

Optimal Income Transfers and Tariffs*

By

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Abstract

This paper investigates the optimality of international income transfers in a two-country model in which each country engages in non-cooperative trade policy behaviour. It is shown that unconditional income transfers can never be optimal for the donor country, which not only suffers the loss of income but is harmed as the recipient responds optimally by raising tariffs. It is further shown that it is possible for the donor to attach carefully designed conditionality rules to the aid package to ensure that the recipient will agree to the package and that the donor's welfare is improved. In fact, the use of conditional income transfers is shown to result in a Pareto efficient equilibrium.

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1 Introduction

There are many studies in the literature that deal with the welfare effects of income transfers between nations in a general equilibrium setting.¹ An important impetus for this extensive literature was the demonstration of the transfer paradox; that the donor country could actually gain from a transfer of income to another, and that the recipient could lose as a result of the gift. The reason for this paradoxical result is that the transfer gives rise to a terms-of-trade effect that is especially beneficial to the donor and detrimental to the recipient. Subsequently, many papers have established conditions under which this paradox will or will not occur.²

A common feature of this literature is the assumption that international trade is either free of policy impediments or that the impediments to trade are exogenously given trade taxes.³ This assumption is made, for example, in Bhagwati, Brecher and Hatta (1983) and Turunen-Red and Woodland (1988), who examine the welfare implications of transfers in models containing fixed trade taxes. These papers point out the importance of the inferiority of goods in consumption and of non-optimal distortions for the existence of the transfer paradox. A second feature commonly present in these models is the assumption that the transfer is exogenously given and is chosen independently of the other policy instruments. The donor is assumed to make a transfer and the recipient is assumed to accept it, and the consequences of this exogenously given aid are then analyzed. The question of optimality of the transfer or of how the transfer relates to the overall policy agenda of the donor are not considered in the literature. A third feature of the literature on transfers concerns the growing number of studies of tied aid, to which our paper relates closely. The issue of tied aid has been examined

¹We shall use throughout the paper the terms income transfers and foreign aid interchangeably.

²Early work by Samuelson (1954) was followed by demonstrations of paradoxes by Gale (1974), Ohyama (1974), Brecher and Bhagwati (1982) and Bhagwati, Brecher and Hatta (1983) among others. Some of the early literature is reviewed by Bhagwati, Brecher and Hatta (1984); a more recent survey is provided by Kemp (1992).

³A possible exception in the literature is the paper by Bhagwati, Brecher and Hatta (1985), who consider transfers in a model in which the tariff is influenced endogenously by rent-seeking, lobbying activities.

in Kemp and Kojima (1985), Schweinberger (1990) and Hatzipanayotou and Michael (1995). In each of these papers the aid is tied in the sense that the donor provides it on the agreement that the recipient spends the aid in a pre-determined manner, for example that a given proportion of it is spent on the donor's export good. Accordingly, the aid is tied to its expenditure, but not to the trade policy of the recipient, which is assumed to be given.⁴ In this literature there is no discussion of whether such a contract is optimal for the donor. In other words, the literature assumes that the tying rule is exogenous.

The purpose of the present paper is to relax each of these three assumptions, viz. the exogeneity of trade taxes, transfers and of the tying rule, and to analyze international transfers in a model where both transfers and trade taxes are endogenously chosen. In this sense, our focus is on the welfare implications of transfers in a context where the trade policies of both countries are endogenously determined along with the amount of aid.

The justification for treating trade taxes endogenously is based upon the premise that the countries in question are large enough to influence world prices by their policy actions. In the transfer literature world prices are endogenous and are at the heart of the analysis. If the countries involved in the transfer of income are large enough to affect world prices, they are large enough to strategically choose their trade taxes. We shall therefore assume that they play a Nash game in trade taxes. This assumption sets our model apart from such income transfer studies as Bhagwati, Brecher and Hatta (1983) and Turunen-Red and Woodland (1988), that assume given trade policies.

While it is clearly the case that one important reason for undertaking foreign aid is altruism and a sense of social duty, we concentrate totally upon selfish reasons for aid. We assume that aid is only given if the donor perceives a benefit, and will

⁴Two exceptions are the papers by Lahiri and Raimondos (1995) and Lahiri and Raimondos-Møller (1997a), who examine the welfare effects of aid tied to the reform of exogenously given quotas and tariffs, respectively.

only be accepted if the recipient also perceives a benefit. Accordingly, we are viewing aid as a source of Pareto improvement in welfare for the countries involved.⁵ More specifically, we treat the decision to provide (and accept) aid as part of the countries' optimal policy decision. Within this framework we examine the optimality of tied aid. Given that aid and trade taxes constitute the policy instruments of each country, it seems plausible to imagine the donor country using aid as a lever to help shift the trade policy of the recipient to a position more conducive to the donor's welfare. Our paper seeks to determine the optimal policy choice of the donor, which includes not only the amount of aid and its own trade tax, but also the required change in the trade tax of the recipient; that is, the optimal tying rule.

Following the formulation of the model (section 2) consisting of two countries engaged in trade in a perfectly competitive environment, we consider three policy scenarios. Section 3 deals with the first of these policy scenarios in which both countries' governments choose their trade taxes and aid instruments simultaneously in a non-cooperative Nash policy game. It is shown that the welfare of the donor always goes down with aid and, hence, that it is never optimal for the country to give aid. In the second policy scenario, dealt with in section 4, we consider a two-stage game in which the trade taxes are chosen at the second stage, given the first stage choice on the level of aid. Again, it is shown that in this context (under plausible assumptions) it will never pay the potential donor to offer any aid. The donor not only loses the benefit of the income given up as aid, but also finds that the recipient responds by raising its import tax and hence turning the equilibrium terms of trade against the donor. The donor thus suffers a double loss of welfare and so will decide against providing aid. The result that aid is never optimal extends the previous literature by its relaxation of the assumption that trade taxes are fixed. That aid will not be given when the two countries optimally choose their trade taxes also implies that the donor will only find it in its interest to provide foreign aid if there is non-optimal tariff policy behaviour on

⁵Economic motivation of donors is well documented in the literature. See, for example, Maizels and Nissanke (1984).

the part of the recipient. The third scenario, covered in section 5, therefore deals with the case where the donor offers tied aid. In this case, the donor offers the recipient an amount of aid conditional upon the recipient undertaking a trade tax reform that is determined by the donor. It is shown that there exist tied aid offers that will make both donor and recipient better off than at the Nash equilibrium and that this new equilibrium is sustainable by the threat of a return to the Nash equilibrium. Moreover, Pareto efficiency can be achieved in this final scenario. Our results therefore suggest an important primary role for international income transfers as a lever for the encouragement of tariff reforms. This is in contrast to most of the existing literature that provides transfers with a secondary role of accommodating tariff reforms.⁶ In this respect, our paper supports the argument for international income transfers as a primary policy instrument as developed by Kowalczyk and Sjöström (1994).

2 The Model

There are two countries labeled donor (α) and recipient (β), and two tradable goods, 1 and 2. All product and factor markets are assumed to be perfectly competitive. Both countries have convex technologies and preferences, but their technologies, preferences, and factor endowments may be different. Without loss of generality, good 1 is chosen as the numeraire, and p denotes the international relative price of good 2.

Both countries are active in choosing trade policies. The specific trade tax imposed by country i on good 2 is denoted by t^i , $i = \alpha, \beta$. A positive t^i is interpreted as a tax if good 2 is imported and as a subsidy if good 2 is exported, with the opposite interpretation if t^i is negative. Country α , the donor, also gives an aid of $T \geq 0$ to country β , the recipient, in terms of the numeraire good.

We denote the revenue and expenditure functions of country i by $r^i(1, p + t^i)$ and $e^i(1, p + t^i, u^i)$, respectively, where u^i is the social utility level, and $p + t^i$ is the

⁶See, for example, Turunen-Red and Woodland (1991) who prove the existence of a variety of Pareto-improving multilateral tariff reforms assuming that accompanying international income transfers are possible.

domestic relative price of good 2.⁷ The trade expenditure function of country i can be defined as $E^i(1, p + t^i, u^i) \equiv e^i(1, p + t^i, u^i) - r^i(1, p + t^i)$. The (compensated) import demand function for good 2 in country i is equal to $m^i(1, p + t^i, u^i) = E_p^i(1, p + t^i, u^i) \equiv \partial E^i / \partial (p + t^i)$, where, for simplicity, we use subindex p to denote the partial derivative of the trade expenditure function with respect to the domestic price of good 2. We assume that the trade expenditure of each country is strictly concave in the price of the non-numeraire good p , implying that $E_{pp}^i \equiv \partial^2 E^i / \partial (p + t^i)^2 < 0$.⁸

Assuming that the entire trade tax revenue and the foreign aid is distributed to the consumers in a lump-sum fashion, we can write the national budget constraints as:

$$E^\alpha(1, p + t^\alpha, u^\alpha) = -T + t^\alpha m^\alpha, \quad (1)$$

$$E^\beta(1, p + t^\beta, u^\beta) = T + t^\beta m^\beta. \quad (2)$$

The model is completed with the equilibrium condition for the world market of the non-numeraire good, viz. exports of the one country need to be equal to imports of the other:⁹

$$m^\alpha(1, p + t^\alpha, u^\alpha) + m^\beta(1, p + t^\beta, u^\beta) = 0. \quad (3)$$

Given the policy instruments — the tariffs t^α and t^β and the income transfer T — (1)-(3) determine the equilibrium price ratio, p , and the consumers' utility levels, u^α and u^β . Accordingly, the welfare levels of the two consumers can be expressed as reduced-form functions of the aid and the tariffs and these relationships may be expressed as $u^i = u^i(T, t^\alpha, t^\beta)$, $i = \alpha, \beta$.

⁷Since factor endowments do not change in our analysis, they are left out of the revenue functions.

⁸The revenue function is convex, and the expenditure function concave, in commodity prices, implying that the trade expenditure function is concave in commodity prices. Hence the Hessian matrix of the trade expenditure function is negative semidefinite. See Dixit and Norman (1980), Woodland (1982) and Wong (1995) for a textbook exposition of duality in trade theory. To facilitate the comparative static exercises in the present paper, we make a slightly stronger assumption that $E_{pp} < 0$, i.e., the compensated demand for each good declines with its own price.

⁹The world market clearing equation for the numeraire commodity has been omitted due to Walras's law.

To facilitate the analysis, we totally differentiate the budget constraints of the countries to give:

$$E_u^\alpha (1 - t^\alpha c_y^\alpha) du^\alpha = -dT - (m^\alpha - t^\alpha E_{pp}^\alpha) dp + t^\alpha E_{pp}^\alpha dt^\alpha, \quad (4)$$

$$E_u^\beta (1 - t^\beta c_y^\beta) du^\beta = dT - (m^\beta - t^\beta E_{pp}^\beta) dp + t^\beta E_{pp}^\beta dt^\beta, \quad (5)$$

where $c_y^i \equiv E_{pu}^i/E_u^i$, and $(p + t^i)c_y^i$ is the marginal propensity to consume the non-numeraire good. The three terms on the right hand sides of the above two welfare equations are respectively the direct effect of aid, the terms of trade effect and the effect of a change in the rate of tariff. The first two effects are well known in the literature on the transfer paradox. The third effect is new and, as we shall see, will play an important role in our analysis.

Totally differentiating (3), and using (4) and (5) we get:

$$Z dp = \left(\frac{c_y^\alpha}{1 - t^\alpha c_y^\alpha} - \frac{c_y^\beta}{1 - t^\beta c_y^\beta} \right) dT - \frac{E_{pp}^\beta}{1 - t^\beta c_y^\beta} dt^\beta - \frac{E_{pp}^\alpha}{1 - t^\alpha c_y^\alpha} dt^\alpha, \quad (6)$$

where

$$Z = \frac{E_{pp}^\alpha - m^\alpha c_y^\alpha}{1 - t^\alpha c_y^\alpha} + \frac{E_{pp}^\beta - m^\beta c_y^\beta}{1 - t^\beta c_y^\beta}$$

is the slope of the uncompensated world excess demand function. For the system to be Walrasian stable this slope needs to be negative, i.e. $Z < 0$, an assumption we make throughout the paper. Once again the first term on the

right hand side of (6) is well known in the literature. A transfer shrinks demand from the donor country and expands that from the recipient country. The magnitude of the net shift in the demand function, and therefore the equilibrium level of price, depends on the size of the marginal propensities in the two countries.

Finally, the individual welfare effects of a policy change are obtained by substituting (6) into (4) and (5) to give:

$$\tilde{Z} E_u^\alpha du^\alpha = -A dT + B E_{pp}^\alpha dt^\alpha + (m^\alpha - t^\alpha E_{pp}^\alpha) E_{pp}^\beta dt^\beta, \quad (7)$$

$$\tilde{Z} E_u^\beta du^\beta = C dT + D E_{pp}^\beta dt^\beta + (m^\beta - t^\beta E_{pp}^\beta) E_{pp}^\alpha dt^\alpha, \quad (8)$$

where $\tilde{Z} \equiv Z(1 - t^\alpha c_y^\alpha)(1 - t^\beta c_y^\beta)$ and

$$\begin{aligned} A &= E_{pp}^\beta + E_{pp}^\alpha [1 - (t^\beta - t^\alpha) c_y^\beta], \\ B &= m^\alpha (1 - t^\beta c_y^\beta) + t^\alpha (E_{pp}^\beta - m^\beta c_y^\beta), \\ C &= E_{pp}^\alpha + E_{pp}^\beta [1 - (t^\alpha - t^\beta) c_y^\alpha], \\ D &= m^\beta (1 - t^\alpha c_y^\alpha) + t^\beta (E_{pp}^\alpha - m^\alpha c_y^\alpha). \end{aligned}$$

Equations (6)-(8) express the solutions for the changes in the world price and utility levels in terms of the changes in the policy parameters and so (7) and (8) implicitly yield the partial derivatives of the reduced-form utility functions $u^i = u^i(T, t^\alpha, t^\beta)$, $i = \alpha, \beta$.

The preceding description pertains to the equilibrium conditions for the private sectors of the two economies only, and it therefore remains to describe the behaviour of the national governments. The two national governments choose the levels of their tariffs on the non-numeraire good, and the donor country also chooses its level of aid. To set up a benchmark case for welfare comparison, let us for the time being assume that the level of aid is arbitrarily given (possibly zero) but that the two countries optimally choose their tariff rates. We suppose that the two countries set their tariffs non-cooperatively and follow a Nash strategy: each chooses its tariff optimally, conditional upon the tariff choice of the other country. From (7) and (8), the necessary conditions for the countries α and β are $B = 0$ and $D = 0$, respectively. These two conditions give the implicit tariff reaction functions of the countries as:

$$R^\alpha : \quad B = m^\alpha (1 - t^\beta c_y^\beta) + t^\alpha (E_{pp}^\beta - m^\beta c_y^\beta) = 0, \quad (9)$$

$$R^\beta : \quad D = m^\beta (1 - t^\alpha c_y^\alpha) + t^\beta (E_{pp}^\alpha - m^\alpha c_y^\alpha) = 0. \quad (10)$$

Equations (1)-(3), (9) and (10) determine the endogenous variables $p, u^\alpha, u^\beta, t^\alpha$ and t^β conditional upon the exogenously given level of aid, $T \geq 0$.

Under the normality of preferences, we can readily establish from (9) and (10) that: $sign(t^i) = sign(m^i)$, where t^i denotes the Nash optimal tariffs conditional upon

the exogenously given level of aid.¹⁰ Thus, if a country exports the non-numeraire good, $m^i < 0$, its optimal policy is an export tax, $t^i < 0$; conversely, if a country imports the non-numeraire good, $m^i > 0$, its optimal policy is an import duty, $t^i > 0$. In this paper we assume, without loss of generality, that the donor country exports the non-numeraire good ($m^\alpha < 0$) and that the recipient imports the non-numeraire good ($m^\beta > 0$). This implies that, unambiguously, the donor imposes an export tax and the recipient imposes an import duty on the non-numeraire good, whence $t^\alpha < 0$ and $t^\beta > 0$. This result is well-known in the literature (see, for example, Friedlander and Vandendorpe (1968)). The net importer (exporter) has an incentive to restrict (encourage) domestic demand in order to lower (increase) world relative price of the non-numeraire good.

3 Optimal Income Transfers in a One-Shot Game

The main purpose of this paper is to consider if an income transfer can be used by a donor country as a strategic instrument for improving its welfare. We examine this question in the context of two separate games. In the following section, we consider a two-stage game in which country α chooses the amount of aid in stage one, while both countries choose their trade tax rates in stage two. In the game analyzed in this section, both countries make a one-shot, simultaneous move in which country α chooses the amount of aid it extends to country β and its trade tax rate, while country β chooses whether to receive the aid and its own trade tax rate. The equilibrium is a new Nash equilibrium which can be compared with that in the benchmark case considered in the previous section, in which trade taxes were optimally chosen but the amount of aid was exogenously given.

¹⁰This result depends upon $(1 - t^i c_y^i) > 0$ and $(E_{pp}^i - m^i c_y^i) < 0$, $i = \alpha, \beta$. The first of these conditions is implied by the assumption that all goods are normal but, even if complete normality is not assumed, it coincides with Hatta's (1977) normality (and stability) condition. The second condition is that the non-numeraire good has negatively sloped uncompensated excess demand functions. This condition will be satisfied under normality at the Nash equilibrium. Accordingly, for the rest of the paper it will be assumed that both goods are normal and, hence, have negatively sloped uncompensated excess demand functions at the Nash equilibrium. Normality is assumed for expositional reasons, and because we do not want the results to depend on assumptions like inferiority.

Since T , t^α , and t^β are chosen by the appropriate countries at the same time, the first-order conditions are given by (9), (10) and the following constraints:

$$A = E_{pp}^\beta + E_{pp}^\alpha [1 - (t^\beta - t^\alpha)c_y^\beta] \leq 0, \quad (11)$$

$$C = E_{pp}^\alpha + E_{pp}^\beta [1 - (t^\alpha - t^\beta)c_y^\alpha] \leq 0. \quad (12)$$

If the optimal aid given by country α is positive, the inequality in (11) is replaced by equality. Inequality (11) is the Kuhn-Tucker condition for the optimality of country α 's aid to country β . Inequality (12) makes sure that the recipient country β does not lose from the transfer and thus it represents a voluntary participation condition.

Assuming that both goods are normal in both countries, it is readily shown that $[1 - (t^\beta - t^\alpha)c_y^\beta] > 0$ and, similarly, that $[1 - (t^\alpha - t^\beta)c_y^\alpha] > 0$.¹¹ These inequalities, together with our assumption that $E_{pp}^i < 0$, yield the result that both A and C are negative, i.e. $A < 0, C < 0$, for any choice of tariff rates. This has two important implications. First, the fact that $C < 0$ means that the recipient country β always benefits from aid under the assumptions of our model: it will be happy to accept aid from the donor α when the tariff rates are given. Second, and more importantly for our present investigation, the fact that $A < 0$ implies that the utility of the donor country is a strictly decreasing function of the amount of aid. Accordingly, the optimal policy choice of the donor country in the present context is to offer no aid: the solution to the first-order optimality conditions requires $T = 0$. In other words, $(0, t^{\alpha n}, t^{\beta n})$ is a Nash equilibrium in the present game, where $t^{\alpha n}$ and $t^{\beta n}$ are the Nash equilibrium tariff rates that occur when the two countries choose tariffs non-cooperatively given $T = 0$, as described in the previous section. Proposition 1 formalizes this point.

Proposition 1: *If two countries choose their trade tax rates and the level of aid non-cooperatively, the optimal transfer for the donor country is zero.*

¹¹These inequalities are proved using the fact that the marginal propensities to consume the two goods sum identically to one, viz. $(p + t^i)c_y^i + c_y^{i1} = 1$, where c_y^{i1} is the marginal propensity to consume the numeraire good. This identity may be used to rewrite the bracketed expression in (11) as $[1 - (t^\beta - t^\alpha)c_y^\beta] = 1 - t^\beta c_y^\beta + t^\alpha c_y^\beta = 1 - (p + t^\beta)c_y^\beta + (p + t^\alpha)c_y^\beta = c_y^{\beta 1} + (p + t^\alpha)c_y^\beta > 0$, the strict inequality following since the domestic price $(p + t^\alpha)$ cannot be negative and since both goods are assumed to be normal. A similar proof yields the other inequality.

That country α provides no aid in the Nash equilibrium of the present game is not surprising. It is well known in the literature on transfers that, for given levels of tariffs (including their Nash values of course) and under the normality of preferences, aid is welfare reducing for the donor and welfare improving for the recipient (see Bhagwati, Brecher and Hatta (1985) and Turunen-Red and Woodland (1988)). Our result presented in Proposition 1 extends these authors' results to a situation where the tariff levels (and the level of aid) are endogenously determined rather than being fixed at exogenously given levels. We have shown that the endogeneity of the tariff rates does not affect the previous result that the recipient gains while the donor loses from a transfer. This result arises because, whether the tariffs are fixed or endogenously chosen, aid can only benefit the donor if it yields a substantial improvement in its terms of trade or a more favourable tariff policy response from the recipient. The former is ruled out by the assumed market stability and normality of goods. The latter does not arise because the aid/tariff link is indirect and weak. It is to this link that attention is now turned.

4 Optimal Income Transfers in a Two-Stage Game

We now consider a two-stage game in which the decision about giving aid is taken prior to the decision of setting trade taxes. Thus, in the first stage country α chooses the amount of aid, and in the second stage both countries choose their trade tax rates in a non-cooperative way.^{12,13} Since country α is fully aware of the influence that transfers will have on the Nash tariff game, the analysis starts from the second stage of the game, and uses backward induction. In other words, we consider a subgame perfect equilibrium.

¹²The opposite timing, where aid is given after the trade tax decision is made, is clearly not in the interest of the donor as it will have no effect on the trade taxes.

¹³Lahiri and Raimondos-Møller (1997b) also examine the strategic importance of income transfers on countries' optimal trade policy. There, however, the amount of aid is fixed and there are two recipient countries that compete in receiving the aid.

4.1 Stage two of the game

In stage two of the game each country chooses its trade tax optimally, treating the other country's trade tax and the amount of aid T provided in the first stage as given. The first-order conditions for optimality yield the reaction functions (9) and (10). To discover how each country's optimal trade tax will react to a change in the level of aid or income transfer, we totally differentiate the reaction functions (9) and (10) taking account of the effects of changes in the policy parameters upon the equilibrium price and utility levels as provided by (6)-(8). The resulting reduced-form comparative static equations expressing the required relationships between the changes in the three strategic variables dt^α, dt^β, dT are:

$$R^\alpha : \quad K^\alpha dt^\alpha = L^\alpha dt^\beta + \Omega^\alpha dT \quad (13)$$

$$R^\beta : \quad K^\beta dt^\beta = L^\beta dt^\alpha + \Omega^\beta dT \quad (14)$$

where

$$\begin{aligned} K^\alpha &= \tilde{Z} (E_{pp}^\beta - m^\beta c_y^\beta) + S_p^\beta E_{pp}^\alpha (1 - t^\beta c_y^\beta) - S_u^\beta E_{pp}^\alpha (m^\beta - t^\beta E_{pp}^\beta), \\ L^\alpha &= S_p^\beta [\tilde{Z} - (1 - t^\alpha c_y^\alpha) E_{pp}^\beta] - \tilde{Z} m^\beta c_y^\beta, \\ \Omega^\alpha &= S_p^\beta [c_y^\alpha (1 - t^\beta c_y^\beta) - c_y^\beta (1 - t^\alpha c_y^\alpha)] + S_u^\beta [E_{pp}^\alpha + E_{pp}^\beta (1 - (t^\alpha - t^\beta) c_y^\alpha)], \\ K^\beta &= \tilde{Z} (E_{pp}^\alpha - m^\alpha c_y^\alpha) + S_p^\alpha E_{pp}^\beta (1 - t^\alpha c_y^\alpha) - S_u^\alpha E_{pp}^\beta (m^\alpha - t^\alpha E_{pp}^\alpha), \\ L^\beta &= S_p^\alpha [\tilde{Z} - (1 - t^\beta c_y^\beta) E_{pp}^\alpha] - \tilde{Z} m^\alpha c_y^\alpha, \\ \Omega^\beta &= S_p^\alpha [c_y^\alpha (1 - t^\beta c_y^\beta) - c_y^\beta (1 - t^\alpha c_y^\alpha)] - S_u^\alpha [E_{pp}^\beta + E_{pp}^\alpha (1 - (t^\beta - t^\alpha) c_y^\beta)], \end{aligned}$$

and for $i, j = \alpha, \beta$ and $i \neq j$

$$\begin{aligned} S_p^i &= E_{pp}^i [1 - (t^i - t^j) c_y^i] - t^j E_{ppp}^i - m^i (t^i - t^j) c_{yp}^i, \\ S_u^i &= \frac{E_{ppu}^i}{E_u^i} [1 - (t^i - t^j) c_y^i] - t^j \frac{E_{ppu}^i}{E_u^i} - m^i (t^i - t^j) \frac{c_{yu}^i}{E_u^i}. \end{aligned}$$

Imposing the second-order sufficiency conditions for welfare maximization determines the sign of some of the above coefficients, viz. $K^\alpha > 0$ and $K^\beta > 0$. However,

the signs of the other coefficients remain ambiguous even when the ‘stability’ condition for the game is imposed. The stability condition is:

$$\Delta \equiv K^\alpha K^\beta - L^\alpha L^\beta > 0. \quad (15)$$

The terms L^α and L^β can be signed if we make an assumption about the relationship between the tariff rates in a Nash equilibrium tariff game. The ambiguity of the signs of these terms implies that the slopes of the tariff reaction functions are also ambiguous. This ambiguity is well known in the literature and is normally resolved by making a simplifying assumption about the signs of the derivatives of the reaction functions. In this paper we follow the normal practice and assume the intuitively plausible case where an increase in the export tax imposed by one country is met by a decrease in the optimal import tariff imposed by the other country.¹⁴ That is, we assume that the reaction functions R^α and R^β have positive slopes, $dt^\beta/dt^\alpha|_T > 0$. This assumption amounts to the statement that the two trade taxes are strategic substitutes: an increase in the import duty t^β imposed by β induces country α to increase t^α , which, being negative, is a reduction in α ’s export tax. Similarly, an increase in α ’s export tax ($dt^\alpha < 0$) will induce β to reduce its import duty. This assumption implies that $L^\alpha > 0$ and $L^\beta > 0$.

While this assumption can be effectively exploited in the analysis below, it is not strong enough to establish the signs of the effects of a change in aid upon the optimal tariffs. Therefore, it is convenient to make a stronger assumption that is *sufficient* to ensure that (i) the two tariffs are strategic substitutes, and (ii) the second-order optimality condition is satisfied, and which keeps the analysis at a tractable level.

This assumption is written formally as Assumption 1.

¹⁴The intuition is the following: as the one country increases its tax towards the prohibitive level, the other country’s trade tax tends to go to zero, as there are no terms-of-trade gains at zero trade. The assumption that the reaction curves are negatively sloped is commonly made in the literature on strategic trade policy. See, for example, Johnson (1953), Mayer (1981), Dixit (1987), Vousden (1990), Wong (1995) and Staiger (1996).

Assumption 1: $c_{yp}^i = c_{yu}^i = 0$, and $E_{ppp}^i = E_{ppu}^i = 0$.¹⁵

Under Assumption 1 the signs of all the major terms in (13) and (14) are determinate. In particular, Assumption 1 implies that $S_p^i < 0$ and $S_u^i > 0$. It is then easy to show that the coefficients of dt^α and dt^β in (13) and (14) are always positive, i.e. $K^i > 0$, $L^i > 0$, and that $\Omega^\alpha < 0$ and $\Omega^\beta > 0$.

Assumption 1 and the Nash Stability Condition are now used in order to sign the effect of a change in aid T upon the Nash equilibrium tariff rates chosen by the two countries. Equations (13) and (14) may be solved to obtain the effect of a small change in the level of aid upon the tariff rate of the recipient country as:

$$\frac{dt^\beta}{dT} = \frac{\Omega^\alpha L^\beta + \Omega^\beta K^\alpha}{\Delta}. \quad (16)$$

Since the stability condition requires $\Delta > 0$, the sign of the derivative in (16) depends upon the sign of the numerator. Assumption 1 allows the complicated expression for the numerator in (16) to be signed and hence yields the main result of this subsection as Proposition 2.

Proposition 2: *Given Assumption 1 and the stability condition (15), a small positive income transfer will increase the optimal trade tax of the recipient country: $dt^\beta/dT > 0$. That is, the recipient β will increase its import duty on the non-numeraire good in response to the aid provided by the donor α .*

Proof: Under Assumption 1, the coefficients K^i, L^i, Ω^i may be expressed as:

$$\begin{aligned} K^\alpha &= (\tilde{Z} + E_{pp}^\alpha b) (E_{pp}^\beta - m^\beta c_y^\beta) > 0, \\ L^\alpha &= E_{pp}^\beta b (E_{pp}^\alpha - m^\alpha c_y^\alpha) (1 - t^\beta c_y^\beta) - m^\beta c_y^\beta [\tilde{Z} + E_{pp}^\beta b (1 - t^\alpha c_y^\alpha)] > 0, \end{aligned}$$

¹⁵Clearly, satisfying all four equalities at the same time demands strong assumptions on preferences and technology, such as Leontief functional forms. However, in the literature on Nash tariff equilibrium, simplifying assumptions about preferences and technology are extremely common. For example, Syropoulos (1994) and Gatsios and Karp (1995) adopt specific utility functions within the context of pure exchange economies in order to be able to determine whether tariffs are strategic complements or substitutes. Since the conditions that we have specified in Assumption 1 are *sufficient but not necessary* conditions for our results, we choose to proceed with this assumption.

$$\begin{aligned}
\Omega^\alpha &= b \left[c_y^\alpha E_{pp}^\beta + c_y^\beta E_{pp}^\alpha \right] < 0, \\
K^\beta &= \left(\tilde{Z} + E_{pp}^\beta a \right) \left(E_{pp}^\alpha - m^\alpha c_y^\alpha \right) > 0, \\
L^\beta &= E_{pp}^\alpha a \left(E_{pp}^\beta - m^\beta c_y^\beta \right) \left(1 - t^\alpha c_y^\alpha \right) - m^\alpha c_y^\alpha \left[\tilde{Z} + E_{pp}^\alpha a \left(1 - t^\beta c_y^\beta \right) \right] > 0, \\
\Omega^\beta &= -a \left[c_y^\alpha E_{pp}^\beta + c_y^\beta E_{pp}^\alpha \right] > 0,
\end{aligned}$$

where $a \equiv 1 - (t^\alpha - t^\beta)c_y^\alpha > 0$ and $b \equiv 1 - (t^\beta - t^\alpha)c_y^\beta > 0$. From (16) and the Nash stability condition (15) we know that $dt^\beta/dT > 0$ if and only if $\Omega^\alpha L^\beta + \Omega^\beta K^\alpha > 0$. Using the expressions for K^α , L^β and Ω^i from above, we can rewrite the left hand side of this necessary and sufficient condition as follows:

$$\begin{aligned}
& \left(c_y^\alpha E_{pp}^\beta + c_y^\beta E_{pp}^\alpha \right)^{-1} \left(\Omega^\alpha L^\beta + \Omega^\beta K^\alpha \right) \\
&= bL^\beta - aK^\alpha \\
&= b \left[E_{pp}^\alpha a \left(E_{pp}^\beta - m^\beta c_y^\beta \right) \left(1 - t^\alpha c_y^\alpha \right) - m^\alpha c_y^\alpha \left[\tilde{Z} + E_{pp}^\alpha a \left(1 - t^\beta c_y^\beta \right) \right] \right] \\
&\quad - a \left(\tilde{Z} + E_{pp}^\alpha b \right) \left(E_{pp}^\beta - m^\beta c_y^\beta \right) \\
&= -t^\alpha c_y^\alpha a b E_{pp}^\alpha \left(E_{pp}^\beta - m^\beta c_y^\beta \right) - \tilde{Z} \left[b m^\alpha c_y^\alpha + a \left(E_{pp}^\beta - m^\beta c_y^\beta \right) \right] \\
&\quad - a b m^\alpha c_y^\alpha E_{pp}^\alpha \left(1 - t^\beta c_y^\beta \right) \\
&= -c_y^\alpha a b E_{pp}^\alpha \left[t^\alpha \left(E_{pp}^\beta - m^\beta c_y^\beta \right) + m^\alpha \left(1 - t^\beta c_y^\beta \right) \right] - \tilde{Z} \left[b m^\alpha c_y^\alpha + a \left(E_{pp}^\beta - m^\beta c_y^\beta \right) \right] \\
&= -\tilde{Z} \left[b m^\alpha c_y^\alpha + a \left(E_{pp}^\beta - m^\beta c_y^\beta \right) \right] \\
&< 0,
\end{aligned}$$

where the last equality occurs because $B = t^\alpha \left(E_{pp}^\beta - m^\beta c_y^\beta \right) + m^\alpha \left(1 - t^\beta c_y^\beta \right) = 0$, i.e., the trade tax in the donor country is optimal (see (9)), and the inequality is always true under the stability of the system ($\tilde{Z} < 0$), the normality of the goods, and the assumed trade pattern. Thus, $\Omega^\alpha L^\beta + \Omega^\beta K^\alpha > 0$ and hence $dt^\beta/dT > 0$. **Q.E.D.**

This is an important and novel result. The existing literature on income transfers assumes that an income transfer does not affect the trade tax levels (trade taxes are arbitrarily fixed). However, given that in all these models countries are large open economies one should expect that trade taxes are optimally set and, thus, that they

respond to changes in world market conditions. Hence, a transfer of resources from one country to the other affects the distribution of monopoly power in trade, leading thus to changes in optimal trade policies. What is interesting here is that aid induces the recipient β to raise its import duty. The intuition for the above result is easy to grasp: as the recipient receives resources from the donor its monopoly power in trade is increased relatively to that of the donor country and, as a result of that, its optimal trade tax has also increased.

4.2 Stage one of the game

We now turn to stage one of the game. In this stage the donor decides whether to give aid, knowing what effect this aid has on the Nash trade taxes in the second stage. Since both countries behave optimally with respect to their trade policy, i.e. $B = 0$, $D = 0$, the second terms on the right hand sides of the welfare (7) and (8) are equal to zero irrespective of the level of chosen aid. Consequently, the effects of a transfer upon the levels of welfare in the two countries are given by

$$\tilde{Z} E_u^\alpha \frac{du^\alpha}{dT} = -A + (m^\alpha - t^\alpha E_{pp}^\alpha) E_{pp}^\beta \frac{dt^\beta}{dT}, \quad (17)$$

$$\tilde{Z} E_u^\beta \frac{du^\beta}{dT} = C + (m^\beta - t^\beta E_{pp}^\beta) E_{pp}^\alpha \frac{dt^\alpha}{dT}. \quad (18)$$

It is readily seen that welfare of each country is affected by a transfer on two ways: (i) by the transfer itself (first term in the right hand side of either (17) or (18)), and (ii) by the effect that the transfer has on the trade policy of the other country (second term). Since $A < 0$ and $C < 0$, the former effect is negative for the donor country and positive for the recipient country and it represents the well-known general equilibrium effect of a transfer under the existence of given tariffs (see Bhagwati, Brecher and Hatta (1985)). The latter effect is always negative, in the sense that an increase of the trade tax in one country will always reduce welfare in the other country (keep in mind that \tilde{Z} , t^α and m^α are negative numbers). It should be obvious that the donor will decide to give aid only if that aid reduces the recipient's tariff. In

other words, a necessary condition for a welfare improvement in the donor country is that the recipient reduces its tariff on imports. In the present context, we therefore have that:

$$\frac{du^\alpha}{dT} > 0 \quad \text{only if} \quad \frac{dt^\beta}{dT} < 0. \quad (19)$$

However, as shown in Proposition 2, this does not happen. Proposition 3 follows directly:

Proposition 3: *Given Assumption 1 and the stability condition (15), the optimal transfer for the donor country in the two-stage game is zero.*

Thus, the two-stage game has not altered the result from the one-shot game. Aid is not optimal from the donor's point of view. In fact, it is likely that the two-stage formulation proves to be even more detrimental for the donor since it introduces a new source of loss, viz. a reduction in welfare arising from the increase of the recipient's tariff. The common conclusion of Propositions 1 and 3 is unambiguous: *independently of whether transfers are chosen simultaneously with, or prior to, tariffs, the optimal transfer for the donor country is zero.*

It is well known in the literature that income transfers create no paradoxical outcomes under the usual assumptions such as normal preferences, fixed trade taxes and stable equilibrium, i.e. the donor loses and the recipient gains (see Bhagwati, Brecher and Hatta (1985), and Turunen-Red and Woodland (1988)). Here we have shown that this result holds also when trade taxes adjust optimally in the second stage of a two-stage game to changes in the transfer. However, given that income transfers do take place among countries, the unanswered question is whether there are other conditions under which income transfers are optimal for the donor country, and more importantly, whether a Pareto superior outcome can be reached with the help of income transfers. This issue is addressed in the following section.

5 Strategic, Pareto-Improving Tied-Aid

So far we have been focussing on unconditional income transfers. We have shown that the only way an unconditional transfer can improve the donor's welfare is if it reduces the recipient's optimal tariff (see (17) and (19)). However, we have demonstrated in the previous two sections that this will not happen with unconditional income transfers under the conditions specified in Assumption 1. In the two-stage game the effect of aid on the recipient's trade tax is the opposite of what the donor wants: the aid causes the recipient to increase its tariff and thus the terms of trade for the donor will deteriorate, reducing its welfare. However, given that the donor has an additional policy instrument available — the income transfer — we now examine whether the donor can raise welfare by tying the provision of aid to tariff reductions by the recipient. We will show that this is actually possible. Moreover, we will show that, by specifying conditions on how aid is granted, the resulting equilibrium will be Pareto efficient.

This section considers a game in which the donor is assumed to choose its tariff rate and level of aid, but links the latter to a required tariff behaviour on the part of the recipient. Ensuring that the recipient is no worse off (and possibly marginally better off) than at the original Nash equilibrium, the donor is looking for policy settings that will improve its own welfare. Let the donor country α solve the following maximization problem:

$$u^\alpha(T_1, t_1^\alpha, t_1^\beta) = \max_{T, t^\alpha, t^\beta} \{u^\alpha(T, t^\alpha, t^\beta) : u_0^\beta = u^\beta(T, t^\alpha, t^\beta) \text{ and } T \geq 0\}, \quad (20)$$

where $u_0^\beta = u^\beta(0, t_0^\alpha, t_0^\beta)$ and $(0, t_0^\alpha, t_0^\beta)$ is the initial Nash equilibrium with no transfer. In the present game, the donor offers the recipient aid in the amount of $T_1 > 0$ on the proviso that the recipient sets its tariff at t_1^β . If country β does not agree to the tied-aid offer, α will return to the original Nash equilibrium where no aid is given. Since β is no worse off than at the original Nash equilibrium, it has no reason to reject the offer. The donor, α , will be no worse off and it may be able to improve on the

Nash solution for its level of utility as the Nash solution belongs to the feasible set of the optimisation problem.¹⁶

The donor's problem described by (20) is to choose a point along the indifference curve u_0^β that is consistent with the policy settings and that yields the donor its highest attainable utility level. The changes in policy parameters that are consistent with this restriction and the consequent change in α 's utility level are given by the equations (7) and (8). Along β 's indifference curve u_0^β we have that $du^\beta = 0$, which requires the right hand side of (8) to be zero. Accordingly, the welfare equations become:

$$\tilde{Z} E_u^\alpha du^\alpha = -A dT + B E_{pp}^\alpha dt^\alpha + (m^\alpha - t^\alpha E_{pp}^\alpha) E_{pp}^\beta dt^\beta, \quad (21)$$

$$\tilde{Z} E_u^\beta du^\beta = 0 = C dT + D E_{pp}^\beta dt^\beta + (m^\beta - t^\beta E_{pp}^\beta) E_{pp}^\alpha dt^\alpha. \quad (22)$$

We begin by evaluating the welfare response for α at the initial Nash equilibrium in order to demonstrate that a Pareto-improving policy change, consistent with the problem specified in (20), is possible. Since at the Nash equilibrium, $B = D = 0$, for any given change in transfer, dT , the change in α 's trade tax required to maintain β 's utility at the pre-transfer level can be calculated from (22) as:

$$\frac{dt^\alpha}{dT} = -\theta_1 \equiv -\frac{C}{(m^\beta - t^\beta E_{pp}^\beta) E_{pp}^\alpha} < 0, \quad (23)$$

showing that α needs to raise its export tax (reduce t^α) to compensate for the aid provided to β .¹⁷ Since t^α is optimally chosen at the initial Nash equilibrium, i.e. $B = 0$, by equation (9), $du^\alpha > 0$ if and only if:

$$\frac{dt^\beta}{dT} < -\theta_2 \equiv \frac{A}{(m^\alpha - t^\alpha E_{pp}^\alpha) E_{pp}^\beta}. \quad (24)$$

Given that the right hand side of (24) is always negative, this inequality provides a conditionality or tying rule for aid, requiring a reduction in β 's import tariff: any change in β 's import tariff that satisfies this inequality will be guaranteed to raise α 's

¹⁶On the enforceability of the contract, we simply assume that neither the recipient nor the donor reneges.

¹⁷Note that A and C are both unambiguously negative.

utility level. Clearly, these calculations allow α 's utility level to increase by choosing a small amount of aid, $dT > 0$, reducing t^α (i.e. increasing its export duty) to ensure that β is no worse off and requiring β to reduce its tariff on imports sufficiently. In fact, it follows from the above discussion that, starting from the Nash equilibrium, tied aid of the following type is strictly Pareto improving:

$$\begin{aligned} dT &> 0, \\ dt^\alpha &= -(\theta_1 + \epsilon)dT, \quad \text{and} \\ dt^\beta &= -(\theta_2 + \epsilon)dT, \end{aligned} \tag{25}$$

where ϵ is a small positive number. Formally,

Proposition 4: *Starting from the Nash equilibrium with zero aid, tied aid as specified in (25) is strictly Pareto improving.*

It follows from the above proposition that the optimal solution of the problem specified by (20) is not a Nash equilibrium. It should also be noted that the tying rule specified in (25) implies an increase in the donor's export tax. In this sense, the tying rule, which is strictly Pareto improving, does not take us towards the first best.

We now consider the welfare equations away from the Nash equilibrium and use them to characterize the solution to the policy problem given by (20). Away from the Nash equilibrium neither α 's nor β 's trade taxes are chosen optimally and hence $B \neq 0$ and $D \neq 0$. In this case, (23) is generalized to:

$$\frac{dt^\alpha}{dT} = -\frac{C + DE_{pp}^\beta \frac{dt^\beta}{dT}}{(m^\beta - t^\beta E_{pp}^\beta)E_{pp}^\alpha}. \tag{26}$$

Substituting this relationship into (21) yields the following reduced-form expression for the change in α 's welfare:

$$\tilde{Z} E_u^\alpha du^\alpha = -\left[A + \frac{BC}{(m^\beta - t^\beta E_{pp}^\beta)}\right] dT + E_{pp}^\beta \left[(m^\alpha - t^\alpha E_{pp}^\alpha) - \frac{BD}{(m^\beta - t^\beta E_{pp}^\beta)} \right] dt^\beta. \tag{27}$$

The conditionally optimal amount of aid and level of β 's import duty, taking into account the required change in α 's export tax required to maintain β 's utility at its Nash equilibrium level, (solution to problem (20)) are found by setting the bracketed coefficients of (27) equal to zero. The optimality conditions are therefore:

$$T_1 : \quad A + \frac{BC}{(m^\beta - t^\beta E_{pp}^\beta)} = 0, \quad (28)$$

$$t_1^\beta : \quad (m^\alpha - t^\alpha E_{pp}^\alpha) - \frac{BD}{(m^\beta - t^\beta E_{pp}^\beta)} = 0. \quad (29)$$

The conditional optimality conditions (28) and (29) may be solved, along with the constraint that $u_0^\beta = u^\beta(T, t^\alpha, t^\beta)$, for the conditionally optimal choices of the three policy parameters: t_1^α , t_1^β , and T_1 . Given the choice of α 's policy instruments, the trade tax of country β is determined, that is, tied to the aid. Moreover, since the level of β 's utility is held fixed at the Nash level¹⁸ and the policy instruments maximize α 's utility, the conditional-aid optimal point is also a Pareto optimal point.

The influence of the conditionality of the transfer can be readily identified by examining the optimality conditions (28) and (29). Since $A < 0$, $C < 0$, $m^\alpha - t^\alpha E_{pp}^\alpha < 0$ and $m^\beta - t^\beta E_{pp}^\beta > 0$, it follows from (28) and (29) that $B < 0$ and $D > 0$. The first inequality suggests that the donor's optimal export tax is larger than its Nash value. Similarly, the second inequality suggests that the recipient's import tariff level at the (donor's) optimum is lower than its Nash value.

In summary, we have shown that it is possible for the donor country to design an offer of aid to the recipient country that leads to a Pareto improvement in welfare if the aid package includes the requirement that the recipient's trade tax is tied to the aid in a very specific way. In the previous sections we established that the provision of untied aid is never in the interest of the donor. In other words, given that the two countries initially choose their tariffs in a Nash fashion and the donor is to use an aid

¹⁸In fact, the utility level of the recipient can be set at a slightly higher level than its value, which will ensure that the recipient actually accepts the aid package.

to increase its welfare, it is both necessary and sufficient that the aid be suitably tied. This is the main message of the paper and it is formalized in the following proposition.

Proposition 5: *The optimal amount of an income transfer provided by a donor country is positive if and only if it is provided under carefully designed rules that restrict the behaviour of the recipient by tying its trade tax to the aid offered. These rules can be designed in such a way so that the conditional transfer equilibrium is a Pareto efficient equilibrium.*

The solution to the policy problem (20) is illustrated in Figure 1. Point N is the initial Nash equilibrium with no aid at which country α 's offer curve, OC_0^α , cuts country β 's offer curve, OC_0^β , where m_j^i is the import of good j by country i , $i = \alpha, \beta$ and $j = 1, 2$. Point N is also the point of tangency between a trade indifference curve of each country and the offer curve of the other country, indicating that each country sets its trade tax optimally; i.e. indifference curve u_0^α is tangent to OC_0^β and indifference curve u_0^β is tangent to OC_0^α .

(Figure 1: around here)

The donor's problem described by (20) is to choose a point along the indifference curve u_0^β that is consistent with the policy settings and that puts the donor onto its highest indifference curve. If an amount OT (in terms of the numeraire good) is transferred from country α to country β and both countries alter their trade taxes appropriately, the new offer curves are OC_1^α and OC_1^β . These new offer curves intersect at the new equilibrium point, point P . This equilibrium point P has the following features:

- (i) It is the point of tangency between a trade indifference curve of country α , which is labeled u_1^α , and the initial trade indifference curve of country β , u_0^β . This means that country α has extracted all the gain from tying aid, that country β is not worse off than at N , that there has been a Pareto improvement in welfare and that the point P is Pareto optimal.

- (ii) The new offer curve of country β , OC_1^β , is not tangent to country α 's trade indifference curve u_1^α , meaning that, given country β 's offer curve, country α has not chosen its Nash optimal trade tax. A Nash optimal trade tax would not take into account the conditionality of the aid offer and the requirement of α to keep β at its initial Nash equilibrium utility level.
- (iii) Given the offer curve of country α , OC_1^α , country β would like to impose a higher trade tax if it were unconstrained. In Figure 1, point S is the point of tangency between OC_1^α and a trade indifference curve of country β (the latter not shown). Such behaviour, however, is not consistent with α 's transfer of income to β : if β were to impose a higher tariff and try to move to S , α would withdraw the transfer thus moving the equilibrium point back to the initial point N . Thus, such behaviour will not take place. Tied aid is therefore binding.

Before concluding, there are three points that should be clarified. First, the discussion above assumes weak Pareto efficiency in the sense that one country is better off at the final equilibrium than at the initial Nash equilibrium while the other country is indifferent between the two equilibria. Clearly, this is done for simplicity and without any loss of generality. Any Pareto efficient point along PQ in Figure 1, such as R , can be easily guaranteed by appropriately designed conditionality rules. Secondly, the reason for Pareto efficiency of the equilibrium point is that the donor optimally chooses the policy settings, taking into account the need to obtain the recipient's agreement, which will only be forthcoming if the recipient's welfare is not reduced. The donor's conditionally optimal policy therefore implies a trading point at which there is a tangency between the two countries' trade indifference curve, thus yielding a Pareto optimal point. Thirdly, the mechanism described here for attaining the Pareto optimal point as the final outcome is different from one of cooperative bargaining between the two countries. In the present context, the donor country α is unilaterally attempting to maximize its own welfare. Country α knows (from the previous two sections) that in a one-stage or two-stage game policy choice situation it is not in its

own interest to offer any unconditional aid to β . Clearly, the only possible way for α to gain from an offer of aid is to tie the offer to the requirement that the recipient's trade policy instrument be altered in α 's favour, and β will only agree to this if it is not harmed. The donor induces the recipient to choose the donor's optimal policy choice by making an offer of aid tied to tariff reform or of no aid. The recipient, faced with a choice between the transfer-tariff package and the status quo, is induced to forego its optimal tariff behaviour in favour of the conditional aid offer. The recipient has, in effect, been given 'an offer he cannot refuse'.

6 Conclusion

The main point of this paper is that, within the context of a two-country perfectly-competitive trading world, a transfer of income (aid) from one country to another yields a welfare improvement for the donor if and only if that aid is suitably tied to trade policy reform by the recipient. Our result that untied aid is not welfare improving for the donor in a model with normality of preferences and a Walrasian stable world market is similar to, but quite distinct from, previous results in the literature. The main difference is that we assume that both countries engage in non-cooperative trade tax policies both before and after the aid is provided, in contrast to the existing literature which assumes that the trade policies are exogenously given. Our results show that the endogeneity of trade taxes does not alter the basic result that stability and normality rule out transfer paradoxes. In our case, the two countries have optimal tariffs but they are imposed upon one another in a non-cooperative equilibrium. Despite these differences in context, our results nevertheless support the general proposition stated by Bhagwati, Brecher and Hatta (1985, p.713) that paradoxes cannot arise without a distortion in the system. The final section of our paper, showing that suitably tied aid can yield a Pareto improvement in welfare (thus generating a paradox, since the donor gains), provides a mechanism for the creation of a suitable distortion.

Our assumption that the two nations employ optimal tariffs suggests a possible relationship with the results of Bhagwati, Brecher and Hatta (1983). These authors show that a transfer paradox is ruled out in a three-country model if the donor and recipient form a customs union with an optimal common external tariff, the recipient's trade tariffs being given. Our results in sections 3 and 4 concerning two countries may be applied directly to their model and imply that a Pareto improvement in welfare is not possible (hence a paradox cannot exist) in the extended situation where the recipient employs an optimal tariff that is adjusted in response to the transfer. Application of our results in section 5, however, yields the result that the customs union can make an offer of aid, suitably tied to a trade tax reform of the recipient, that will make both countries better off. The tied aid policy creates a distortion in the sense of requiring the recipient to deviate from its optimal Nash behaviour and thereby allows for a welfare improvement through aid.

Optimizing behaviour by the donor suggests a trade-aid policy that is beneficial to all. In this respect, our results bear some similarity to those of Kowalczyk and Sjöström (1994), who show that international income transfers can be used to induce countries to alter their trade policies in a way that facilitates Pareto welfare improvements through coalition formation. Our results also demonstrate the importance of the connection between transfers and induced changes in trade policies that are welfare improving.

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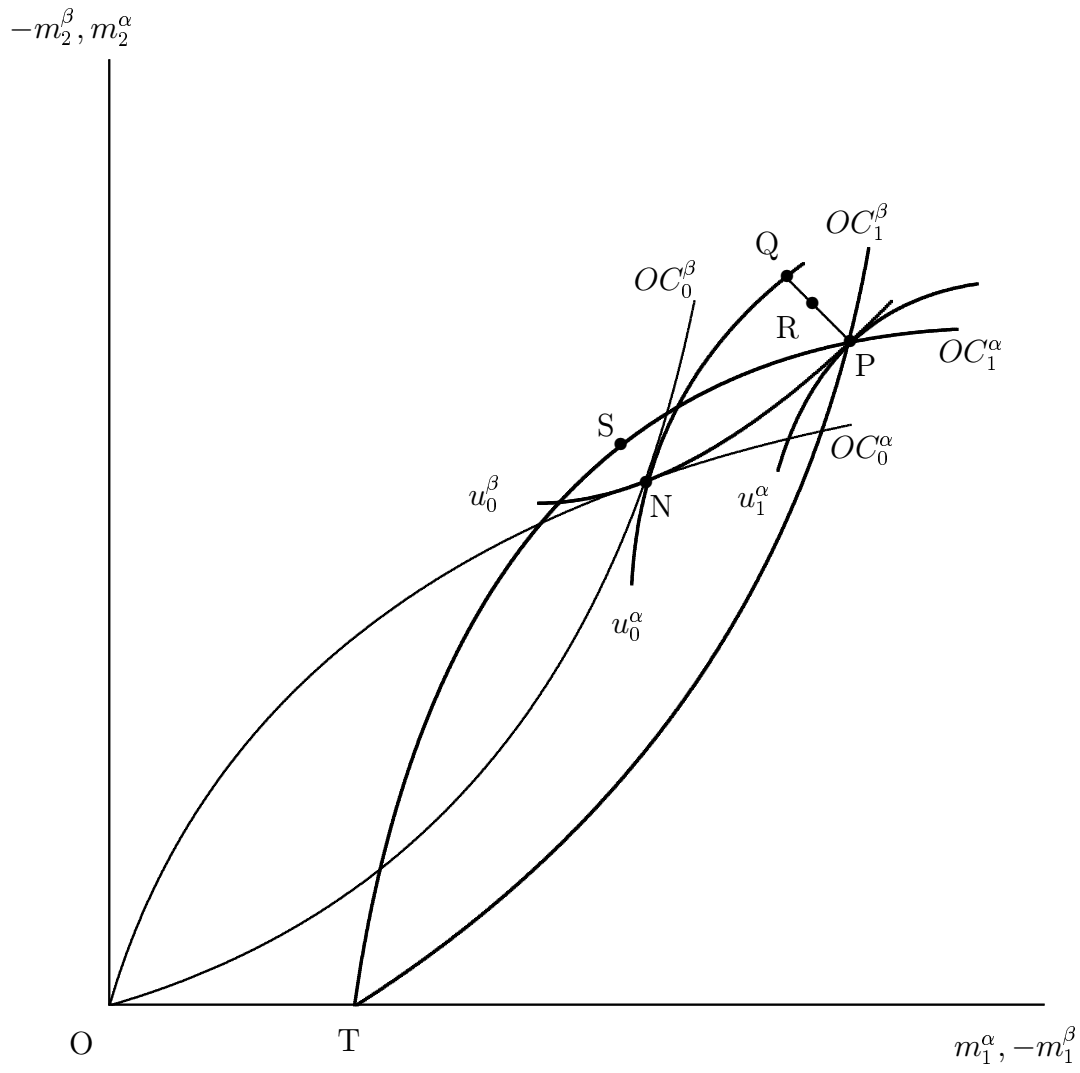


Figure 1