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Donor Enrichment Can Never Occur When the Recipient Imposes a Tariff in a Two-Country Model

Kojun Hamada*

Abstract

In this paper, we reexamine the transfer paradox in a two-commodity world involving two countries. We show that even if the imported good is inferior, donor enrichment can never occur when the recipient imposes a tariff. We assert that if the tariff that the recipient imposes on an imported good is sufficiently lower, no transfer paradoxes arise for the donor and the recipient.

Keywords: Donor enrichment; Optimal tariff; Transfer paradox

JEL classifications: F35, O10

1 Introduction

Following the well-known classical argument (Keynes vs. Ohlin) on German reparation payment, the problem concerning transfer paradoxes has aroused public interest and has raised various economic issues in the theory of international trade.¹

In this paper, we reexamine the transfer paradox in a two-commodity world involving two countries. It is well known that a transfer paradox cannot arise under free trade when the

*Corresponding author.

Address: 8050 Ikarashi 2-no-cho, Nishi-ku, Niigata City 950-2181, Japan.

Tel. and fax: +81-25-262-6538.

E-mail address: khamada@econ.niigata-u.ac.jp

¹Regarding transfer paradoxes, see, for example, Bhagwati, Panagariya, and Srinivasan (1998, Ch.16) in detail.

market is stable in the two-country model, as suggested by Samuelson (1947). Moreover, it is well known that the distortions induced by tariffs cause transfer paradoxes, as proposed by Bhagwati, Brecher, and Hatta (1985).

However, Bhagwati, Brecher, and Hatta (1985) showed only the necessary condition for transfer paradoxes to occur, which is the inferiority of an imported good. We reconsider this issue of transfer paradox and investigate the sufficient conditions for transfer paradoxes to occur.

We show that even if the imported good is inferior, donor enrichment can never occur when the recipient imposes a tariff. We assert that the transfer paradoxes for the donor and recipient do not arise in the environment wherein the recipient imposes a tariff on an imported good, if the tariff is sufficiently lower.

The remainder of this paper is organized as follows. Section 2 describes the model. Section 3 presents the existing results and the main result. The final section concludes the paper with some remarks.

2 The Model

In this section, we describe the structure of the model. We consider a general equilibrium model of international trade in a two-commodity world involving two countries. There are two countries—a donor country (indexed by α) and a recipient country (indexed by β). They trade in two goods—the non-numeraire good (X) and the numeraire good (Y).

Suppose that the donor (recipient) is an exporter (importer) of the non-numeraire good. It is assumed that the entire tariff revenue and foreign aid are distributed in lump-sum among consumers.

As for notations, $T \geq 0$ denotes transfer. The donor provides foreign aid of the amount T in terms of the numeraire good, to the recipient. $t \geq 0$ denotes import tariff. The recipient has in place a specific tariff t on the non-numeraire good. p represents the international price of the non-numeraire good. It may be possible to interpret it as a relative price.

E^i represents trade expenditure function (overspending function). It is defined as the difference between expenditure function e^i and revenue function r^i . Thus, the following equations are satisfied:

$$E^\alpha(1, p, u) \equiv e^\alpha(1, p, u) - r(1, p),$$

$$E^\beta(1, p + t, u) \equiv e^\beta(1, p + t, u) - r(1, p + t).$$

Note that unity (1) is the domestic price of the numeraire good, p is that of the non-numeraire good, and u is the utility level of the representative consumer in country $i = \alpha, \beta$. It is supposed that the subscript x accompanying the functions represents the partial derivative of the functions with respect to x .

m^i denotes the import demand function of the non-numeraire good in country i . It is assumed that $m^\alpha < 0, m^\beta > 0$. Thus, $tm^\beta > 0$ is the import tariff revenue for the recipient.

We consider the budget constraints in the countries:²

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

$$\widehat{E}^\beta(1, p + t, u^\beta) \equiv E^\beta(1, p + t, u^\beta) - tm^\beta = T. \quad (2)$$

The product market-clearing condition (global trade is balanced) is as follows:³

$$m^\alpha + m^\beta = 0. \quad (3)$$

Using McKenzie's lemma, the following equation is satisfied:

$$m^i = E_p^i. \quad (4)$$

²The superscript $\widehat{}$ denotes the net trade expenditure function after subtracting the tariff revenue.

³The world market-clearing condition for the numeraire good has been omitted due to Walras's law.

3 The Analysis

In this section, we analyze the transfer problem when the recipient imposes a tariff, and present some of the main results.

3.1 The existing results

Given tariff level t , we examine the impact of an increase in the unfettered transfer T upon the variables of the model described above (u^α, u^β, p) . The total differentiation of eqs. (1)–(3) provides the following equation:

$$\begin{bmatrix} E_u^\alpha & 0 & m^\alpha \\ 0 & \widehat{E}_u^\beta & \widehat{m}^\beta \\ m_u^\alpha & m_u^\beta & M_p \end{bmatrix} \begin{bmatrix} du^\alpha \\ du^\beta \\ dp \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix} dT, \quad (5)$$

where $\widehat{E}_u^\beta = E_u^\beta - tm_u^\beta$, $\widehat{m}^\beta \equiv \widehat{E}_p^\beta = m^\beta - tm_p^\beta > 0$, and $M_p \equiv m_p^\alpha + m_p^\beta < 0$.

As a first step, in order to consider the transfer problem, we present some of the main results shown by the existing seminal papers as follows:

Proposition 1. (A corollary of Theorem 1 in Bhagwati, Brecher, and Hatta (1985) (hereafter *BBH*))

In the model of (1)–(3),

$$\frac{du^\alpha}{dT} = \frac{M_p + tm_p^\beta m_u^\beta (\widehat{E}_u^\beta)^{-1}}{\Delta E_u^\alpha}, \quad (6)$$

$$\frac{du^\beta}{dT} = -\frac{M_p + tm_p^\beta m_u^\alpha (E_u^\alpha)^{-1}}{\Delta \widehat{E}_u^\beta}, \quad (7)$$

where $\Delta \equiv -M_p + m^\alpha m_u^\alpha (E_u^\alpha)^{-1} + \widehat{m}^\beta m_u^\beta (\widehat{E}_u^\beta)^{-1} > 0$.⁴

Proof. On applying Cramer's rule to the equation of total differentiation (5), we immediately

⁴If the right-hand side of (3) is replaced by \overline{M} , which represents the world's excess demand for X , then $\frac{d\overline{M}}{dp} = -\Delta$ from (1), (2), and thus modified (3), treating u^α , u^β , and \overline{M} as variables. The Marshall-Lerner condition for Walrasian stability states that this derivative is negative.

obtain

$$\frac{du^\alpha}{dT} = \frac{M_p - (m^\alpha + \widehat{m}^\beta)m_u^\beta(\widehat{E}_u^\beta)^{-1}}{\Delta E_u^\alpha}, \quad (8)$$

$$\frac{du^\beta}{dT} = \frac{-M_p + (m^\alpha + \widehat{m}^\beta)m_u^\alpha(E_u^\alpha)^{-1}}{\Delta \widehat{E}_u^\beta}, \quad (9)$$

$$\frac{dp}{dT} = \frac{m_u^\beta(\widehat{E}_u^\beta)^{-1} - m_u^\alpha(E_u^\alpha)^{-1}}{\Delta}. \quad (10)$$

From $\widehat{m}^\beta \equiv m^\beta - tm_p^\beta$ and (3), we have $m^\alpha + \widehat{m}^\beta = -tm_p^\beta$. On substituting this into (8) and (9), we immediately obtain Proposition 1.⁵ \square

Proposition 2. (*A well-known result since Samuelson (1947)*)

It is not possible for any transfer paradox to occur in a two-country free trade model if the Walrasian market stability is satisfied.

Proof. As $t = 0$ under free trade, $\widehat{E}_u^\beta = E_u^\beta$. (6) and (7) are rewritten as follows:

$$\frac{du^\alpha}{dT} = \frac{M_p}{\Delta E_u^\alpha} < 0, \quad (11)$$

$$\frac{du^\beta}{dT} = -\frac{M_p}{\Delta E_u^\beta} > 0. \quad (12)$$

$\Delta > 0$, $M_p < 0$, and $E_u^i = e_u^i > 0$ are satisfied under $t = 0$. Thus, the signs of the above equations are obtained. \square

Regarding the terms of trade, normalizing $E_u^\alpha = E_u^\beta = 1$ in (10) without the loss of generality, we obtain $\frac{dp}{dT} = \frac{m_u^\beta - m_u^\alpha}{\Delta} \geq 0 \Leftrightarrow m_u^\beta \geq m_u^\alpha$. If the marginal propensity of import for the recipient is larger than that for the donor, the terms of trade for the recipient become exaggerated. This result is summarized in the following proposition.

Proposition 3. (*A corollary of Theorem 2 and 3 in BBH (1985)*)

Suppose that the following three assumptions are satisfied: (a) $t > 0$; (b) the Walrasian stability condition for the world markets is satisfied; and (c) the Vanek-Bhagwati-Kemp stability condition

⁵With regard to the terms of trade, we may be able to obtain some additional results from (10), although we do not investigate them in this note.

is satisfied for the trade quantity adjustment in each country.⁶ Then, if a transfer causes a paradoxical change in the welfare of one country, there must be an inferior good in the other country. Moreover, the inferiority must be in a good for which the tariff is imposed.

Proof. As $\widehat{E}_u^\beta \neq E_u^\beta$, based on the characteristics of expenditure function $e_u^\beta > 0$, $\widehat{E}_u^\beta > 0$ cannot be proven. Noting that $E_u^\beta = y_u + (p + t)m_u$, we find that $\widehat{E}_u^\beta = E_u^\beta - tm_u^\beta = y_u + pm_u$. It is well known that the positiveness of the right-hand expression $\widehat{E}_u^\beta > 0$ is a necessary condition for the stability of the quantity adjustment process. This is termed as the Vanek (1965)-Bhagwati (1968)-Kemp (1968) stability condition for the recipient. Under assumption (c), $\widehat{E}_u^\beta > 0$ holds. Thus, the necessary and sufficient conditions for the donor and the recipient to face the paradoxical transfer are, respectively, as follows:

$$M_p + tm_p^\beta m_u^\beta (\widehat{E}_u^\beta)^{-1} > 0, \quad (13)$$

$$-M_p - tm_p^\beta m_u^\alpha (E_u^\alpha)^{-1} < 0. \quad (14)$$

$M_p < 0$, $t > 0$, $E_u^\alpha > 0$, $\widehat{E}_u^\beta > 0$, and $m_p^\beta < 0$. The following are the necessary conditions in which the signs of (13) and (14) are satisfied:

$$m_u^\beta < 0 \text{ and } m_u^\alpha < 0. \quad (15)$$

When the first (second) inequality of (15) holds, it is possible that $\frac{du^\alpha}{dT} > 0$ ($\frac{du^\beta}{dT} < 0$) may arise for the donor (recipient). \square

In the case of Proposition 3, for further details, let us introduce the explanation after Theorem 3 in BBH (1985). Refer to lines 1 to 7 on p.707.

Theorem 3 also yields **necessary conditions** for the welfare paradoxes when the policy distortion is a **tariff**, since a tariff is equivalent to a proposition subsidy and a consumption tax on the importable good at the same rate. For example, when only the recipient country imposes a tariff on importing X , we have $\sigma = \tau (= t)$ (in our model) and $\sigma^* = \tau^* = 0$.

⁶In the specified case of this paper, it is sufficient that this stability condition is satisfied in only the recipient country.

And this implies that, for the paradoxes to occur, X must be inferior in the donor's or the recipient's consumption.

(The emphasis in **boldface** and the insertion of the parenthetical elements are made by the author.)

3.2 Examination of the sufficient conditions

However, according to Theorem 3 in BBH (1985), inferior goods are a necessary condition for transfer paradoxes. Thus, we need to investigate in detail the necessary and sufficient conditions for transfer paradoxes.

Now, we present the main proposition.

Proposition 4. (*A revision of Theorem 3 in BBH (1985)*)

Suppose that the following four assumptions are satisfied: (a) $t > 0$; (b) the Walrasian stability condition for the world markets is satisfied; (c) the Vanek-Bhagwati-Kemp stability condition is satisfied for the trade quantity adjustment in each country; and (d) good X for which a tariff is imposed is an inferior good in both the donor and recipient countries, that is, $m_u^\alpha < 0$ and $m_u^\beta < 0$ hold. Under the above assumptions, the double transfer paradoxes can never occur. The paradox cannot occur for the donor since the donor's welfare necessarily decreases by the transfer under any tariff level. The following condition is sufficient for the recipient's immiserization:

$$t > t^\alpha \equiv -\frac{M_p E_u^\alpha}{m_p^\beta m_u^\alpha}. \quad (16)$$

Thus, if the import tariff is sufficiently large, $t > t^\alpha$, the transfer paradox occurs merely for the recipient.

Proof. Based on Proposition 3, the necessary and sufficient conditions for the donor and recipient to face the paradoxical transfer are (13) and (14), respectively. Rewriting (14), we obtain

$t > t^\alpha \equiv -\frac{M_p E_u^\alpha}{m_p^\beta m_u^\alpha} (> 0)$ as the necessary and sufficient condition for the recipient's immiser-

ization. Likewise, rewriting (13), we obtain $t > -\frac{M_p \widehat{E}_u^\beta}{m_p^\beta m_u^\beta} (> 0)$ as the necessary and sufficient

condition for donor enrichment. Substituting $\widehat{E}_u^\beta \equiv E_u^\beta - tm_u^\beta$ into this condition and arranging the inequality with regard to t , we obtain the following equation:

$$t > -\frac{M_p(E_u^\beta - tm_u^\beta)}{m_p^\beta m_u^\beta} \Leftrightarrow t < \frac{M_p E_u^\beta}{m_p^\alpha m_u^\beta} < 0. \quad (17)$$

The negative sign of the last term in (17) is immediately obtained by $m_u^\beta < 0$, m_p^α , $M_p < 0$, and $E_u^\beta > 0$. Thus, (17) is never satisfied under any positive import tariff. \square

Proposition 4 implies that it is impossible for both donor enrichment and recipient immiserization to occur, and the donor's welfare necessarily decreases. When the import good is inferior for the donor ($m_u^\alpha < 0$), if the import tariff exceeds a certain threshold, $t > t^\alpha$, the recipient immiserizes.

When the import good is inferior for the donor, the necessary and sufficient condition for the recipient to immiserize is $t > t^\alpha \equiv -\frac{M_p E_u^\alpha}{m_p^\beta m_u^\alpha} (> 0)$. In other words, the recipient's immiserization occurs only if the import good is inferior for the donor ($m_u^\alpha < 0$) and the import tariff is relatively large, that is, t exceeds the threshold of $t^\alpha \equiv -\frac{M_p E_u^\alpha}{m_p^\beta m_u^\alpha}$.⁷

It is shown that (14), which is a necessary condition for donor enrichment, is not satisfied, even if the imported good is inferior for the recipient ($m_u^\beta < 0$). In other words, the transfer paradox for the donor cannot arise under any positive tariff levels, even if the import commodity is inferior for the recipient, which is a necessary condition for the transfer paradox to occur.

This proposition implies that even if X is inferior for the recipient, the transfer paradox for the donor never occurs. On the other hand, when X is inferior for the donor, if the tariff level of the recipient is sufficiently high ($t > t^\alpha$), the recipient immiserizes. This result at first appears to be contradictory, as a high tariff may enable tariff revenue to increase. However, (16) is rewritten as $tc_u^\alpha < -\frac{M_p}{m_p^\beta} (< -1)$. The decline of the marginal propensity by the tariff for the donor exceeds the sum of substitute effects in the two countries over its own substitute effect

⁷It is defined that $c_u^i \equiv m_u^i (E_u^i)^{-1}$. pc_u^i represents the marginal propensity to consume the non-numeraire good in country $i = \alpha, \beta$. Although we can rewrite the previous and following equations more briefly by using c_u^i , all the results remain unchanged.

(and also -1). We summarize the result of Proposition 4 in Table 1.

β (recipient)	normal	inferior
α (donor)	$(m_u^\beta > 0)$	$(m_u^\beta < 0)$
normal $(m_u^\alpha > 0)$	$\frac{du^\alpha}{dT} < 0, \frac{du^\beta}{dT} > 0$ (No paradoxes occur.)	
inferior $(m_u^\alpha < 0)$	$\frac{du^\alpha}{dT} < 0, \frac{du^\beta}{dT} \geq 0 \Leftrightarrow t \leq t^\alpha \equiv -\frac{M_p E_u^\alpha}{m_p^\alpha m_u^\alpha}$ (It is possible for only the paradox of the recipient to occur.) (The paradox of the donor never occurs.)	

Table 1: Transfer paradox when the recipient imposes an import tariff

We can immediately derive the following corollary that is obtained from Table 1.

Corollary 1. *It is impossible that both countries will improve their welfares through the transfer.*

BBH (1985) showed the necessary conditions for welfare paradoxes (p.706). However, investigating these conditions in detail, we conclude that even if these necessary conditions—for instance, if the good is inferior for the recipient—are satisfied, the paradox for the donor does not occur in the case of any import tariff. In conclusion, there exists no necessary and sufficient condition for donor enrichment through transfer. This new result complements the assertion of BBH (1983).

4 Concluding Remarks

In the previous section, we reexamined the necessary and sufficient conditions for transfer paradoxes to occur. Our results reaffirm the argument related to the transfer paradox. In other words, we show that even if the imported good is inferior, donor enrichment can never occur

when the recipient imposes a tariff. This is contrary to the conventional belief that transfer paradoxes are possible when an import tariff is imposed, if the good is inferior. We assert that a transfer paradox for the donor and the recipient does not arise in an environment wherein the recipient imposes a tariff on an imported good, if the tariff is sufficiently lower.

Throughout the paper, it is assumed that the tariff is exogenously given. As part of an extension, we should examine whether or not the transfer paradox occurs under the optimal tariff for the recipient.

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