarks

This paper examines the welfare implications of temporary foreign aid in the context of an intertemporal model of trade. The intertemporal framework has the virtue of enabling us to consider the case where the costs and benefits of an aid transfer may change over time for both the donor and the recipient. Explicit consideration of time also brings into focus issues related to the international credit market. An important share of foreign aid goes from the rich to poor countries which are separated by barriers to international lending and borrowing. Such barriers, while obviously overlooked in a static setting, constitute a distortion which plays an important role in the welfare analysis of transfers.

The present study considers these intertemporal dimensions of the transfer problem in the context of a two-period, two-country model of trade. Assuming stability, a temporary transfer of income in the first period is shown to increase period-one welfare of the recipient and lower that of the donor. However, in the presence of habit formation or 'good will' effects, period-one aid may serve to shift preferences of the recipient in favor of the donor's export good in period two. Assuming the donor's export good is normal, the terms-of-trade effect associated with this shift improves the second-period welfare of the donor at the expense of the recipient. When the effect

is sufficiently large and the real rate of interest sufficiently low, the donor's period-two gain dominates its period-one loss.

The same transaction can also result in a net increase in welfare of the recipient country, provided the real rate of interest used to discount the period-two loss is sufficiently high, making its present value smaller than the period-one gain. One is likely to observe this in less developed countries following an adverse supply shock which suddenly creates a shortage of present goods, driving up the country's real rate of interest, while lack of tradable assets prevents the economy from acquiring goods from abroad. Consequently, each unit of aid is of great value to the recipient, at least in relation to a unit of future output. By accepting foreign aid, the country enjoys an improvement in welfare, even if the current value of the terms-of-trade loss in the second period is large in relation to the current value of the aid transfer itself.

From this perspective, temporary aid is seen as a vehicle for 'intertemporal' trade between economies with different discount rates when other more efficient mechanisms for international lending and borrowing are absent. By contrast, if the real rates of interest are equalized across countries, a temporary transfer which shifts income from the donor to the recipient in one period and in the opposite direction (via the terms-of-trade effect) in the next, has no power to generate a welfare improvement in the world economy as a whole. This rules out the possibility of both countries benefiting from a temporary aid transaction. Our conclusions, however, require appropriate modification in a more general setting where the donor enjoys satisfaction from the act of the transfer itself or when the transfer serves to overcome the effects of some other distortion, thereby improving the efficiency of production or consumption in one or both economies.

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