International Trade and Foreign Aid

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Contents

1 Introduction

1.1 Introduction

A large amount of foreign aid flows from developed countries to developing countries. The main objective of foreign aid program is to improve welfare in the developing world. Then, this raises the following important question: can an international income transfer always rise the welfare level of the aid receiving countries? If it does not, we should know under what circumstances an international transfer benefits or harms the recipient country. International trade plays a vital role in the evaluation of the effects of foreign aid. To answer this important and frequently posed question, we develop the following trade models and study the economic consequences of international unilateral transfers.

First, chapter 2 represents the transfer problem in the context of internationally mobile capital, a topic that has been neglected in the preceding studies. Recently, international capital movement caused by foreign aid has been widely taken as one of the important factors for the economic growth of developing countries. Aid enhances the income level of the recipient and can be used for providing infrastructures that contribute to the economic development. Foreign aid reduces the reluctance of private capital to move into the recipient and its economic growth accelerates. Therefore, the role of internationally mobile capital is indispensable for the evaluation of transfers effects. For the first step, chapter 2 simply studies the effects of international capital movement in the transfer problem. We investigate how international factor movement caused by transfers affects the welfare of the donor and the recipient countries.

We show that an international transfer benefits the recipient country and suffers the donor country in a competitive two-country framework in spite of free capital movement. The international capital movement restrains the change in the goods price. If capital moves internationally, the country's welfare will change depending conversely on the direction of improvement in its terms of trade, in comparison with the case of transfers without mobile capital. This result implies the following foreign aid program, if we assume that the donor can only approve a fixed welfare loss through the income transfer. That is, the amount of aid under internationally mobile capital may tend to be smaller (larger) than that of aid without internationally mobile capital when terms of trade improve in favor of the donor (recipient) country as a result of the aid. Moreover, we show that aid by capital, which means renting capital with a lower rental price than at market equilibrium, can be treated as a transfer of rental subsidy.

Second, we develop a generalized model of tied aid in chapter 3. Recent analyses of international transfers have focused on so-called tied aid in various forms. Most aid is given from the donor's government to the recipient's government. Foreign aid is usually taken place not in lump-sum fashion, but it is often carried out in a tied manner such that the government of the donor country restricts how to distribute it in the recipient country. Then, studies on tied aid are quite essential in the international transfer problem. In spite of the recent development in the analysis of tied aid, no attempt has been made to mediate disputes between Kemp and Kojima (1985) and Schweinberger (1990). Kemp and Kojima (1985) and Schweinberger (1990) made a formal analysis of aid that is tied to the recipient government's purchases of export goods of the donor country in a competitive two-country model. These two studies reached contrasting results on the welfare effects of tied aid, though they examined the same type of tied aid. Transfers

analyzed by them are tied in the following sense. The government of the recipient country is forced to spend a fraction of aid on one good and the remainder on the other good, and the households of the recipient are forced to consume them. Kemp and Kojima observed that the paradoxes of donor-enrichment and recipient-impoverishment might take place simultaneously by tied aid. On the other hand, Schweinberger showed that recipient-impoverishment may occur but donor-enrichment can be ruled out in his tied aid model.

We develop a generalized model of tied aid to clarify the similarities and differences between those two analyses. We present the model which utilizes a notion of 'virtual utility' as well as a virtual price. It turns out to be a comprehensive model that includes the Kemp and Kojima model and the Schweinberger model as special cases. Then, we show, in the Kemp-Kojima case, that whenever the transfer paradoxes (i.e., donor-enrichment and/or recipient-impoverishment) occur, the households of the recipient country have an incentive to trade the goods purchased from their production income after they receive tied aid. We show, in the Schweinberger case, that the normality condition in consumption rules out a possibility of the paradox of recipient-impoverishment, while the impossibility of the paradox of donor-enrichment has already proved. The basic difference between Kemp-Kojima and Schweinberger lies in a households' acquaintance with the government transfer and a possibility of re-allocation at the expense of production income after the transfer is carried out.

Third, we investigate tied aid related to the domestic policy of the recipient country in chapter 4. Most of the studies on tied aid examine the aid tied in the sense that the government restricts expenditures of an income transfer on goods, and do not formally introduce differences in the policies between the donor and the recipient into the models.

There are few analyses on the income transfers that affect the policies originally taken by the government of the donor and the recipient for certain purpose.

We construct a model of tied aid that finances public input goods used for the factor adjustment in the recipient country. The public inputs, which are produced in the donor country, have the technology to transform one kind of specific factor into another and the amount of the factors is endogenously determined in the recipient country. In most less-developed countries, the lack of technology and infrastructures will restrict the movement of factors between the industries. In this respect, the factors are somewhat specific. The factor specificity causes adjustment costs and gaps between the returns of factors in each industry. The tied aid can be interpreted as one form of the industrial policy of the recipient's government supported by the transfer. The tied aid will enable the recipient's government to adjust the amount of factors available in each industry in order to equate the differences in the factor prices. It is essential to study the transfer problem in the context of different features in the markets and policies between the donor country and the recipient country. Since the public inputs are produced in the donor country, our tied aid model describes a feature of tying that the recipient country's government must spend tied aid on goods that are produced using the factors of production such as labor and capital in the donor country.

Within the framework, chapter 4 examines the effects of tied aid on the welfare of the donor and the recipient as well as world welfare (i.e., the sum of the two countries' welfare). We identify the conditions under which the income transfer benefits the recipient country and harms the donor country. The transfer can be welfare enriching for the donor and welfare immiserizing for the recipient. We show that the recipient may suffer from the income transfer even if extension of the factor adjustment benefits it.

The income transfer can raise (reduce) world welfare and may enrich (harm) both the donor and the recipient.

We will survey literature on the analyses of international transfers in the following sections before presenting our transfer models. Finally, in chapter 5, we summarize the preceding chapters with major conclusions and some remarks.

1.2 The transfer problem

Analyses of the economic consequences of international unilateral transfers have been historically discussed as “the transfer problem”. The unilateral transfer is called unilateral, since you help someone by giving money or goods without getting anything in return. There exist many unilateral transfers in the domestic and international economies (e.g., donation, unemployment benefits, remittances by migrants, and foreign aid). In principle, countries should record all such transfers in the balance-of-payments statistics. The International Monetary Fund makes a distinction between capital and current transfers. Capital transfers consist of the transfer of ownership of a fixed asset or debt forgiveness by private sectors and the government. Current transfers are all transfers that are not capital transfers. Such government and non-government transfers are gifts of food, medical supplies, and financial assistance to international organizations and also fines.

Since the remarkable dispute between Keynes and Ohlin in 1929, the transfer problem has been one of the important problems in economics. Keynes argued in the *Economic Journal* in 1929 that the reparations payments imposed on Germany after World War I were too high a burden on the German economy. According to Keynes, it

was impossible for the German economy to achieve the required price and cost cuts for the expansion of its export sector. On the other hand, Ohlin responded in the same journal and claimed that only limited export price changes, or none at all, were necessary for the payment of the reparations.

The main discrepancy between Keynes and Ohlin was how changes in the relative price play the predominant role in the necessary adjustment of trade balance for making the transfer. Keynes, however, ignored an important factor, that is, the influence of income change in the transfer paying and receiving countries on the demand for goods. Ohlin claimed that the demand changes in goods caused by an income transfer might change terms of trade but its change is entirely unnecessary under certain circumstances. The lack of a formal analysis of the transfer problem made the discussion unnecessarily complicated. However, this well-known controversy undoubtedly highlighted the transfer problem as one of the important problems in economics.

After World War II, attention to the transfer problem shifted from war reparations payments to foreign aid. The main objective of foreign aid program is to improve welfare in the developing world. Foreign aid has two basic functions. First, use of income transfers to finance economic development policies gives a “big push” to developing countries. The developing countries can be set on the path to self-sustained growth. Second, to alleviate poverty in the aid receiving countries. The main focus of international transfers has been on the latter function of aid. It is assumed that poverty is alleviated if the recipient’s welfare level rises as a result of the transfer.

1.3 The basic model and the transfer paradox

We present the basic model of the transfer problem and see the economic consequences of international transfers. How does an international transfer affect the terms of trade and the welfare of the donor and the recipient? Since the lack of an explicit formulation of the problem, the discussion between Keynes and Ohlin was unnecessarily complicated and obtained indefinite outcomes.

There are two basic effects associated with an international transfer. A direct income effect (income loss in the donor country and gain in the recipient country) and an effect of changes in the terms of trade. The change in the terms of trade is induced by a change in the demand for goods after the transfer. We can expect that terms of trade never change when the donor and the recipient have the same expenditure pattern. In particular, any difference in spending pattern between the donor and the recipient causes adjustments in terms of trade. This change in the terms of trade might be in favor of the donor country or the recipient country. Then, this raises the following important question: if the terms of trade change in favor of the donor country as a result of the transfer, can its gain be so large as to improve the welfare of the donor country? More precisely, can the improvement in the donor's terms of trade offset the direct income loss in the donor country? Can the change dominate the income gain in the recipient country and worsen the recipient's welfare? If these rather paradoxical results are possible, we should know why and under what circumstances it takes place. An answer for this question was initially presented in Leontief (1936).

Analyses of international transfers have been greatly stimulated by paradoxical welfare results, that is, the donor benefits and the recipient suffers from the transfer. Leontief (1936) observed such results using an example. The purpose of his paper is to

show the existence of the paradoxical welfare effects of an income transfer.

Leontief (1936) considered a numerical example in a two-country and two-good framework. The two goods are freely traded. The donor country makes aid by transfer of goods to the recipient country. The income transfer is collected and distributed in a non-distortive lump-sum fashion. The terms of trade may change due to changes in the demand for goods as a result of the transfer. It is assumed that markets clear at all times and both countries' economies are perfectly competitive. He compared the pre-transfer consumption bundles with the post-transfer consumption bundles. The donor country gains and the recipient country suffers from the transfer. These results are counter-intuitive, therefore, termed "the transfer paradoxes". The transfer paradox has attracted a lot of attention of economists.

The reason for the paradoxical welfare results is the enormous changes in terms of trade. The terms of trade strongly change in favor of the donor country as a result of the transfer and it is large enough to dominate the direct income loss of the transfer. We should notice that the transfer paradoxes do not arise from distortions in the economy. This Leontief's welfare result is obtained under the circumstance that even though the relative price of one good has extremely increased as a result of the transfer, both the donor and the recipient increase the relative consumption of the good. This peculiar expenditures on goods arising from strong income effects are the factor of the paradox.

Samuelson (1947) first pointed out that in a competitive, distortion-free, two-country and two-good world a transfer will always reduce the donor's welfare and increase the recipient's welfare, if the equilibrium is Walrasian-stable. Thus, this implies that Leontief's paradoxical welfare results of unilateral lump-sum transfers can only happen under an unstable equilibrium. In a system where an increase in a price of a

commodity increases rather than decreases demand for the commodity, the transfer paradoxes can only occur. Samuelson (1947) did not prove his claim that the donor country suffers and the recipient country gains from an income transfer, provided that the equilibrium is stable. Many years later, the result is proved by Mundell (1960) (see also Jones, 1970, 1975; Kemp, 1964). We can prove the Samuelson's welfare results straightforwardly using the duality theory (e.g., Kemp, 1995; Brakman and Marrewijk, 1998).

We present the basic transfer model using the duality theory as in Kemp (1995) and Brakman and Marrewijk (1998).[1] There are two free-trading countries, α and β, and two goods, good 1 and 2. Households of each country is completely homogeneous in preferences and asset holdings. The transfer (T) is financed in α and distributed in β by means of lump-sum taxes and subsidies. Then, equilibrium in the world economy is characterized by the following conditions:

$$E^{\alpha}(p, u^{\alpha}) = r^{\alpha}(p) - T, \tag{1.1}$$

$$E^{\beta}(p, u^{\beta}) = r^{\beta}(p) + T, \tag{1.2}$$

$$z^{\alpha 1}(p, u^{\alpha}) + z^{\beta 1}(p, u^{\beta}) = 0. \tag{1.3}$$

$E^{j}(p, u^{j})$ is the expenditure function of country j with expenditure in terms of good 2 ($j = \alpha, \beta$). p is the price of good 1 in terms of good 2. The utility level of country j is denoted by u^{j}. $r^{j}(p)$ is the revenue function of country j with revenue in terms of good 2. $z^{j1}(p, u^{j}) \equiv E_{p}^{j} - r_{p}^{j}$ is the excess demand function for good 1 in

[1] The transfer problem is examined in overlapping generations models. For example, Haaparanta (1989) studied the transfer problem in an overlapping generations model with government debt. The international transfer is from a creditor country to a debtor country and he showed possibility of the transfer paradox under the stability condition.

country j and subscripts indicate differentiation (e.g., $E_p^j \equiv \partial E^j / \partial p$). Equations (1.1) and (1.2) are the budget constraints of the donor and the recipient, respectively. Equation (1.3) is the market-clearing condition for good 1. From Walras' Law, the description of world equilibrium is completed by the system of equations (1.1)–(1.3). The system is assumed to possess a unique solution.

We now see the effects of an income transfer. It is assumed that the initial amount of the transfer $T = 0$. Differentiating the system (1.1)–(1.3), we obtain the following equations:

$$\Delta(dp/dT) = \left(pz_u^{\alpha 1} - pz_u^{\beta 1} \right)/p \,, \tag{1.4}$$

$$\Delta\left(du^{\alpha}/dT\right) = -z_p^1 = -\Delta\left(du^{\beta}/dT\right), \tag{1.5}$$

where $z_p^1 \equiv z_p^{\alpha 1} + z_p^{\beta 1}$ and $\Delta \equiv z_p^1 + z^{\beta 1}(pz_u^{\alpha 1} - pz_u^{\beta 1})/p$. z_p^1 is the sum of two pure (or compensated) price slopes of the two countries and is necessarily negative. Δ represents the Jacobian determinant of the system (1.1)–(1.3). We consider the dynamic system consisting of equations (1.1), (1.2), and $\dot{p} = a\left[z^{\alpha 1}(p, u^{\alpha}) + z^{\beta 1}(p, u^{\beta})\right]$. The relative price p is adjusted according to the equation $\dot{p} = a\left[z^{\alpha 1}(p, u^{\alpha}) + z^{\beta 1}(p, u^{\beta})\right]$ where $\dot{p}$ denotes the change in the relative price of good 1 over times as a result of an imbalance in the demand and supply of good 1. $a > 0$ reflects the speed of price adjustment in the goods market. Linearizing the system at the equilibrium values of the variables, we obtain $\Delta < 0$ if the equilibrium is locally Walrasian stable. Let us assume that $\Delta < 0$. We note that $pz_u^{j1} / E_u^j = pz_u^{j1}$ is the marginal propensity to consume good 1 in country j.

From equation (1.5), an international transfer necessarily hurts the donor country α and benefits the recipient country β. Under Walrasian stability, no paradoxical welfare results, that is, donor-enrichment or recipient-impoverishment, can appear, no matter how special the marginal propensities to consume in each country. If the marginal propensities to consume goods are the same for the donor and the recipient (i.e., $pz_u^{\alpha 1} = pz_u^{\beta 1}$), there are no terms of trade effects from equation (1.4). In this case, the welfare consequences are due to a pure income effect of the transfer; one unit gain of welfare in the recipient country and one unit loss of welfare in the donor country. Without loss of generality, we assume that the recipient imports and the donor exports good 1, i.e., $z^{\beta 1} > 0$. If the marginal propensity to consume the recipient's imported (the donor's exported) good is higher in the recipient than the donor (i.e., $z^{\beta 1}(pz_u^{\alpha 1} - pz_u^{\beta 1})/p < 0$), the recipient gains as a result of the transfer but partially suffers from the deterioration in its terms of trade. On the other hand, the donor suffers as a result of the transfer but there is secondary benefit from the improvement in its terms of trade. There is strong support for the Samuelson's ordinary welfare result under the stability condition.

We can interpret in the basic transfer model that Ohlin stressed the importance of differences of the marginal propensities to consume between the donor and the recipient. Keynes was right in the sense that the transfer payment was difficult for Germany if the rest of the world did not spend much of the transfer on German exports.

The Samuelson's proposition is based on strict assumptions. The proposition on the welfare effects of transfers can be generalized to a limited extent. First, Safra (1983) showed that the number of commodities is immaterial to obtain the ordinary welfare

effects. Second, the proposition remains valid if there is a country-specific non-traded good in the donor and the recipient countries (e.g., McDougall, 1965; Chipman, 1974; Jones, 1975). Third, Kemp and Abe (1994) studied the transfer problem in a context of public goods. They showed that the donor suffers and the recipient benefits from an international transfer in a competitive, two-good, two-country and Walrasian-stable world, even if there is a country-specific public consumption good that is provided efficiently.

It is well-known that transfer paradoxes can occur in more generalized frameworks. The following sections relax the assumptions used to obtain the Samuelson's proposition. There are not only two countries (the donor and the recipient) and there exist bystanders. Markets are not perfectly competitive and free of distortions (e.g., trade policy). Moreover, the recipient country cannot freely spend the transfer and there are some constraints (i.e., tied aid).

1.4 Third parties

We showed that in a two-country, competitive, and distortion-free world, transfer paradoxes never occur if the economy is Walrasian-stable. For many years, it was taken for granted that the proposition remains valid under more general assumptions. In the basic transfer model, however, there is a donor and a recipient, but there are no other countries. Does the existence of other countries which do not participate in the transfer play a vital role in welfare effects of the transfer?

It was David Gale's important contribution to show that when an income transfer is given in the presence of bystanders there is possibility of transfer paradoxes, that is,

donor-enrichment and/or recipient-impoverishment, even if the world economy is stable and free of distortions (see, Gale, 1974). Of course, the ordinary two-country outcome is still possible. He observed the paradoxical welfare results using an example. There is no production of goods and each country has the fixed endowment of goods with fixed proportion preferences.

There are several important observations in Gale's example. First, the equilibrium is Walrasian-stable and the world economy is free of distortions. Second, the donor country gains from an international transfer as does the recipient country in the presence of bystanders. In the basic two-country transfer model, the donor's welfare always decreases as a result of a transfer when the world economy is stable. Third, since the initial equilibrium is Pareto-optimal in this distortion-free world, the donor and the recipient can gain from the transfer at the expense of the non-participating country. The transfer moves the world economy from one Pareto-optimal allocation to another. It can take place when the price of the donor's imported good extremely drops (see also Chichilnisky, 1980).

Bhagwati, Brecher, and Hatta (1983) and Yano (1983) formally examined the effects of transfers in a three-country framework. They obtained the conditions under which the transfer paradox will occur in a Walrasian-stable, competitive, two-good world with three countries. The donor country can only benefit from giving an international transfer, if (i) the bystander's offer curve is inelastic (or backward-bending, i.e., a country's exported good supply falls if the relative price of it rises), and/or (ii) the bystander's exported good is an inferior good to the recipient country. Similarly, the recipient country may suffer from the income transfer, if (i) the bystander's offer curve is inelastic, and/or (ii) the bystander's exported good is inferior in consumption to the

donor country. The transfer paradox is only possible if the offer curve is inelastic or there is an inferior good. In a three-country model, the relative price of one good rises if, and only if, the recipient country has a higher marginal propensity to consume the good than the donor country. The introduction of non-participating countries has no influence on changes in the terms of trade. The differences in preferences between the donor and the recipient will determine changes in the relative prices of goods as in a two-country transfer model.

1.5 Tied aid

Recently, the focus in the analyses of international transfers has been on so-called “tied aid” in various forms. It is widely accepted that tied aid may deteriorate the welfare of the recipient and improve that of the donor in a competitive two-country model. The term tied aid indicates that the recipient country is in some way restricted in the allocation of the resources it receives from the donor country. Foreign aid may be tied to a specific project, to a specific good or service, or to a trade or domestic policy reform. The most well-known way of restricting the allocation of aid by the donor country is through regional tying. The OECD’s Development Assistance Committee (DAC) distinguishes between untied aid, partially untied aid, and tied aid. Untied aid is not restricted in any way by the donor country. The recipient is forced to spend partially untied aid in the donor or any developing country. The remainder of aid is tied aid.

Most aid is given from the donor country’s government to the recipient country’s government. An income transfer is usually taken place not in lump-sum fashion. It is, however, often carried out in a tied manner such that the government of the donor

country restricts the way to expenditure the transfer in the recipient country. According to DAC, *Development Co-operation*, in 1996, for example, 71.6 percent of bilateral Official Development Assistance (ODA) by United States was tied aid. The average proportion of untied aid (i.e., not partially tied and tied aid) for the total 21 DAC members in 1996 was 69.7 percent.[2] Thus, it is quite essential to study tied aid in the transfer problem.

From the importance of tied aid in the real world and possibility of transfer paradoxes by tied aid, tied aid has attracted a lot of attention of economists. Ohyama (1974) initially presented the model of tied aid. He studied two types of tied aid that the recipient country is forced to (i) increase its import value and (ii) use the transfer to subsidize its imports from the donor country, and showed the possibility of transfer paradoxes. Brecher and Bhagwati (1982) analyzed aid tied to an increase in production of the specific good in the recipient country. Kemp and Kojima (1985) and Schweinberger (1990) formally examined aid that is tied to purchases of export goods of the donor country in a basic competitive two-country model. These two studies reached contrasting results on the welfare effects of tied aid, though they examined the same type of tied aid. Transfers analyzed by them are tied in the following sense. The government of the recipient country is forced to spend a fraction of aid on one good and the remainder on the other good, and the households of the recipient country are forced to consume them. Kemp and Kojima observed that the paradoxes of donor-enrichment and recipient-impoverishment might take place simultaneously by the tied aid. On the other hand, Schweinberger showed that recipient paradoxes may occur but donor paradoxes can be ruled out in his tied aid model.

[2] In the same year, on the other hand, 98.9 percent of bilateral ODA by Japan was untied aid.

Tied aid is examined in a non-competitive economy framework. Brakman and Marrewijk (1995) applied the Schweinberger's forced choice approach to a model with increasing returns to scale and monopolistic competition. Michael and Marrewijk (1998) examined the welfare effects of aid tied to capital transfers in a two-country model, where capital is either sector-specific or intersectorally mobile under full employment and unemployment of the Harris-Todaro type. They showed that welfare paradoxes are possible.

There are basically common approaches to tied aid in the above-mentioned studies. The aid is tied in the sense that the government restricts expenditures of the income transfer on goods, and differences in the policies between the donor and the recipient are not formally introduced into the models. The income transfers do not affect the policies originally taken by the government of the donor and the recipient for certain purpose. We will see such tied aid in the next section.

1.6 Trade policy and foreign aid

Trade policies, such as tariffs or quotas, may influence the welfare effects of an international transfer, since they affect the terms of trade. After the Samuelson's result, studies on transfer paradoxes were developed in more general frameworks with trade polices. Ohyama (1974) initially examined the transfer problem in the context of tariffs imposed by the recipient with a two-country and two-good model. He found the possibility of transfer paradoxes. Turunen-red and Woodland (1988) showed that a strict Pareto-improving multilateral transfer exists under tariff distortions.

Foreign aid can be tied in various forms. The government of the donor restricts the

allocation of the income transfer on goods and links it to changes in the policies originally taken by the government of the recipient. Such tied aid is formally introduced into the models and one of the recent important topics in the transfer problem. Lahiri and Raimondos (1995) first investigated tied aid related to changes in the policy. They examined the welfare effects of tied aid in the presence of quantitative restrictions in the recipient country and showed the possibility of transfer paradoxes. From this result, we can answer an interesting question that a country gains more from aid or from trade. More trade can be welfare-enhancing for both the donor and the recipient if the reduction of the quantitative restrictions is supported by the aid. Hatzipanayotou and Michael (1995) studied that the recipient country's government is forced to use an income transfer to finance pubic goods (see also Michael and Hatzipanayotou, 1996). Lahiri and Raimondos (1997) examined the tied aid to stimulate a trade policy reform in the recipient country.

References

Bhagwati, J. N., R. A. Brecher, and T. Hatta (1983), "The generalized theory of transfers and welfare: bilateral transfers in a multilateral world", *American Economic Review*, 73, 606-618.

Brakman, S. and C. Marrewijk (1995), "Transfers, returns to scale, tied aid and monopolistic competition", *Journal of Development Economics*, 47, 333-354.

——— (1998), *The Economics of International Transfers*, Cambridge: Cambridge University Press.

Brecher, R. A. and J. N. Bhagwati (1982), "Immiserizing transfers from abroad",

Journal of International Economics, 13, 353-364.

Chichilnisky, G. (1980), "Basic goods, the effects of commodity transfers and the international economic order", *Journal of Development Economics*, 7, 505-519.

Chipman, J. S. (1974), "The transfer problem once again", in G. Horwich and P. A. Samuelson (eds.), *Trade, Stability and Macroeconomics*, New York: Academic Press, 19-78.

Gale, D. (1974), "Exchange equilibrium and coalitions: an example", *Journal of Mathematical Economics*, 1, 63-66.

Haaparanta, P. (1989), "The intertemporal effects of international transfers", *Journal of International Economics*, 26, 371-382.

Hatzipanayotou, P. and M. S. Michael (1995), "Foreign aid and public goods", *Journal of Development Economics*, 47, 455-467.

Jones, R. W. (1970), "The transfer problem revisited", *Economica*, 37, 178-184.

——— (1975), "Presumption and the transfer problem", *Journal of International Economics*, 5, 263-274.

Kemp, M. C. (1964), *The Pure Theory of International Trade*, Englewood Cliffs: Prentice-Hall.

——— (1995), *The Gains from Trade and the Gains from Aid*, London: Routledge.

Kemp, M. C. and K. Abe (1994), "The transfer problem in the context of public goods", *Economics Letters*, 45, 223-226.

Kemp, M. C. and S. Kojima (1985), "Tied aid and the paradoxes of donor-enrichment and recipient-impoverishment", *International Economic Review*, 26, 721-729.

Keynes, J. M. (1929), "The German transfer problem", *Economic Journal*, 39, 1-7.

Lahiri, S. and P. Raimondos (1995), "Welfare effects of aid under quantitative trade

restrictions", *Journal of International Economics*, 39, 297-315.

——— (1997), "On the tying of aid to tariff reform", *Journal of Development Economics*, 54, 479-491.

Leontief, W. (1936), "A note on the pure theory of transfers", in *Explorations in Economics: Notes and Essays Contributed in Honor of F. W. Taussig*, New York: McGraw-Hill, 84-91.

McDougall, I. (1965), "Non-traded goods and the transfer problem", *Review of Economic Studies*, 32, 67-84.

Michael, M. S. and P. Hatzipanayotou (1996), "Foreign aid tied to public inputs", *Keio Economic Studies*, 33, 35-45.

Michael, M. S. and C. Marrewijk (1998), "Tied to capital or untied foreign aid?", *Review of Development Economics*, 2, 61-75.

Mundell, R. A. (1960), "The pure theory of international trade", *American Economic Review*, 50, 67-110.

Ohlin, B. (1929), "The reparations problem: a discussion; transfer difficulties, real and imagined", *Economic Journal*, 39, 172-183.

Ohyama, M. (1974), "Tariffs and the transfer problem", *Keio Economic Studies*, 11, 29-45.

Safra, Z. (1983), "The transfer paradox: stability, uniqueness and smooth preferences", Harvard University, mimeo.

Samuelson, P. A. (1947), *Foundations of Economic Analysis*, Cambridge, Mass.: Harvard University Press.

Schweinberger, A. G. (1990), "On the welfare effects of tied aid", *International Economic Review*, 31, 457-462.

Turunen-red, A. H. and A. D. Woodland (1988), “On the multilateral transfer problem: existence of Pareto improving international transfers”, *Journal of International Economics*, 25, 249-269.

Yano, M. (1983), “Welfare aspects of the transfer problem”, *Journal of International Economics*, 15, 277-289.

2 The Welfare Effects of Aid and International Capital Movement

2.1 Introduction

Since Samuelson (1952, 1954), a large volume of studies have established a widely-accepted proposition about the welfare effects of international transfers. That is, in a stable and distortion-free competitive world, with just two free-trading countries, a lump-sum transfer between countries must reduce the welfare of the donor and enhance that of the recipient (Samuelsonian proposition). Gale (1974), first represented in an example that when a transfer of goods is given in the presence of bystanders, there is possibility of the transfer paradox under the same conditions as the transfer with two agents. The bystander trades goods with the donor and the recipient but does not join transfers and it is considered as a distortion. Bhagwati, Brecher, and Hatta (1983), and Yano (1983) formally analyzed the welfare effects of transfers with the bystander in more general frameworks. The former introduced a suitable optimal tariff that rules out the paradox; the union of the donor and the recipient utilizing an optimal tariff against the bystander.

There have been a small number of studies highlighting the production sectors in the transfer problem. Especially, few papers focused on a factor market or factor itself. Caves and Jones (1985) examined aid by transfer of factors under no internationally mobile factors in a competitive model. They showed that it is no longer inevitable that the donor suffers and the recipient benefits from the aid, in other words, the transfer paradox may arise. Caves and Jones (1985) assumed no internationally mobile factors

and we can think it as a distortion. Wang (1985) showed that aid by transfer of goods may paradoxically increase or decrease the paying country's welfare in the presence of a factor market reward differential in a two-country model. A wage differential is maintained between the industries and it gives rise to a distortion. Li and Mayer (1990) analyzed the transfer problem with variable labor supply caused by intercountry differences in propensities to consume commodities and leisure. They showed that there is strong support for the paradox view on terms of trade changes. Those aboved-mentioned papers dealing with factor markets, however, did not study how international factor movement caused by transfers affects the welfare of countries.

Recently, a role of the government in the production sectors has been focused in the transfer problem. Kemp and Abe (1994) studied a transfer of goods in the context of a country-specific public good which is provided efficiently in a two-country model. They showed that the transfer paradox never appears. Kemp, Ng, and Shimomura (1993) and Kemp (1995) considered aid by transfer of information and the transfer may arise the transfer paradox. Hatzipanayotou and Michael (1995) studied that the recipient country's government is forced to use an income transfer to finance pubic goods (see also Michael and Hatzipanayotou, 1996). The allocation of this type of transfers is restricted in a particular fashion and it is called tied aid. It is well-known that such tied aid may deteriorate the recipient's welfare and improve the donor's welfare.

Chapter 2 represents the transfer problem in the context of internationally mobile capital, a topic which has been neglected in the preceding studies.[1] Recently, international capital movement caused by foreign aid has been widely taken as one of the important factors for the economic growth of developing countries. Aid enhances

[1] This chapter builds on Takarada (1998).

the income level of the recipient and can be used for providing infrastructures that contribute to the economic development. Foreign aid reduces the reluctance of private capital to migrate and the economic growth of the recipient accelerates. Therefore, the role of internationally mobile capital is indispensable for the evaluation of transfers effects. For the first step, chapter 2 simply studies the effects of international capital movement in the transfer problem.[2]

In this chapter, we will show that an international transfer benefits the recipient and suffers the donor in a competitive two-country framework in spite of free capital movement. The international capital movement restrains the change in the goods price. If capital moves internationally, the country's welfare will change depending conversely on the direction of improvement in its terms of trade, in comparison with the case of transfers without mobile capital. This result implies the following foreign aid program, if we assume that the donor can only approve a fixed welfare loss through the income transfer. That is, the amount of aid under internationally mobile capital may tend to be *smaller* (*larger*) than that of aid without internationally mobile capital, if terms of trade improve in favor of the *donor* (*recipient*) country as a result of the aid. We show that aid by capital, which means renting capital for a lower rental price than at market equilibrium, can be treated as a transfer of rental subsidy. Furthermore, aid by transfer of goods in a framework with the bystander is discussed. Even if a transfer of goods is given among three countries, we can rule out the transfer paradox by introducing internationally mobile capital. To obtain the ordinary welfare effects of transfers, we

[2] Takarada (1999) analyzed the welfare effects of a transfer in a tow-country general equilibrium model with incomplete factor mobility in the recipient. Technology of converting a specific capital into a non-specific one, which is embodied in the donor's internationally mobile capital, is diffused to the recipient by means of Marshallian externality. The transfer suffers the donor and benefits the recipient, if the converted capital is irreversible, goods are not inferior, and the equilibrium is stable. The world welfare improves (does not change) if the donor's capital flows into (out from) the recipient, however,

assume some conditions in order for the Chipman flat to exist and do not use an optimal tariff employed by Bhagwati et al. (1983).

Chapter 2 is organized as follows. Section 2.2 analyzes aid by transfer of goods with two agents in two cases. We assume both free trade and free capital mobility in the first case, and only free capital mobility in the second case. We study the differences between the effects of transfers with and without mobile capital. Aid by capital is studied in a two-country model in section 2.3. In section 2.4, aid by transfer of goods with the bystander is discussed. Finally, section 2.5 concludes the chapter with a summary of the effects of international capital movement in the transfer problem.

2.2 Aid by transfer of goods with two agents

2.2.1 Goods trade and capital movement

We begin with a case of the two-agent transfer problem under both free trade and free capital mobility. Let there be two free-trading countries with internationally mobile capital, α and β, and two goods, 1 and 2. Good 2 is chosen as numeraire. The price of good 1 and the rental rate of capital in terms of good 2 are denoted by p and r, respectively. The amount of capital movement and aid from α to β are denoted by k and $T^{\alpha\beta}$, respectively; the amount of an income transfer in terms of the second good is initially, $T^{\alpha\beta} = 0$.

The household of each country is completely homogeneous in all respects. The expenditure function of the j th country may therefore be written simply as $E^j(p, u^j)$, in terms of the second good, where u^j denotes the welfare level of country j. The

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there is no Pareto improving outcome under the normality condition.

gross domestic product function of the j th country is denoted by $G^j(p, K^j, v^j)$, in terms of the second good, where K^j is the amount of capital worked and v^j is the vector of other factor endowments in the j th country; $K^\alpha \equiv \bar{k}^\alpha - k$, $K^\beta \equiv \bar{k}^\beta + k$, where $\bar{k}^j$ is the amount of capital endowment in the j th country. G^j is defined for *given* K^j and v^j, in that sense, is *restricted* revenue function.[3] Henceforth, we shall delete the constant endowments vector and rewrite the gross domestic product function of the j th country simply as $g^j(p, K^j)$. The excess demand function for good 1 in the j th country is then $z^{j1}(p, u^j, k) \equiv \partial E^j / \partial p - \partial g^j / \partial p$.

A transfer is financed in α and distributed in β by means of lump-sum taxes and subsidies. The equilibrium of the world economy is described by the system of equations:

$$E^\alpha(p, u^\alpha) = g^\alpha(p, K^\alpha) + rk - T^{\alpha\beta}, \tag{2.1}$$

$$E^\beta(p, u^\beta) = g^\beta(p, K^\beta) - rk + T^{\alpha\beta}, \tag{2.2}$$

$$z^{\alpha 1}(p, u^\alpha, k) + z^{\beta 1}(p, u^\beta, k) = 0, \tag{2.3}$$

$$r = g_K^\alpha(p, K^\alpha), \tag{2.4}$$

$$r = g_K^\beta(p, K^\beta), \tag{2.5}$$

where subscripts indicate partial derivatives (e.g., $g_K^\alpha \equiv \partial g^\alpha / \partial K^\alpha$). Here, equations (2.1) and (2.2) are budget constraints of households. They indicate that household expenditure is constrained by the sum of earnings from production, returns from capital, and the amount received by the transfer (negative for α, positive for β). Equation (2.3) expresses the market-clearing condition for good 1. Finally, equations (2.4) and

[3] Such revenue function (the gross domestic product function) is used in Neary (1985) to examine an economy with international factor mobility. See the properties of the function in Neary (1985), and Li and Mayer (1990).

(2.5) state the market-clearing equations for capital under free capital mobility. In view of Walras' Law, the market-clearing equation for good 2 has been omitted.

We consider the effects of an income transfer. Totally differentiating (2.1)–(2.5), choosing units of utility so that $E_u^j \equiv 1$, and defining $z_p^1 \equiv z_p^{\alpha 1} + z_p^{\beta 1}$, we obtain

$$\Delta\left(dp/dT^{\alpha\beta}\right) = \left(g_{KK}^{\alpha} + g_{KK}^{\beta}\right)\left(pz_u^{\beta 1} - pz_u^{\alpha 1}\right)/p\,, \tag{2.6.a}$$

$$\Delta\left(dr/dT^{\alpha\beta}\right) = \left(g_{KK}^{\alpha} g_{Kp}^{\beta} + g_{KK}^{\beta} g_{Kp}^{\alpha}\right)\left(pz_u^{\beta 1} - pz_u^{\alpha 1}\right)/p\,, \tag{2.6.b}$$

$$\Delta\left(dk/dT^{\alpha\beta}\right) = \left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)\left(pz_u^{\beta 1} - pz_u^{\alpha 1}\right)/p\,, \tag{2.6.c}$$

$$\Delta\left(du^{\alpha}/dT^{\alpha\beta}\right) = \left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)^2 + z_p^1\left(g_{KK}^{\alpha} + g_{KK}^{\beta}\right), \tag{2.6.d}$$

$$\Delta\left(du^{\beta}/dT^{\alpha\beta}\right) = -\Delta\left(du^{\alpha}/dT^{\alpha\beta}\right), \tag{2.6.e}$$

where

$$\begin{aligned}\Delta \equiv -\left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)^2 - \left(g_{KK}^{\alpha} + g_{KK}^{\beta}\right)\left[z_p^1 + z^{\alpha 1}\left(z_u^{\beta 1} - z_u^{\alpha 1}\right)\right] \\ + k\left(z_u^{\beta 1} - z_u^{\alpha 1}\right)\left(g_{KK}^{\alpha} g_{Kp}^{\beta} + g_{KK}^{\beta} g_{Kp}^{\alpha}\right).\end{aligned} \tag{2.7}$$

It can be shown that $\Delta < 0$ is a sufficient but not necessary condition for the local stability of the system;[4] let us assume that $\Delta < 0$. Since $z_p^1 < 0$ and $g_{KK}^j \le 0$, (2.6.d) and (2.6.e) yield the desired result:

$$du^{\alpha}/dT^{\alpha\beta} < 0\,,\quad du^{\beta}/dT^{\alpha\beta} > 0\,. \tag{2.8}$$

That is, an income transfer deteriorates the welfare of the donor country and improves that of the recipient country under goods trade and capital movement.

[4] We consider price adjustment in the goods market and quantity adjustment in the capital market. The goods price p and international capital movement k are adjusted according to the following conditions: $\dot{p} = a[z^{\alpha 1}(p, u^{\alpha}, k) + z^{\beta 1}(p, u^{\beta}, k)]$, $\dot{k} = b[g_K^{\beta}(p, K^{\beta}) - g_K^{\alpha}(p, K^{\alpha})]$, where $a > 0$ and $b > 0$

2.2.2 The effects of transfers with and without mobile capital

It is important to see how the introduction of international capital movement affects the ordinary welfare effects of transfers without factor mobility. There are the ordinary direct transfer and terms of trade effects, and the change in returns from capital in addition. Therefore, to make the comparison between the effects of transfers with and without internationally mobile capital, we consider a case of no initial capital movement, $k = 0$. The effects of a transfer are decomposed into the transfer itself and capital movement:

$$\Delta'\left(dp/dT^{\alpha\beta}\right) = -\left(pz_u^{\beta 1} - pz_u^{\alpha 1}\right)/p - \left(pz_u^{\beta 1} - pz_u^{\alpha 1}\right)\left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)^2/p\Delta, \tag{2.9}$$

$$= -\left[\left(pz_u^{\beta 1} - pz_u^{\alpha 1}\right)/p\right]\left[1 + \left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)^2/\Delta\right], \tag{2.9'}$$

$$\Delta'\left(du^{\alpha}/dT^{\alpha\beta}\right) = -\Delta'\left(du^{\beta}/dT^{\alpha\beta}\right),$$

$$= -z_p^1 + z^{\alpha 1}\left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)^2\left(pz_u^{\beta 1} - pz_u^{\alpha 1}\right)/p\Delta, \tag{2.10}$$

where $\Delta' \equiv z_p^1 + z^{\beta 1}\left(pz_u^{\alpha 1} - pz_u^{\beta 1}\right)/p < 0$ is a condition for the stability of goods market. The first right hand side terms of (2.9) and (2.10) denote the effects of the transfer without capital movement; i.e., $-\left(pz_u^{\beta 1} - pz_u^{\alpha 1}\right)/p$ in terms of trade and $-z_p^1$ in welfare are the ordinary effects of the transfer. The second right hand side terms of (2.9) and (2.10), $-\left(pz_u^{\beta 1} - pz_u^{\alpha 1}\right)\left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)^2/p\Delta$ and $z^{\alpha 1}\left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)^2\left(pz_u^{\beta 1} - pz_u^{\alpha 1}\right)/p\Delta$, are the additional effects caused by introduction of

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reflect the speeds of adjustment.

internationally mobile capital. The signs of them are determined by whether capital moves after the transfer.

Equation (2.6.c) implies that capital movement arises if the factor intensity of good 1 and the marginal propensity to consume good 1 are different between α and β; that is, $g^{\alpha}_{Kp} - g^{\beta}_{Kp} \neq 0$ and $pz^{\beta 1}_{u} - pz^{\alpha 1}_{u} \neq 0$. Stability conditions ($\Delta < 0$ and $\Delta' < 0$) and $g^{j}_{KK} \leq 0$ denote $0 \leq 1 + \left(g^{\alpha}_{Kp} - g^{\beta}_{Kp}\right)^2 / \Delta < 1$ if $g^{\alpha}_{Kp} - g^{\beta}_{Kp} \neq 0$. Therefore, the international capital movement restrains changes in the goods price. That is, from equation (2.9'), $-\left[(pz^{\beta 1}_{u} - pz^{\alpha 1}_{u})/p\right]\left[1 + (g^{\alpha}_{Kp} - g^{\beta}_{Kp})^2 / \Delta\right] > (<) -(pz^{\beta 1}_{u} - pz^{\alpha 1}_{u})/p$, if the marginal propensity to consume good 1 of the recipient is greater (less) than that of the donor, $pz^{\beta 1}_{u} - pz^{\alpha 1}_{u} > (<) 0$.

To understand why this will happen, we should consider the effect of capital movement to the change in the world supply of good 1. It can be easily seen from (2.6.c). Suppose that good 1 is capital intensive in the donor country ($g^{\alpha}_{Kp} = \partial Q^{\alpha 1} / \partial K^{\alpha} > 0$, where Q^{j1} is the amount of good 1 produced in country j). On the other hand, good 1 is not capital intensive (e.g., labor intensive) in the recipient country ($g^{\beta}_{Kp} = \partial Q^{\beta 1} / \partial K^{\beta} < 0$). Then, $g^{\alpha}_{Kp} - g^{\beta}_{Kp} > 0$. Furthermore, we assume that the marginal propensity to consume good 1 of the recipient is greater than that of the donor, $pz^{\beta 1}_{u} - pz^{\alpha 1}_{u} > 0$. In this case of $g^{\alpha}_{Kp} - g^{\beta}_{Kp} > 0$ and $pz^{\beta 1}_{u} - pz^{\alpha 1}_{u} > 0$, from equation (2.6.c), capital moves from the recipient to the donor. The increase of capital worked in the donor country will increase the supply of good 1 ($g^{\alpha}_{Kp} = \partial Q^{\alpha 1} / \partial K^{\alpha} > 0$). The decrease of capital worked in the recipient country will also increase the supply of

good 1 ($g^{\beta}_{Kp} = \partial Q^{\beta 1} / \partial K^{\beta} < 0$). Thus, the world supply of good 1 necessarily increases. Other cases can be similarly treated. Note that even if the marginal propensity to consume good 1 of the recipient is greater (less) than that of the donor, international capital movement involves increase (decrease) in the world supply of good 1. This movement of capital weakens the change in the terms of trade.

Now, we can consider how internationally mobile capital affects the welfare. If the relationship between the marginal propensity to consume good 1 of the recipient and the donor are such that $pz_u^{\beta 1} - pz_u^{\alpha 1} > (<)\ 0$, from (2.6.a), the terms of trade in the donor improve (deteriorate) when it exports good 1 ($z^{\alpha 1} < 0$). However, the price change is restrained by international capital movement as we see in the above. The improvement (deterioration) in terms of trade of the donor with capital movement is smaller than that of the donor without capital movement. The effect of terms of trade in the recipient is symmetric since the recipient imports good 1 from (2.3) ($z^{\beta 1} = -z^{\alpha 1} > 0$). Thus, (2.10) expresses that if capital moves between the countries as a result of a transfer, the welfare effect of the transfer will be magnified or reduced depending conversely on the direction of improvement in each country's terms of trade. This result implies the following foreign aid program, if we assume that the donor country can only approve a fixed welfare loss through the income transfer. That is, the amount of aid under internationally mobile capital may tend to be *smaller* (*larger*) than that of aid without internationally mobile capital, if terms of trade improve in favor of the *donor* (*recipient*) country as a result of the aid.

2.2.3 The pure capital mobility case

We consider another case in which capital is allowed to move internationally but trade in goods is ruled out. It could be interpreted as the case where goods trade is rather restricted and small. On the other hand, factors such as capital or labor move internationally more freely. The system is described as follows:

$$E^{\alpha}(p^{\alpha}, u^{\alpha}) = g^{\alpha}(p^{\alpha}, K^{\alpha}) + rk - T^{\alpha\beta}, \tag{2.11}$$

$$E^{\beta}(p^{\beta}, u^{\beta}) = g^{\beta}(p^{\beta}, K^{\beta}) - rk + T^{\alpha\beta}, \tag{2.12}$$

$$z^{\alpha 1}(p^{\alpha}, u^{\alpha}, k) = 0, \tag{2.13}$$

$$z^{\beta 1}(p^{\beta}, u^{\beta}, k) = 0, \tag{2.14}$$

$$r = g_K^{\alpha}(p^{\alpha}, K^{\alpha}), \tag{2.15}$$

$$r = g_K^{\beta}(p^{\beta}, K^{\beta}), \tag{2.16}$$

where p^j is the domestic price of good 1 in the j th country. Here, equations (2.11) and (2.12) are the budget constraints of households in the donor and the recipient, respectively. They indicate that household expenditure is constrained by the sum of earnings from production, returns from capital, and the amount received by the transfer (negative for α, positive for β). There is no goods trade, (2.13) and (2.14) express the market-clearing conditions for good 1 in each country. Equations (2.15) and (2.16) state the market-clearing equations for capital under free capital mobility and the rental price is equal in both countries.[5] Then, we have

$$\Delta''\left(dp^{\alpha}/dT^{\alpha\beta}\right) = -z_u^{\alpha 1} z_p^{\beta 1}\left(g_{KK}^{\alpha} + g_{KK}^{\beta}\right) + g_{Kp}^{\beta}\left(pz_u^{\beta 1} g_{Kp}^{\alpha} - pz_u^{\alpha 1} g_{Kp}^{\beta}\right)/p, \tag{2.17.a}$$

[5] In this pure capital mobility case, trade-balance means that returns from capital or rental cost is equal to the transfer. That is, $T^{\alpha\beta} = rk$ and trade in capital is balanced in both countries.

$$\Delta''\left(dp^{\beta}/dT^{\alpha\beta}\right)=z_u^{\beta 1}z_p^{\alpha 1}\left(g_{KK}^{\alpha}+g_{KK}^{\beta}\right)+g_{Kp}^{\alpha}\left(pz_u^{\beta 1}g_{Kp}^{\alpha}-pz_u^{\alpha 1}g_{Kp}^{\beta}\right)/p\,, \tag{2.17.b}$$

$$\begin{aligned}\Delta''\left(dr/dT^{\alpha\beta}\right)=&-z_u^{\alpha 1}z_p^{\beta 1}g_{Kp}^{\alpha}g_{KK}^{\beta}+z_u^{\beta 1}z_p^{\alpha 1}g_{Kp}^{\beta}g_{KK}^{\alpha}\\&+g_{Kp}^{\alpha}g_{Kp}^{\beta}\left(pz_u^{\beta 1}g_{Kp}^{\alpha}-pz_u^{\alpha 1}g_{Kp}^{\beta}\right)/p\,,\end{aligned} \tag{2.17.c}$$

$$\Delta''\left(dk/dT^{\alpha\beta}\right)=-z_u^{\alpha 1}z_p^{\beta 1}g_{Kp}^{\alpha}-z_u^{\beta 1}z_p^{\alpha 1}g_{Kp}^{\beta}\,, \tag{2.17.d}$$

$$\Delta''\left(du^{\alpha}/dT^{\alpha\beta}\right)=z_p^{\alpha 1}\left(g_{Kp}^{\beta}\right)^2+z_p^{\beta 1}\left(g_{Kp}^{\alpha}\right)^2+z_p^{\alpha 1}z_p^{\beta 1}\left(g_{KK}^{\alpha}+g_{KK}^{\beta}\right), \tag{2.17.e}$$

$$\Delta''\left(du^{\beta}/dT^{\alpha\beta}\right)=-\Delta''\left(du^{\alpha}/dT^{\alpha\beta}\right), \tag{2.17.f}$$

where

$$\begin{aligned}\Delta''\equiv&-z_p^{\alpha 1}\left(g_{Kp}^{\beta}\right)^2-z_p^{\beta 1}\left(g_{Kp}^{\alpha}\right)^2-z_p^{\alpha 1}z_p^{\beta 1}\left(g_{KK}^{\alpha}+g_{KK}^{\beta}\right)\\&-k\left\{z_u^{\alpha 1}g_{Kp}^{\alpha}\left[z_p^{\beta 1}g_{KK}^{\beta}+\left(g_{Kp}^{\beta}\right)^2\right]-z_u^{\beta 1}g_{Kp}^{\beta}\left[z_p^{\alpha 1}g_{KK}^{\alpha}+\left(g_{Kp}^{\alpha}\right)^2\right]\right\}>0\end{aligned} \tag{2.18}$$

is a condition for the local stability. Since $z_p^{j1}<0$ and $g_{KK}^{j}\le 0$, (2.17.e) and (2.17.f) yield the desired result:

$$du^{\alpha}/dT^{\alpha\beta}<0,\quad du^{\beta}/dT^{\alpha\beta}>0\,.$$

From this section, the following generalized Samuelsonian proposition can be derived.

Proposition 1. *Suppose that there is goods trade and/or international capital movement. Then, aid by lump-sum transfer of goods benefits the recipient and suffers the donor in a stable and distortion-free two-country model.*

It is known that Samuelsonian proposition can be generalized to a limited extent. For example, it can be shown that the number of commodities is immaterial (see, Kemp, 1995). If we think of international capital mobility as trade in a third commodity (capital

services), the model in this section is, in effect, dealing with a special example involving two-country and three-commodity. However, introducing internationally mobile capital, we can obtain the result as is shown in section 2.2.2. That is, we can see the degree of disturbance in the welfare effects of a transfer induced by capital movement after the transfer and compare them with the usual ones without capital movement. Furthermore, our model considers not only the difference of preferences through marginal propensities to consume, but it highlights the differences of technology in the production sectors between the donor and the recipient. The differences of technology between the two countries will prescribe the degree of the welfare effect of a transfer in each country.

2.3 Aid by capital with two agents

We consider aid by renting capital for a lower rental price than at market equilibrium (r). Such loan plays an important role in foreign aid such as a transfer of goods and technical assistance. Caves and Jones (1985) examined aid by transfer of factors under no internationally mobile factors. They pointed out the possibility of transfer paradoxes. If rental prices are different between the donor and the recipient, the capital movement changes each country's national income additionally as a result of a transfer of factors. On the other hand, we allow international factor movement. Both goods trade and capital movement are assumed. The donor (country α) government rents capital to the recipient (country β) for $(1-t)r$, $0<t<1$. The amount of aid by capital is denoted by λ; initially, $\lambda=0$. The budget constraint of the donor government is written as

$$r\lambda = (1-t)r\lambda + T\,, \tag{2.19}$$

where T is tax revenue. The left hand side of (2.19) is expenditure on renting capital from capitalists of α. The right hand side of (2.19) is revenue from renting capital to β and lump-sum taxes. Then, the private budget constraint of α and β are denoted by

$$E^{\alpha}(p, u^{\alpha}) = g^{\alpha}(p, \hat{K}^{\alpha}) + rk + (1-t)r\lambda\,, \tag{2.20}$$

$$E^{\beta}(p, u^{\beta}) = g^{\beta}(p, \hat{K}^{\beta}) - rk - (1-t)r\lambda\,, \tag{2.21}$$

respectively, where $\hat{K}^{\alpha} \equiv \bar{k}^{\alpha} - k - \lambda$, $\hat{K}^{\beta} \equiv \bar{k}^{\beta} + k + \lambda$. Market-clearing conditions for goods and capital are

$$z^{\alpha 1}(p, u^{\alpha}, k, \lambda) + z^{\beta 1}(p, u^{\beta}, k, \lambda) = 0\,, \tag{2.22}$$

$$r = g^{\alpha}_{\hat{K}}(p, \hat{K}^{\alpha})\,, \tag{2.23}$$

$$r = g^{\beta}_{\hat{K}}(p, \hat{K}^{\beta})\,. \tag{2.24}$$

Recalling initially $\lambda = 0$, we have

$$\Delta(dp/d\lambda) = tr\left(g^{\alpha}_{KK} + g^{\beta}_{KK}\right)\left(pz^{\beta 1}_{u} - pz^{\alpha 1}_{u}\right)/p\,, \tag{2.25.a}$$

$$\Delta(dr/d\lambda) = tr\left(g^{\alpha}_{KK}g^{\beta}_{Kp} + g^{\beta}_{KK}g^{\alpha}_{Kp}\right)\left(pz^{\beta 1}_{u} - pz^{\alpha 1}_{u}\right)/p\,, \tag{2.25.b}$$

$$\begin{aligned}\Delta(dk/d\lambda) = {} & \left(g^{\alpha}_{Kp} - g^{\beta}_{Kp}\right)^2 + z^1_p\left(g^{\alpha}_{KK} + g^{\beta}_{KK}\right) \\ & + \left[z^{\alpha 1}\left(g^{\alpha}_{KK} + g^{\beta}_{KK}\right) - k\left(g^{\alpha}_{KK}g^{\beta}_{Kp} + g^{\beta}_{KK}g^{\alpha}_{Kp}\right)\right. \\ & \left. + tr\left(g^{\alpha}_{Kp} - g^{\beta}_{Kp}\right)\right]\left(pz^{\beta 1}_{u} - pz^{\alpha 1}_{u}\right)/p\,,\end{aligned} \tag{2.25.c}$$

$$\Delta(du^{\alpha}/d\lambda) = tr\left[\left(g^{\alpha}_{Kp} - g^{\beta}_{Kp}\right)^2 + z^1_p\left(g^{\alpha}_{KK} + g^{\beta}_{KK}\right)\right], \tag{2.25.d}$$

$$\Delta\left(du^{\beta}/d\lambda\right) = -\Delta\left(du^{\alpha}/d\lambda\right). \qquad (2.25.e)$$

It can be seen from comparing equation (2.25) with equation (2.6) that aid by capital has almost the same effect as giving $T = t\,r\,\lambda$ by goods as rental subsidy. Caves and Jones (1985) observed that if there is no internationally mobile factor, aid by factor may bring the transfer paradox. The paradox may take place when intensity of goods, exported/imported goods, taste, or the factor price is different between α and β. If capital is internationally mobile, aid by capital has the same welfare effects as a transfer of goods. This can be obtained straightforward by rewriting (2.20), (2.21), and (2.22) as

$$E^{\alpha}(p, u^{\alpha}) = g^{\alpha}(p, \hat{K}^{\alpha}) + rk^{*} - \tilde{T}^{\alpha\beta}, \qquad (2.20')$$

$$E^{\beta}(p, u^{\beta}) = g^{\beta}(p, \hat{K}^{\beta}) - rk^{*} + \tilde{T}^{\alpha\beta}, \qquad (2.21')$$

$$z^{\alpha 1}(p, u^{\alpha}, k^{*}) + z^{\beta 1}(p, u^{\beta}, k^{*}) = 0, \qquad (2.22')$$

where $k^{*} = k + \lambda$ and $\tilde{T}^{\alpha\beta} = t\,r\,\lambda$. Formally, the two systems, [(2.1)–(2.5)] and [(2.20'), (2.21'), (2.22'), (2.23), and (2.24)], are the same with each other. Thus, the argument in section 2.2.1 can be directly applied to this case of aid by capital because initially $\lambda = 0$ is assumed. The effects of aid by capital when goods trade is ruled out can be analyzed in a similar way. The following corollary can be directly derived from the anti-paradox result of proposition 1.

Corollary. *We assume a stable and distortion-free two-country model with free capital mobility. Then, the welfare effects of aid by capital are equal to those of aid by lump-sum transfer of goods given as rental subsidy, regardless of whether there is goods trade or not.*

2.4 Aid with three agents

2.4.1 The model

Since Gale (1974), it is accepted that it is no longer inevitable that the donor suffers and the recipient benefits when aid is given in the presence of bystanders with trade in goods, even if the world economy is stable and free of distortions. Of course, the Samuelsonian proposition outcome is still possible, generally the welfare effects of transfers differ. Bhagwati, Brecher, and Hatta (1983) introduced a suitable optimal tariff that rules out the transfer paradox; the union of the donor and the recipient utilizing an optimal tariff against the bystander.

Actually, it is significant to discuss the transfer problem taking the rest of the world into consideration. In this section, a transfer with the bystander is analyzed and the role of international capital movement is observed.

We add a free-trading country γ without internationally mobile capital to the system (2.1)–(2.5).[6] The gross domestic product function and the excess demand function for good 1 of γ in terms of the second commodity are denoted by $g^{\gamma}(p)$ and $z^{\gamma 1}(p, u^{\gamma})$, respectively. A transfer is financed in α and distributed in γ by means of lump-sum taxes and subsidies, and denoted by $T^{\alpha\gamma}$ in terms of the second commodity, initially $T^{\alpha\gamma} = 0$.[7] The system is described as follows:

$$E^{\alpha}(p, u^{\alpha}) = g^{\alpha}(p, K^{\alpha}) + rk - T^{\alpha\gamma}, \tag{2.26}$$

[6] Even if the bystander is a country with free trade and capital movement or with only international capital movement, the fundamental outcomes are the same. In the transfer problem, the assumption of free trade and free capital mobility in three countries may be unrealistic. Because, usually there are differences in trade policy, technology, and factor endowments in each country.

[7] A transfer from α to β can be treated in a similar way, and the fundamental conclusions are not affected by a selection of the donor and the recipient among three countries.

$$E^{\beta}(p,\, u^{\beta}) = g^{\beta}(p,\, K^{\beta}) - rk\,, \tag{2.27}$$

$$E^{\gamma}(p,\, u^{\gamma}) = g^{\gamma}(p) + T^{\alpha\gamma}\,, \tag{2.28}$$

$$z^{\alpha 1}(p,\, u^{\alpha},\, k) + z^{\beta 1}(p,\, u^{\beta},\, k) + z^{\gamma 1}(p,\, u^{\gamma}) = 0\,, \tag{2.29}$$

$$r = g_K^{\alpha}(p,\, K^{\alpha})\,, \tag{2.4}$$

$$r = g_K^{\beta}(p,\, K^{\beta})\,. \tag{2.5}$$

Differentiating this system totally, and redefining z_p^1 as $z_p^{\alpha 1} + z_p^{\beta 1} + z_p^{\gamma 1}$, we obtain

$$\Delta'''\left(dp/dT^{\alpha\gamma}\right) = -\left(g_{KK}^{\alpha} + g_{KK}^{\beta}\right)\left(pz_u^{\gamma 1} - pz_u^{\alpha 1}\right)/p\,, \tag{2.30.a}$$

$$\Delta'''\left(dr/dT^{\alpha\gamma}\right) = -\left(g_{KK}^{\alpha} g_{Kp}^{\beta} + g_{KK}^{\beta} g_{Kp}^{\alpha}\right)\left(pz_u^{\gamma 1} - pz_u^{\alpha 1}\right)/p\,, \tag{2.30.b}$$

$$\Delta'''\left(dk/dT^{\alpha\gamma}\right) = -\left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)\left(pz_u^{\gamma 1} - pz_u^{\alpha 1}\right)/p\,, \tag{2.30.c}$$

$$\begin{aligned}\Delta'''\left(du^{\alpha}/dT^{\alpha\gamma}\right) = &-\left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)^2 - \left(g_{KK}^{\alpha} + g_{KK}^{\beta}\right)\left[z_p^1 - z^{\beta 1}\left(pz_u^{\beta 1} - pz_u^{\gamma 1}\right)/p\right] \\ &+ k\left(pz_u^{\beta 1} - pz_u^{\gamma 1}\right)\left(g_{KK}^{\alpha} g_{Kp}^{\beta} + g_{KK}^{\beta} g_{Kp}^{\alpha}\right)/p\,,\end{aligned} \tag{2.30.d}$$

$$\begin{aligned}\Delta'''\left(du^{\beta}/dT^{\alpha\gamma}\right) = &- z^{\beta 1}\left(g_{KK}^{\alpha} + g_{KK}^{\beta}\right)\left(pz_u^{\alpha 1} - pz_u^{\gamma 1}\right)/p \\ &- k\left(pz_u^{\alpha 1} - pz_u^{\gamma 1}\right)\left(g_{KK}^{\alpha} g_{Kp}^{\beta} + g_{KK}^{\beta} g_{Kp}^{\alpha}\right)/p\,,\end{aligned} \tag{2.30.e}$$

$$\begin{aligned}\Delta'''\left(du^{\gamma}/dT^{\alpha\gamma}\right) = &\left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)^2 + \left(g_{KK}^{\alpha} + g_{KK}^{\beta}\right)\left[z_p^1 + z^{\beta 1}\left(pz_u^{\alpha 1} - pz_u^{\beta 1}\right)/p\right] \\ &+ k\left(pz_u^{\alpha 1} - pz_u^{\beta 1}\right)\left(g_{KK}^{\alpha} g_{Kp}^{\beta} + g_{KK}^{\beta} g_{Kp}^{\alpha}\right)/p\,,\end{aligned} \tag{2.30.f}$$

where

$$\begin{aligned}\Delta''' \equiv &\left(g_{Kp}^{\alpha} - g_{Kp}^{\beta}\right)^2 + \left(g_{KK}^{\alpha} + g_{KK}^{\beta}\right)\left[z_p^1 - z^{\alpha 1}\left(z_u^{\alpha 1} - z_u^{\gamma 1}\right) - z^{\beta 1}\left(z_u^{\beta 1} - z_u^{\gamma 1}\right)\right] \\ &+ k\left(z_u^{\alpha 1} - z_u^{\beta 1}\right)\left(g_{KK}^{\alpha} g_{Kp}^{\beta} + g_{KK}^{\beta} g_{Kp}^{\alpha}\right) > 0\end{aligned} \tag{2.31}$$

is a condition for the local stability.

From equation (2.30), we see at a glance that the donor might benefit and/or the recipient suffers from an income transfer. In a three-country model, there is possibility

of transfer paradoxes in spite of capital movement. Since international capital movement restrains the price change, the welfare effects of the transfer will be magnified or reduced, such as the transfer with two agents. The initial equilibrium is Pareto-efficient and a country will benefit only when at least one country suffers.

2.4.2 The case of Chipman flat

First, consider a case where the production function of good 1 and good 2 are linearly homogeneous employing two factors (capital and labor), and the economy is diversified, in both α and β. The production possibility frontier of the world under goods trade and capital movement has a flat segment, known as the *Chipman flat* ; that is, $g_{KK}^{\alpha} = 0$ and $g_{KK}^{\beta} = 0$.[8] If the equilibrium is on the Chipman flat, the supply of goods can be adjusted not by changing the price but by international capital movement. Then, the welfare of each country is affected only by the direct transfer and there are no terms of trade and rental effects on welfare.

In the case of Chipman flat, equations (2.30.d), (2.30.e), and (2.30.f) yield almost the same result as we obtained under the case of a transfer with two agents in section 2.2. There is no possibility for the donor to benefit or the recipient to suffer. In other words, the transfer paradox does not arise:[9]

$$du^{\alpha} / dT^{\alpha\gamma} < 0, \quad du^{\beta} / dT^{\alpha\gamma} = 0, \quad du^{\gamma} / dT^{\alpha\gamma} > 0. \tag{2.32}$$

[8] We assume that the Chipman flat does not degenerate to a point. See Uekawa (1972) for further discussion.

[9] Kemp and Kojima (1987) analyzed that joint donors and joint recipients without internationally mobile factors may cause the transfer paradox. Even if a transfer of goods in joint is given, the paradox does not take place in the case where the equilibrium is on the Chipman flat.

Bhagwati, Brecher, and Hatta (1983) introduced a suitable optimal tariff that rules out the transfer paradox in a three-country transfer model. However, their optimal tariff is not the only way to have the ordinary welfare result. In the case of free capital movement and trade in goods, we can obtain the ordinary result without using trade policy such as Bhagwati et al. (1983). The following proposition can be derived.[10]

Proposition 2. *Suppose that there are three countries. Then, aid by lump-sum transfer of goods does not cause the paradoxes of enriched donor or immiserized recipient, if the following conditions are satisfied; (i) the equilibrium is stable and the world economy is free of distortions, (ii) at least two countries are diversified and trade both goods and capital, and (iii) the conditions for the Chipman flat to exist.*

2.4.3 The transfer paradox and trade policy

Second, consider a case where there is possibility of the transfer paradox. That is, $g^{\alpha}_{KK} + g^{\beta}_{KK} < 0$; at least one country, α or β, is completely specialized in either commodity, either production function does not exhibit constant returns to scale, or factors employed are more than two. The recipient that will be the developing country might be completely specialized. Therefore, the assumption of complete specialization in one of two countries is important in the transfer problem.

In this case, if the marginal propensity to consume good 1 is different between the

[10] If more than two countries with diversification trade only goods or capital, the result will differ and there is possibility of the paradox because of the change in prices. The change in world goods demand cannot be adjusted by the supply change of goods induced only by international capital movement when the equilibrium is not on the Chipman flat. To satisfy the market-clearing conditions for goods after the transfer, terms of trade and rental must change.

donor and the recipient, terms of trade and rental will change from (2.30.a) and (2.30.b). The change in world goods demand cannot be adjusted by the supply change of goods induced only by international capital movement in the case of complete specialization. To satisfy the market-clearing conditions for goods as a result of a transfer, terms of trade and rental must change to a certain extent. If terms of trade and rental (do not) improve sufficiently in favor of the donor country (the recipient country), the welfare of the donor (the recipient) may increase (decrease) and there is possibility of the transfer paradox. It is the well-known welfare result in the case of a three-country transfer model.

From equation (2.30.d), the welfare improvement in the donor implies that the bystander be a net trader ($z^{\beta 1} \neq 0$), good 1 is capital or labor intensive in α and β with capital movement in the initial equilibrium ($k(g^{\alpha}_{KK} g^{\beta}_{Kp} + g^{\beta}_{KK} g^{\alpha}_{Kp}) \neq 0$), and with β 's marginal propensities to consume which differ from those of the recipient ($pz^{\beta 1}_{u} - pz^{\gamma 1}_{u} \neq 0$). Failure in satisfying some of these conditions will bring us back to the two-country model. From (2.30.f), the welfare deterioration in the recipient implies similar conditions to those of the donor.[11]

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[11] Alternative necessary conditions can be obtained by making use of Slutzky equation to (2.30.d) and (2.30.f), we get

$$\Delta'''(du^{\alpha}/dT^{\alpha\gamma}) = -(g^{\alpha}_{Kp} - g^{\beta}_{Kp})^2 - (g^{\alpha}_{KK} + g^{\beta}_{KK})\left[z^{\alpha 1}_{p} + z^{\gamma 1}_{p} + \tilde{z}^{\beta 1}_{p} + z^{\beta 1} z^{\gamma 1}_{u} + k\, z^{\beta 1}_{u} g^{\beta}_{Kp}\right] + k(pz^{\beta 1}_{u} - pz^{\gamma 1}_{u})(g^{\alpha}_{KK} g^{\beta}_{Kp} + g^{\beta}_{KK} g^{\alpha}_{Kp})/p, \quad \text{(A)}$$

$$\Delta'''(du^{\gamma}/dT^{\alpha\gamma}) = (g^{\alpha}_{Kp} - g^{\beta}_{Kp})^2 + (g^{\alpha}_{KK} + g^{\beta}_{KK})\left[z^{\alpha 1}_{p} + z^{\gamma 1}_{p} + \tilde{z}^{\beta 1}_{p} + z^{\beta 1} z^{\alpha 1}_{u} + k\, z^{\beta 1}_{u} g^{\beta}_{Kp}\right] + k(pz^{\alpha 1}_{u} - pz^{\beta 1}_{u})(g^{\alpha}_{KK} g^{\beta}_{Kp} + g^{\beta}_{KK} g^{\alpha}_{Kp})/p, \quad \text{(B)}$$

where $\tilde{z}^{\beta 1}(p,k) \equiv z^{\beta 1}(p, \hat{u}^{\beta}(p,k), k)$ is the uncompensated net demand function of country β ; $\tilde{z}^{\beta 1}_{p} = z^{\beta 1}_{p} - z^{\beta 1}_{u}(z^{\beta 1} + kg^{\beta}_{Kp})$. Suppose that $z^{\beta 1}$ is negative, that is, the bystander exports good 1. From (A), if a transfer enriches the donor ($du^{\alpha}/dT^{\alpha\gamma} > 0$), then good 1 is inferior to the recipient ($z^{\gamma 1}_{u} < 0$), the bystander's offer curve is inelastic (such that the export supply falls as the relative price improves; $\tilde{z}^{\beta 1}_{p} > 0$), or good 1 is capital intensive and superior to the bystander with capital movement from α to

We investigate the relationship between the possibility of the transfer paradox and the difference in trade policy. Consider a transfer between two countries with internationally mobile capital, α and β, and we see the differences in the effects of the transfer in comparison with the above. The above case is the transfer between the donor, country α, with mobile capital and the recipient, country γ, with no capital mobility. The welfare effects of a transfer from α to β are described as follows:

$$\Delta'''\left(du^{\alpha}/dT^{\alpha\beta}\right)=-\left(g_{Kp}^{\alpha}-g_{Kp}^{\beta}\right)^{2}-\left(g_{KK}^{\alpha}+g_{KK}^{\beta}\right)\left[z_{p}^{1}-z^{\gamma 1}\left(pz_{u}^{\gamma 1}-pz_{u}^{\beta 1}\right)/p\right], \quad (2.33)$$

$$\Delta'''\left(du^{\beta}/dT^{\alpha\beta}\right)=\left(g_{Kp}^{\alpha}-g_{Kp}^{\beta}\right)^{2}+\left(g_{KK}^{\alpha}+g_{KK}^{\beta}\right)\left[z_{p}^{1}+z^{\gamma 1}\left(pz_{u}^{\alpha 1}-pz_{u}^{\gamma 1}\right)/p\right], \quad (2.34)$$

$$\Delta'''\left(du^{\gamma}/dT^{\alpha\beta}\right)=-z^{\gamma 1}\left(g_{KK}^{\alpha}+g_{KK}^{\beta}\right)\left(pz_{u}^{\alpha 1}-pz_{u}^{\beta 1}\right)/p\,. \quad (2.35)$$

Needless to say, proposition 2 is valid, therefore, $g_{KK}^{\alpha}+g_{KK}^{\beta}<0$ is assumed. In this case of a transfer between α and β, the recipient, country β, will be affected not only by the direct income transfer and terms of trade effects but by the change in rental because of capital movement. From the above equations, we can see at a glance that if there is no international capital movement in the initial equilibrium ($k=0$), the effects of the transfer from the donor, country α, to the recipient, country β, in equations (2.33)–(2.35) are similar to those of the transfer from the donor, country α, to the recipient, country γ, in (2.30).

Now, we suppose that capital moves internationally from α to β ($k>0$), good 1 is capital intensive in both α and β ($g_{Kp}^{j}>0$, $j=\alpha,\beta$). Furthermore, it is assumed that the marginal propensity to consume good 1 of β and γ are the same,

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β ($k\,z_{u}^{\beta 1}g_{Kp}^{\beta}>0$), or all. A similar thing can be said to the recipient.

they are less than that of the donor, country α ($pz_u^{\beta 1} = pz_u^{\gamma 1}$, $pz_u^{\alpha 1} - pz_u^{\beta 1} > 0$), and β and γ export good 1 ($z^{\beta 1} = z^{\gamma 1} < 0$). Equations (2.33) and (2.34) imply that there is no possibility of the paradox when a transfer is given between countries with internationally mobile capital. On the other hand, (2.30.d) sates that the impoverishment in the donor $du^{\alpha} / dT^{\alpha\gamma} < 0$ and (2.30.f) shows that there is possibility of the recipient paradox, that is $du^{\gamma} / dT^{\alpha\gamma} < 0$, when the transfer is between countries with and without mobile capital.

The differences in trade policy, that is, trade in both goods and capital are allowed or not, play an important role in welfare effects of an income transfer. We can see from (2.30.e) and (2.35), that the bystander expressed in (2.30.e) is more affected by the transfer between a country with and without internationally mobile capital. Since the bystander, country β, expressed in (2.30.e) faces both the change in the goods price and rental after a transfer, then the donor, country α, and the recipient, country γ, expressed in equations (2.30.d) and (2.30.f) are also more affected by such transfer because the initial equilibrium is Pareto-efficient. The immobility of capital in recipient γ generates a distortion which affects the welfare of country γ. Thus, there is possibility of the recipient paradox as we see in the above example. The welfare may be more disturbed by the transfer between a country with and without internationally mobile capital than by the transfer between two countries with international capital movement.

2.5 Concluding remarks

This chapter studies the transfer problem in the context of internationally mobile capital with and without the bystander. In a stable and distortion-free two-country model, the donor suffers and the recipient benefits from both aid by transfer of goods and by capital. The result of aid by transfer of goods does not change regardless of whether there is goods trade or internationally mobile capital. Aid by capital can be treated as rental subsidy under international capital movement and the effects are similar to the transfer of goods. The capital movement restrains the price change as a result of the transfer. Thus, the welfare effect of the transfer will be magnified or reduced depending conversely on the direction of improvement in each country's terms of trade, in comparison with the ordinary transfer without mobile factor.

Even if a transfer is given with the existence of the bystander, when international capital movement is allowed, satisfying some acceptable conditions, we can obtain the ordinary welfare result. That is, aid unambiguously hurts the donor, benefits the recipient, and does not affect the bystander. The policy of an optimal tariff is not a necessary condition for the ordinary result in transfers among three countries. When some countries are not diversified, differences in trade policy of the bystander, trading only goods, capital, or both, may increase the possibility of the paradoxical welfare effects of transfers. If the equilibrium is on the Chipman flat, the effects of aid are definite. That is, there is no possibility of the transfer paradox. Consequently, international capital movement plays an important role in the transfer problem.

For next steps, we need other approaches to the transfer problem and international capital movement. As noted in the introduction, aid enhances the income level of the recipient and can be used for providing infrastructures that contribute to reduce the reluctance of private capital to migrate. This capital movement will increase world

welfare and the outcome of a transfer may be Pareto-improving. We should construct another model with explicit description of incentives of international capital movement.

References

Bhagwati, J. N., R. A. Brecher and T. Hatta (1983), "The generalized theory of transfers and welfare: bilateral transfers in a multilateral world", *American Economic Review*, 73, 606-618.

Caves, R. E., and R. W. Jones (1985), *World Trade and Payments: An Introduction*, Toronto: Little, Brown.

Gale, D. (1974), "Exchange equilibrium and coalitions: an example", *Journal of Mathematical Economics*, 1, 63-66.

Hatzipanayotou, P. and M. S. Michael (1995), "Foreign aid and public goods", *Journal of Development Economics*, 47, 455-467.

Kemp, M. C. (1995), *The Gains from Trade and the Gains from Aid*, London: Routledge.

Kemp, M. C. and K. Abe (1994), "The transfer problem in the context of public goods", *Economics Letters*, 45, 223-226.

Kemp, M. C. and S. Kojima (1987), "More on the welfare economics of foreign aid", *Journal of the Japanese and International Economies*, 1, 97-109.

Kemp, M. C., Y. Ng and K. Shimomura (1993), "The international diffusion of the fruits of technical progress", *International Economic Review*, 34, 381-385.

Li, J. and W. Mayer (1990), "The transfer problem with supply effects: presumption for terms of trade changes", *Canadian Journal of Economics*, 23, 896-907.

Michael, M. S. and P. Hatzipanayotou (1996), "Foreign aid tied to public inputs", *Keio Economic Studies*, 33, 35-45.

Neary, J. P. (1985), “International factor mobility, minimum wage rates, and factor-price equalization: a synthesis”, *Quarterly Journal of Economics*, 100, 551-570.

Samuelson, P. A. (1952), “Transfer problem and transport costs: the terms of trade when impediments are absent”, *Economic Journal*, 62, 278-304.

——— (1954), “The transfer problem and transport costs, analysis of effects of trade impediments”, *Economic Journal*, 64, 264-289.

Takarada, Y. (1998), “The welfare effects of aid and international capital movement”, *Osaka Economic Papers*, 48, 140-156.

——— (1999), “The international diffusion of technology and the transfer problem” (In Japanese. With English summary.), *Osaka Economic Papers*, 48, 98-110.

Uekawa, Y. (1972), “On the existence of incomplete specialization in international trade with capital mobility”, *Journal of International Economics*, 2, 1-23.

Wang, L. F. S. (1985), “Factor market distortions, the transfer problem, and welfare”, *Keio Economic Studies*, 22, 57-64.

Wong, K. (1995), *International Trade in Goods and Factor Mobility*, Cambridge, Massachusetts: The MIT Press.

Yano, M. (1983), “Welfare aspects of the transfer problem”, *Journal of International Economics*, 15, 277-289.

3 Tied Aid and Welfare

3.1 Introduction

There exists now a volume of literature on the welfare effects of international transfers.[1] In a general equilibrium framework, an international transfer affects the welfare of a donor and a recipient not only through a direct effect of the income transfer but also through a change in world prices. The donor always loses and the recipient always gains by the former effect of the international transfer. The price changes caused by the transfer, however, may be in favor of the aid receiving country or the donor country. If the international transfer improves the terms of trade of the donor country, it may benefit the donor country and harm the recipient country paradoxically. The transfer paradox was initially observed by Leontief (1936). Later, Samuelson (1947) found that such a paradox never appears if the equilibrium is Walrasian stable. That is, in a competitive two-country, two-good, and distortion-free model, an international transfer deteriorates the welfare of the donor and improves that of the recipient if the equilibrium is stable (see, Balasko, 1978).

After the Samuelson's result, studies on transfer paradoxes were developed in more general frameworks. Gale (1974), Yano (1983), and Bhagwati, Brecher, and Hatta (1983, 1985) showed that an income transfer might enrich the donor country and impoverish the recipient country under the existence of bystanders, even if the equilibrium is stable. Ohyama (1974) examined the transfer problem in the context of tariffs with a two-country and two-good model and found the possibility of transfer paradoxes. Turunen-red and Woodland (1988) showed that a strict Pareto-improving multilateral

transfer exists under tariff distortions.

Recent analyses of international transfers have focused on so-called tied aid in various forms. Most aid is given from the donor's government to the recipient's government. Foreign aid is usually taken place not in lump-sum fashion, but it is often carried out in a tied manner such that the government of the donor country restricts how to distribute it in the recipient country. Then, studies of tied aid are quite essential in the international transfer problem.

Ohyama (1974) first presented the model of tied aid and obtained that tying of aid might paradoxically benefit the donor country or harm the recipient country in a two-country framework. He studied two types of tied aid. First, the recipient country is forced to increase its import value up to the amount of the transfer. The second case is that the recipient country must use the transfer to subsidize its imports from the donor country. Brecher and Bhagwati (1982) also indicated the possibility of a transfer paradox when aid is given on the condition that the recipient must increase production of the specific good. Kemp and Kojima (1985) and Schweinberger (1990) made a formal analysis of aid that is tied to the recipient government's purchases of export goods of the donor country in a competitive two-country model. Brakman and Marrewijk (1995) applied the Schweinberger's forced choice approach to a model with increasing returns to scale and monopolistic competition. Lahiri and Raimondos (1995) examined the welfare effects of tied aid in the presence of quantitative restrictions. The tied aid to stimulate a trade policy reform was studied by Lahiri and Raimondos (1997).

In spite of the recent development in the analysis of tied aid, no attempt has been made to mediate disputes between Kemp and Kojima (1985) and Schweinberger (1990).

[1] See for example Kemp (1995) and Brakman and Marrewijk (1998).

These two studies reached contrasting results on the welfare effects of tied aid, though they examined the same type of tied aid. Transfers analyzed by them are tied in the following sense. The government of the recipient country is forced to spend a fraction of aid on one good and the remainder on the other good, and the households of the recipient are forced to consume them. Kemp and Kojima observed that the paradoxes of donor-enrichment and recipient-impoverishment might take place simultaneously by tied aid. On the other hand, Schweinberger showed that recipient paradoxes may occur but donor paradoxes can be ruled out in his tied aid model.

In chapter 3, we develop a generalized model of tied aid to clarify the similarities and differences between those two analyses.[2] We present the model which utilizes a notion of 'virtual utility' as well as a virtual price. It turns out to be a comprehensive model that includes the Kemp and Kojima model and the Schweinberger model as special cases. Then, we show, in the Kemp-Kojima case, that whenever the transfer paradoxes occur, the households of the recipient country have an incentive to trade the goods purchased from their production income after they receive tied aid. We show, in the Schweinberger case, that the normality condition in consumption rules out a possibility of the recipient paradox, while the impossibility of the donor paradox has already proved. The basic difference between Kemp-Kojima and Schweinberger lies in a households' acquaintance with the government transfer and a possibility of re-allocation at the expense of production income after the transfer is carried out.

This chapter is organized as follows. Section 3.2 presents the comprehensive tied aid model. In section 3.3, we examine the relation between an introduction of tied aid and incentives for reallocation of the goods in the Kemp-Kojima case. Section 3.4 studies

[2] This chapter builds on Abe and Takarada (1999).

the welfare effects of the tied aid in the Schweinberger case. Final section concludes chapter 3 with some remarks.

3.2 The model

We consider a general equilibrium model of two countries and two goods. Country α is the donor and country β is the recipient. Let u^j be the utility of country j. Good 1 and good 2 are traded in a competitive world market. Let p be the market price of good 1 in terms of good 2. $E^j(p,u^j)$ and $r^j(p)$ are the expenditure and revenue functions of country j. The government of the donor raises T via lump sum taxes and transfers it to the government of the recipient country. The government of the recipient purchases the required quantities in the world market and distributes them to the households. The aid is tied in the sense that a fraction m must be spent on good 1 and $(1-m)$ on good 2 ($0 \le m \le 1$). The households in the recipient are prohibited from selling abroad the quantities which are distributed to them by their government.

Now, we will consider two cases. First, the households of the recipient country do not know the quantities of the government transfer at their consumption decision, and they are prevented from trading the goods they purchased from their production income after the government distributes the quantities of tied aid. Since the households of the recipient country are forced to consume the required quantities by tied aid, they may have an incentive to sell or buy goods again but they cannot do that. The equilibrium conditions of this case are given by the following five equations.[3]

[3] Subscripts indicate differentiation throughout this chapter (e.g., $E_p^j \equiv \partial E^j / \partial p$, $r_p^j \equiv \partial r^j / \partial p$, etc.)

$$E^{\alpha}(p,u^{\alpha}) = r^{\alpha}(p) - T\,, \tag{3.1}$$

$$E^{\beta}(\overline{p},u^{\beta}) + (p-\overline{p})\left[\, E_p^{\beta}(p,u^0) + mT/p \,\right] = r^{\beta}(p) + T\,, \tag{3.2}$$

$$E_p^{\beta}(\overline{p},u^{\beta}) = E_p^{\beta}(p,u^0) + mT/p\,, \tag{3.3}$$

$$E^{\beta}(p,u^0) = r^{\beta}(p)\,, \tag{3.4}$$

$$z^{\alpha 1}(p,u^{\alpha}) + z^{\beta 1}(p,u^0) + mT/p = 0\,, \tag{3.5}$$

where $z^{j1}(\cdot) \equiv E_p^j(\cdot) - r_p^j(\cdot)$ is the compensated excess demand function for good 1 in country j which excludes the government purchases. Equation (3.1) is the budget constraint of the donor country. Equation (3.2) states the income expenditure relation in the recipient country. Equation (3.3) defines the virtual price $\overline{p}$, while equation (3.4) defines the virtual utility u^0 of the recipient country.[4] The virtual utility here represents the utility level the recipient country can attain when all income from production, excluding foreign aid, is spent on purchases of the commodities. Note that $p = \overline{p}$ and $u^{\beta} = u^0$ if $T = 0$. Finally, equation (3.5) is the world market clearing condition for good 1. The total excess demand in the recipient country consists of two parts: the excess demand from private consumption and production $z^{\beta 1}(p,u^0)$ and the government purchase of the recipient country mT/p.[5] The world market for good 2 also clears by Walras' Law. We assume that, given T and m, equations (3.1)–(3.5) can be uniquely solved for u^{α}, u^{β}, u^0, p, and $\overline{p}$. With $T = 0$ initially, the equation system (3.1), (3.4), and (3.5) corresponds to the Kemp and Kojima model.[6]

[4] The virtual price is utilized in Schweinberger (1990) to examine the tied aid. See Neary and Roberts (1980) for the virtual price. On the other hand, the virtual utility is used in Kemp and Kojima (1985). Since Kemp and Kojima assumed the Pareto optimality of the initial equilibrium, they could derive the welfare effects of tied aid on the recipient country without using the actual utility of the country.

[5] The good financed by tied aid are entirely consumed by the households of the recipient country without any loss. See Kemp and Wong (1993) for foreign aid with the administration cost.

[6] Kemp and Kojima (1985) presented two models of tied aid. Our model corresponds to the model in section 2 of their paper.

The second case is that the households of the recipient country are informed of the quantities of the government transfer at their consumption decision. Even if we assume that they cannot sell and buy the transferred goods from the government, they can freely choose the purchases from their production income. They manage to trade the goods to equate the virtual price to the real price. If the amount of tied aid is small enough to ensure the positive consumption of goods purchased from their production income, the virtual price is identical to the real price and equation (3.3) becomes redundant. Then, the model turns out to be the standard untied aid model. If the amount of tied aid is so large that the households do not purchase one of the good from their production income, the market price of the good remains higher than the virtual price of it. If we assume $p > \bar{p}$ and $E_p^{\beta}(p, u^0) \equiv 0$, that is, all income from production is spent on good 2, then the system (3.1), (3.2), (3.3), and (3.5) coincides with the model of Schweinberger (1990).

3.3 Tied aid and incentives for exchange

In this section, we will consider the first case. The model has a special feature such that equations (3.1), (3.4), and (3.5) are sufficient to determine u^{α}, u^0, and p. Totally differentiating equations (3.1), (3.4), and (3.5) and choosing the unit of utilities as $E_u^{\alpha}(p, u^{\alpha}) = E_u^{\beta}(p, u^0) = 1$, we obtain

$$\begin{aligned} \Delta\left(du^{\alpha}/dT\right) = -\left\{ z_p^{\alpha 1}(p, u^{\alpha}) + z_p^{\beta 1}(p, u^0) \right\} \\ + (1-m)mT/p^2 + z^{\beta 1}(p, u^0)\,\theta/p \end{aligned}, \tag{3.6}$$

$$\Delta\left(du^0/dT\right) = -z^{\beta 1}(p,u^0)\left\{\ pz_u^{\alpha 1}(p,u^\alpha) - m\right\}/p\,, \tag{3.7}$$

$$\Delta\left(dp/dT\right) = \left\{\ pz_u^{\alpha 1}(p,u^\alpha) - m\right\}/p\,, \tag{3.8}$$

where

$$\theta \equiv p\, z_u^{\beta 1}(p,u^0) - m\,,$$

$$\begin{aligned}\Delta \equiv\ & z_p^{\alpha 1}(p,u^\alpha) + z_p^{\beta 1}(p,u^0) - mT\left\{1 - pz_u^{\alpha 1}(p,u^\alpha)\right\}/p^2 \\ & + z^{\beta 1}(p,u^0)\left\{\ pz_u^{\alpha 1}(p,u^\alpha) - pz_u^{\beta 1}(p,u^0)\right\}/p\end{aligned}\,. \tag{3.9}$$

Δ is the Jacobian determinant of equations (3.1), (3.4), and (3.5). Δ is negative if the Walrasian local stability condition holds.[7] We assume that $\Delta < 0$ throughout this chapter.

Let us consider the conditions for donor-enrichment. Suppose that the initial amount of tied aid is zero and the recipient imports good 1, that is, $T = 0$ and $z^{\beta 1}(p,u^0) > 0$. This corresponds to the Kemp-Kojima case. Equation (3.6) shows that, under the stability condition, it is necessary and sufficient for $du^\alpha/dT > 0$ that

$$z^{\beta 1}(p,u^0)\,\theta/p < z_p^{\alpha 1}(p,u^\alpha) + z_p^{\beta 1}(p,u^0)\,.$$

Notice that $z_p^{j1}(\cdot) < 0$ for α and β. If the donor paradox occurs, then θ must be negative.[8]

Totally differentiating equations (3.2) and (3.3), let $p = \bar{p}$ and $u^\beta = u^0$ in the

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[7] We consider the dynamic system consisting of (3.1), (3.4), and $\dot{p} = z^{\alpha 1}(p,u^\alpha) + z^{\beta 1}(p,u^0) + mT/p$. Linearizing the system at the equilibrium values of the variables, we obtain $\Delta < 0$ if the equilibrium is locally Walrasian stable.

[8] Since the initial allocation of goods is Pareto optimal, we obtain $du^\alpha/dT = -du^\beta/dT$. The recipient paradox follows from the donor paradox, and vice versa.

initial equilibrium, we obtain

$$E_{pp}^{\beta}(p,u^0)\left(d\,\overline{p}/dT\right)=\left[\,z_u^{\beta 1}(p,u^0)\,z^{\beta 1}(p,u^0)+E_{pp}^{\beta}(p,u^0)\,\right]\left(d\,p/dT\right)$$
$$+\,z_u^{\beta 1}(p,u^0)\left(du^0/dT\right)-\theta/p\,.$$

In addition, total differentiation of (3.4) yields

$$du^0/dT=-z^{\beta 1}(p,u^0)\left(d\,p/dT\right).$$

From these two equations, we have

$$E_{pp}^{\beta}(p,u^0)\left(d\,\overline{p}/dT-dp/dT\right)=-\theta/p\,.$$

This equation implies that if θ is negative, we have $d\,\overline{p}/dT<dp/dT$. The households of the recipient country will face a lower virtual price of good 1 than the actual price after they receive the quantities of tied aid. On the other hand, all the other economic agents face the actual price. Then, whenever the donor paradox occurs, the households of the recipient country will have an incentive to sell good 1 in exchange for good 2.

3.4 The welfare effects of tied aid under the possibility of re-allocation

Next, we will consider the second case where the households of the recipient country take the amount of tied aid into consideration at their consumption decision and they can trade the goods they purchase from production income. If the consumption of

both goods from their production income remains positive at the equilibrium, we observe that $\bar{p}$ is identical to p. Then, equations (3.2) and (3.5) become

$$E^{\beta}(p,u^{\beta}) = r^{\beta}(p) + T, \tag{3.2'}$$

$$z^{\alpha 1}(p,u^{\alpha}) + z^{\beta 1}(p,u^{\beta}) = 0. \tag{3.5'}$$

The equation system (3.1), (3.2'), and (3.5') constitutes the standard untied aid model. Then, the transfer paradoxes are ruled out under the stability condition.

The model deviates from the standard one when the virtual price differs from the actual price even after the households trade the goods purchased from their production income. For example, the amount of tied aid is so large that the households of the recipient country sell all of good 1 which can be purchased from production income, i.e., $E_p^{\beta}(p,u^0) \equiv 0$, and they still have an incentive to sell more of good 1 but they cannot do that. Then, the virtual price good 1 remains lower than the actual price. That is, $\bar{p} < p$. In this case, tying is called effective on good 1. The equilibrium conditions of this case are given by equations (3.1)–(3.5) with $E_p^{\beta}(p,u^0) \equiv 0$. This corresponds to the Schweinberger case. Noticing that $z^{\beta 1}(p,u^0) = -r_p^{\beta}(p) < 0$ and $\theta = -m \leq 0$, we obtain, from equation (3.6), $du^{\alpha}/dT < 0$ if the equilibrium is stable. The donor suffers from tied aid, as is proved in Schweinberger (1990).

Technically, one of the main causes of the contrasting results between Kemp and Kojima (1985) and Schweinberger (1990) lies in the opposite sign of $z^{\beta 1}(p,u^0)$ in them. Kemp and Kojima assumed $z^{\beta 1}(p,u^0) > 0$, which means that the recipient country imports good 1. On the other hand, in the Schweinberger case, his assumption makes $z^{\beta 1}(p,u^0) < 0$. As long as we consider the private transactions, the recipient

country exports good 1. This difference in the initial trade pattern causes the contrasting results.

Let us next consider the welfare changes in the recipient country. Differentiating (3.2) and (3.3) and solving for du^{β}/dT, we have

$$\begin{aligned} du^{\beta}/dT = E_u^{\beta}(\bar{p},u^{\beta})^{-1}\big[1-m(p-\bar{p})/p-(p-\bar{p})\,z_u^{\beta 1}(p,u^0)\big(du^0/dT\big) \\ -\big\{z^{\beta 1}(p,u^0)+(p-\bar{p})\,E_{pp}^{\beta}(p,u^0)+m\bar{p}T/p^2\big\}\big(dp/dT\big)\big] \end{aligned} . \qquad (3.10)$$

Substituting (3.7) and (3.8) into (3.10), we obtain

$$\begin{aligned} \Delta\big(du^{\beta}/dT\big) = -E_u^{\beta}(\bar{p},u^{\beta})^{-1}\big[\big\{z_p^{\alpha 1}(p,u^{\alpha})-r_{pp}^{\beta}(p)\big\}\{m(1-\bar{p}/p)-1\} \\ -\eta\,E_{pp}^{\beta}(p,u^0)+\eta\,z_u^{\beta 1}(p,u^0)(1-m)T/p \\ -\eta\,\{-pz^{\beta 1}(p,u^0)+(1-m)T\}\theta/p^2\big] \end{aligned} , \qquad (3.11)$$

where $\eta \equiv 1-(p-\bar{p})z_u^{\alpha 1}(p,u^{\alpha}) = \big\{1-pz_u^{\alpha 1}(p,u^{\alpha})\big\}+\bar{p}z_u^{\alpha 1}(p,u^{\alpha})$. Notice that η is positive if there is no inferior good in the donor country. In addition, $z_u^{\beta 1}(p,u^0)=0$ if $E_p^{\beta}(p,u^0)\equiv 0$. Then, from equation (3.11), we have $du^{\beta}/dT>0$ under the stability condition if there is no inferior good in the donor country. Summing up, we obtain

Proposition. *Suppose that (i) the households of the recipient country is informed of the quantities of a government transfer at their consumption decision, (ii) all income from production is spent on the good on which tying is not effective, and (iii)the equilibrium is stable. Then, the donor suffers from tied aid. The recipient benefits from tied aid if there is no inferior good in the donor country.*

Schweinberger (1990) shows the impossibility of the donor paradox, but suggests a

possibility of the recipient paradox. We prove that the recipient paradox does not occur under the normality condition. Transfer paradoxes are not likely under the normality condition when the households in the recipient country are informed of the government transfers at their consumption decision and they can freely spend what they earn from production.

Furthermore, it should be noted that the proposition remains valid even if the tied aid is just binding, that is, $p = \bar{p}$ and $E_p^{\beta}(p, u^0) \equiv 0$. The two approaches by Kemp and Kojima (1985) and Schweinberger (1990) yield the contrasting results even if the initial equilibrium is Pareto optimal. The basic difference between Kemp and Kojima (1985) and Schweinberger (1990) lies in a households' acquaintance with the government transfer and a possibility of trade at the expense of production income after the transfer is made. It leads us to obtain the contrasting results on the welfare effects of tied aid.

3.5 Concluding remarks

This chapter introduces the generalized model to bridge the gap between Kemp and Kojima (1985) and Schweinberger (1990). Our results complement their analyses. However, there is a common assumption on tied aid in their analyses. First, the households in the recipient country are prohibited to sell or buy the quantities transferred from the government. The transferred goods may also traded in black markets if the virtual price differs from the actual price. In order to avoid a trade on the transferred goods, Lahiri and Raimondos (1995) introduce, for example, quantitative

trade restrictions on imports of the recipient country. Secondly, tying may take the other form. For example, aid may be tied to a trade policy reform as in Lahiri and Raimondos (1997). We should construct a new model to analyze the other type of tying.

References

Abe, K. and Y. Takarada (1999), "Tied aid and welfare", mimeo.

Balasko, Y. (1978), "The transfer problem and the theory of regular economies", *International Economic Review*, 19, 687-694.

Bhagwati, J. N., R. A. Brecher, and T. Hatta (1983), "The generalized theory of transfers and welfare: bilateral transfers in a multilateral world", *American Economic Review*, 73, 606-618.

——— (1985), "The generalized theory of transfers and welfare: exogenous (policy-imposed) and endogenous (transfer-induced) distortions", *Quarterly Journal of Economics*, 100, 697-714.

Brakman, S. and C. Marrewijk (1995), "Transfers, returns to scale, tied aid and monopolistic competition", *Journal of Development Economics*, 47, 333-354.

——— (1998), *The Economics of International Transfers*, Cambridge: Cambridge University Press.

Brecher, R. A. and J. N. Bhagwati (1982), "Immiserizing transfers from abroad", *Journal of International Economics*, 13, 353-364.

Gale, D. (1974), "Exchange equilibrium and coalitions: an example", *Journal of Mathematical Economics*, 1, 63-66.

Kemp, M. C. (1995), "The static welfare economics of foreign aid", *The Gains from*

Trade and the Gains from Aid, London: Routledge, 333-355.

Kemp, M. C. and S. Kojima (1985), "Tied aid and the paradoxes of donor-enrichment and recipient-impoverishment", *International Economic Review*, 26, 721-729.

——— (1987), "More on the welfare economics of foreign aid", *Journal of the Japanese and International Economies*, 1, 97-109.

Lahiri, S. and P. Raimondos (1995), "Welfare effects of aid under quantitative trade restrictions", *Journal of International Economics*, 39, 297-315.

——— (1997), "On the tying of aid to tariff reform", *Journal of Development Economics*, 54, 479-491.

Leontief, W. (1936), "A note on the pure theory of transfers", in *Explorations in Economics: Notes and Essays Contributed in Honor of F. W. Taussig*, New York: McGraw-Hill, 84-91.

Neary, J. P. and K. W. S. Roberts (1980), "The theory of household behavior under rationing", *European Economic Review*, 13, 25-42.

Ohyama, M. (1974), "Tariffs and the transfer problem", *Keio Economic Studies*, 11, 29-45.

Samuelson, P. A. (1947), *Foundations of Economic Analysis*, Cambridge, Mass.: Harvard University Press.

Schweinberger, A. G. (1990), "On the welfare effects of tied aid", *International Economic Review*, 31, 457-462.

Turunen-red, A. H. and A. D. Woodland (1988), "On the multilateral transfer problem: existence of Pareto improving international transfers", *Journal of International Economics*, 25, 249-269.

Yano, M. (1983), "Welfare aspects of the transfer problem", *Journal of International*

Economics, 15, 277-289.

4 Tied Aid and the Factor Adjustment with Public Goods

4.1 Introduction

Analyses on the welfare effects of international income transfers have been developed in a volume of literature.[1] In a general equilibrium framework, an international transfer might alter world prices in favor of the aid receiving country or the donor country. The change in terms of trade will affect the initial welfare impacts of the transfer, direct income loss in the donor country and gain in the recipient country. Then, it is possible that the income transfer enriches the donor country and harms the recipient country paradoxically. Leontief (1936) first observed the transfer paradox in a two-by-two example. Later, Samuelson (1947) found that if the assumption of Walrasian stability is added then such a paradox never appears. That is, an income transfer deteriorates the welfare of the donor country and improves that of the recipient country if the equilibrium is Walrasian stable, in a competitive two-country, two-good, and distortion-free world (e.g., Balasko, 1978).

It has been well known that transfer paradoxes and the stable equilibrium can be consistent within more general frameworks. An income transfer might benefit the donor country and harm the recipient country under the existence of bystanders, even though the equilibrium is stable (see, e.g., Gale, 1974; Yano, 1983; Bhagwati et al., 1983, 1985). Ohyama (1974) studied the transfer problem in the context of tariffs with a two-country and two-commodity model, and observed the transfer paradox. Turunen-red and

[1] See, for example, Kemp (1995) and Brakman and Marrewijk (1998).

Woodland (1988) showed the existence of a strict Pareto-improving multilateral transfer under tariff distortions.

Recently, the focus in the analyses of international transfers has been on so-called tied aid in various forms. Most aid is given from the donor country's government to the recipient country's government. The income transfer is usually taken place not in lump-sum fashion. It is, however, often carried out in a tied manner such that the government of the donor country restricts the way to expenditure the transfer in the recipient country. Thus, it is quite essential to study tied aid in the transfer problem.

Ohyama (1974) initially presented the model of tied aid. He studied two types of tied aid that the recipient country is forced to (i) increase its import value and (ii) use the transfer to subsidize its imports from the donor country, and showed the possibility of transfer paradoxes. Brecher and Bhagwati (1982) also analyzed aid tied to an increase in production of the specific good in the recipient country. Kemp and Kojima (1985) and Schweinberger (1990) formally examined aid that is tied to purchases of export goods of the donor country in a basic competitive two-country model. Brakman and Marrewijk (1995) applied the Schweinberger's forced choice approach to a model with increasing returns to scale and monopolistic competition.

There are basically common approaches to tied aid in the above-mentioned studies. The aid is tied in the sense that the government of the donor restricts expenditures of the income transfer on goods, and differences in the policies between the donor and the recipient are not formally introduced into the models. The income transfers do not affect the policies originally taken by the government of the donor and the recipient for certain purpose. Lahiri and Raimondos (1995) first investigated tied aid related to changes in the policy. They examined the welfare effects of tied aid in the presence of quantitative

restrictions in the recipient country and showed the possibility of transfer paradoxes. Hatzipanayotou and Michael (1995) studied that the recipient country's government is forced to use an income transfer to finance pubic goods (see also Michael and Hatzipanayotou, 1996). Lahiri and Raimondos (1997) examined the tied aid to stimulate a trade policy reform in the recipient country.

In this chapter, we construct a model of tied aid that finances public input goods used for the factor adjustment in the recipient country.[2] The public inputs, which are produced in the donor country, have the technology to transform one kind of specific factor into another and the amount of the factors is endogenously determined in the recipient country.[3] In most less-developed countries, the lack of technology and infrastructures will restrict the movement of factors between the industries. In this respect, the factors are somewhat specific. The factor specificity causes adjustment costs and gaps between the returns of factors in each industry. The tied aid can be interpreted as one form of the industrial policy of the recipient's government supported by the transfer. The tied aid will enable the recipient's government to adjust the amount of factors available in each industry in order to equate the differences in the factor prices. It is essential to study the transfer problem in the context of different features in the markets and policies between the donor country and the recipient country. Since the public inputs are produced in the donor country, our tied aid model describes a feature of tying that the recipient country's government must spend tied aid on goods that are

[2] Takarada (1999a) studied the income transfer tied to production of public goods in a small open country model. The recipient country produces a public good, and a non-traded and many tradable private goods. The production of the public sector will affect private good sectors, especially the non-tradable good sector, since it must be produced in the domestic industry. We show a possibility of recipient-impoverishment in this framework. A change in the welfare of the recipient depends on the efficiency in the supply of the public good. The paper identifies the conditions under which the transfer enriches or harms the recipient.

[3] See Mussa (1978) for a model with adjustment costs and the transformation of specific factors.

produced using the factors of production such as labor and capital in the donor country.

Within the framework, chapter 4 examines the effects of tied aid on the welfare of the donor and the recipient as well as world welfare (i.e., the sum of the two countries' welfare).[4] We identify the conditions under which the income transfer benefits the recipient country and harms the donor country. The transfer can be welfare enriching for the donor and welfare immiserizing for the recipient. We show that the recipient may suffer from the income transfer even if extension of the factor adjustment benefits it. The income transfer can raise (reduce) world welfare and may enrich (harm) both the donor and the recipient.

This chapter is organized as follows. Section 4.2 presents the model of tied aid with the factor movement activity and public production. The effects of tied aid on terms of trade and the public inputs are examined in section 4.3. Section 4.4 studies the welfare effects of tied aid. Finally, we conclude the chapter with some remarks.

4.2 The model

4.2.1 Factor specificity and public production

We consider the production structure of the recipient country and the donor country. The recipient is an open economy with factor specificity. The donor is an open economy with public production. The properties of both models play an important role in the analysis of the welfare effects of tied aid.

First, we consider the production structure of the recipient country. The recipient is the open factor specificity economy where two tradable private goods are produced

[4] This chapter builds on Takarada (1999b).

using specific and non-specific factors, and consumed by a representative consumer. The private goods are good 1 and good 2 which is the numeraire. Each good is produced using two internationally immobile factors, labor and capital. While labor is intersectorally mobile, capital is specific to a certain industry. The goods and factor markets are perfectly competitive and trade in goods is free.

The production functions of good 1 and 2 are denoted by $Q^1 = F^1(L^1, K)$ and $Q^2 = F^2(L^2, S)$. F^1 and F^2 are homogeneous of degree one in (L^1, K) and (L^2, S), respectively. L^i is the amount of labor employed for the production of good i, Q^i; $i = 1, 2$. K and S are the capital specific to good 1 and 2, respectively. We also assume that $\partial F^1(0, K)/\partial L^1 = \partial F^2(0, S)/\partial L^2 = \infty$ for positive K and S. Then, for any positive prices, it is desirable to allocate the mobile labor to each use, that is, all goods are produced. Full employment in the labor market requires that

$$L^1 + L^2 = \bar{L}, \tag{4.1}$$

where $\bar{L}$ is the fixed labor endowment.

The specific capital markets have a special feature. We assume the following simple technology of a factor adjustment that can convert one kind of specific factor into another.

Assumption. *The technology of a specific factor conversion is expressed by the function* $\phi = \phi(g)$ *which is concave and increasing in* g. *The amount of* $\phi(g)$ *of a specific factor in good 2 industry is transformed into a specific factor in good 1 industry depending on the level of the input* g.

Each specific capital is so different in the technical and physical sense. There must be such technology that requires real resources for the specific capital to become mobile between industries. It is assumed that the technology of the specific factor conversion is embodied in the particular input g and the economy cannot produce it. We can consider that the economy does not have some indispensable factors or technology to produce the particular input for the factor movement activity. The level of g is the amount of the indispensable input for the factor movement activity available in the economy and it must be imported from foreign countries. Since the input has external effects, g is assumed to be publicly supplied (e.g., highways, power plants, port).[5] The government implements the factor movement activity. A change in the amount of specific factors available in the economy will alter the shape of the production possibility frontier. We assume that the private sectors take the public input g as a constant.

From the assumption of the capital movement activity, each capital worked in the respective industry is denoted by

$$K = \overline{K} + \phi(g), \tag{4.2}$$
$$S = \overline{S} - \phi(g), \tag{4.3}$$

where $\overline{K}$ and $\overline{S}$ are the fixed endowments of the capital specific to good 1 and 2, respectively. Equations (4.2) and (4.3) imply that the amount of the transformed capital $\phi(g)$ is used in the industry of good 1 instead of the industry of good 2 when g is given. From the properties of the function ϕ, an increase in g increases the amount of the specific capital K and reduces that of the specific capital S. It is assumed that

[5] If we consider specific factors such as skilled and unskilled labor, the intermediate input for the conversion from unskilled into skilled labor will be education or learning by doing.

the entire amount of each specific capital is not converted into another one, i.e., $K, S > 0$. Then, both good 1 and 2 are produced in the economy.

We assume that the returns from the capital specific to the industry of good 1 are higher than those specific to the industry of good 2.[6] The extension of the factor movement activity by the government facilitates the factor adjustment in the economy. The government complements the factor adjustment of the private sectors. Intuitively, we can consider in most less-developed countries that the specific capital S that might be employed in the exported good industry is capital with a low degree of technology. On the other hand, the specific capital K which might be used in the imported good industry is high-tech capital. The economy must increase certain inputs with the technology of conversion to use the former capital in the latter industry.

The gross domestic product (GDP) function with the factor movement activity is defined as follows:

$$\tilde{R}(p, g, \bar{L}, \bar{K}, \bar{S}) \equiv \max_{L} \left\{ pF^1(L^1, K) + F^2(L^2, S) \,\middle|\, L^1 + L^2 = \bar{L}, \; K = \bar{K} + \phi(g), S = \bar{S} - \phi(g) \right\}, \tag{4.4}$$

where p is the price of good 1 in terms of good 2. From the assumption that each capital is specific to a particular industry and labor is freely mobile between industries, the basic construction of the model is well known as the specific-factors model.[7] Since the public input g is an exogenous variable for the private sectors, the GDP function

[6] Wang (1985) studied the welfare effects of lump-sum transfers (untied aid) in the presence of a constant factor price differential between the industries with a two-country model and showed the possibility of transfer paradoxes.

[7] The specific-factors model is usually interpreted as a short-run version of the Heckscher-Ohlin model. In this chapter, however, the specific factors are quite different kinds of inputs and cannot become freely mobile between industries, even though we consider a long-run period. For the factor mobility, the economy must use certain economic resources and obtain the technology to convert one kind of factor into another. See, for example, Mussa (1974, 1978), Mayer (1974), and Neary (1978).

$\tilde{R}$ has the following well-known properties:[8]

$$\tilde{R}_K = r_K \quad \text{and} \quad \tilde{R}_S = r_S, \tag{4.5}$$

$$\tilde{R}_{KK} < 0 \quad \text{and} \quad \tilde{R}_{SS} < 0, \tag{4.6}$$

$$\tilde{R}_{pK} > r_K / p > 0 \quad \text{and} \quad \tilde{R}_{pS} < 0, \tag{4.7}$$

where r_K and r_S are the rental prices of the specific capital K and S in terms of the second commodity, respectively. The subscript on the function, throughout this chapter, represents the partial derivative with respect to the element, i.e., $\tilde{R}_K \equiv \partial \tilde{R} / \partial K$ and $\tilde{R}_{KK} \equiv \partial^2 \tilde{R} / \partial K^2$. Henceforth, we shall delete the constant endowment variables and rewrite the GDP function simply as $R(p, g) \equiv \tilde{R}(p, g, \overline{L}, \overline{K}, \overline{S})$.

Finally, we briefly present the production structure of the donor country. The donor is the open economy with public production. The economy produces the two private traded goods, good 1 and 2, and the public input using many internationally immobile factors. There are constant returns to scale in the production of the public input. The behavior of the production sectors will be characterized by the well-known restricted revenue function:

$$\tilde{G}(p, g, v) \equiv \max_{Q} \left\{ pQ^{*1} + Q^{*2} \;\middle|\; (Q^{*1}, Q^{*2}, g) \in Y(v) \right\}, \tag{4.8}$$

where g is the output of the public input, v is the factor endowment vector, Q^{*i} is the output of good i, and $Y(v)$ is the production possibility set in the economy with public production. Henceforth, we define the GDP function simply as $G(p, g) \equiv \tilde{G}(p, g, v)$. It is well known that the GDP function with public production

[8] See Dixt and Norman (1980).

G has the following properties:

$$Q^{*1} = G_p(p, g) \quad \text{and} \quad -C^g = G_g(p, g), \tag{4.9}$$

$$G_{gg}(p, g) \leq 0, \tag{4.10}$$

where C^g is the unit cost of the public input in terms of good 2.[9]

4.2.2 Equilibrium in the world economy

We consider a world of two countries, country α and β, and two private goods, good 1 and 2, where an international income transfer takes place. Country α is the donor country and country β is the recipient country. Trade in the private goods is free and good 1 is exported by country α and imported by country β. Country β is the economy with the factor movement activity where each capital is basically specific to a particular industry but its amount changes endogenously and labor is intersectorally mobile as we previously described.[10] In each country, the representative consumer consumes the two tradable private goods.

The government of α produces the public input g which is not freely traded. Country α is the economy with public production presented in section 4.2.1. An income transfer from the government of α to that of β finances the public input. Then, the government of the recipient country obtains g and converts one kind of specific factor into another. The aid is tied to expenditure of the public input that will

[9] See Abe (1992, 1995) for a treatment of the properties of the GDP function with public production.
[10] Li and Mayer (1990) studied the welfare effects of lump-sum transfers in a two-country model with variable labor supply caused by intercountry differences in propensities to consume commodities and leisure. In their model, transfer paradoxes do not arise.

change the amount of each specific capital available in β.[11]

Equilibrium in the world economy is characterized by the following conditions:

$$E^{\alpha}(p, u^{\alpha}) = G^{\alpha}(p, g) - \left\{ T + G_g^{\alpha}(p, g)\, g \right\}, \tag{4.11}$$

$$E^{\beta}(p, u^{\beta}) = R^{\beta}(p, g), \tag{4.12}$$

$$T = -G_g^{\alpha}(p, g)\, g, \tag{4.13}$$

$$z^{\alpha 1}(p, g, u^{\alpha}) + z^{\beta 1}(p, g, u^{\beta}) = 0, \tag{4.14}$$

where $E^{j}(p, u^{j})$ is the expenditure function of the representative consumer in country j with expenditure in terms of the second commodity, $j = \alpha, \beta$. u^{j} is the utility level of the representative consumer in country j. Since g is the public input used in the recipient's production sectors, it does not appear in the expenditure function. $G^{\alpha}(p, g)$ is the GDP function with public production in the donor country. $R^{\beta}(p, g)$ is the GDP function with the factor movement activity in the recipient country. $z^{\alpha 1}(p, g, u^{\alpha}) \equiv E_p^{\alpha} - G_p^{\alpha}$ and $z^{\beta 1}(p, g, u^{\beta}) \equiv E_p^{\beta} - R_p^{\beta}$ represent the compensated excess demand function for good 1 in the donor and the recipient, respectively. Since the donor exports and the recipient imports the first commodity, $z^{\alpha 1} < 0$ and $z^{\beta 1} > 0$.

Equation (4.11) is the budget constraint of the donor country. The government of the donor raises the transfer (T) by means of lump-sum taxes and produces the public input. Equation (4.12) gives the income-expenditure identity in the recipient country with the factor movement activity. The budget constraint of the government of the recipient country is denoted by equation (4.13). Tied aid finances the public input produced in the

[11] It should be carefully noted that the public input transforms the capital specific to the numeraire good into the other. The tying is to finance the public input produced in the donor and increase the amount of the specific capital in the recipient's imported industry.

donor. The amount of each specific capital available in the recipient is endogenously determined through g which depends on the amount of the transfer (T) and the unit cost of the public input ($-G_g^{\alpha}$). Finally, equation (4.14) implies the market-clearing condition for good 1. From Walras' Law, the description of world equilibrium is completed by the system of equations (4.11)–(4.14).

The system of equations (4.11)–(4.14) contains the four endogenous variables (p, g, u^{α}, and u^{β}) and the one exogenous variable (T). The system is assumed to possess a unique solution. Totally differentiating equations (4.11)–(4.14) and choosing $E_u^j \equiv 1$, we obtain the following equations:

$$(z^{\alpha 1} + g\,G_{gp}^{\alpha})dp + g\,G_{gg}^{\alpha}dg + du^{\alpha} = -dT\,, \tag{4.15}$$

$$z^{\beta 1}dp - R_g^{\beta}dg + du^{\beta} = 0\,, \tag{4.16}$$

$$g\,G_{gp}^{\alpha}dp + (G_g^{\alpha} + g\,G_{gg}^{\alpha})dg = -dT\,, \tag{4.17}$$

$$z_p^1 dp + (z_g^{\beta 1} - G_{pg}^{\alpha})dg + z_u^{\alpha 1}du^{\alpha} + z_u^{\beta 1}du^{\beta} = 0\,, \tag{4.18}$$

where $z_p^1 \equiv z_p^{\alpha 1} + z_p^{\beta 1}$ denotes a change in the world compensated excess demand for good 1 due to changes in its relative price and is negative. $pz_u^{j1}/E_u^j = pz_u^{j1}$ is the marginal propensity to consume good 1 in country j.

Equation (4.15) shows that for given prices, an increase in the output of the public input in the donor ($dg > 0$) will increase the welfare of the donor ($g\,G_{gg}^{\alpha} \le 0$). However, improvement in the donor's terms of trade ($dp > 0$) has ambiguous effect on its welfare, since it may increase or decrease the unit cost of the public input ($G_{gp}^{\alpha} < 0$ or $G_{gp}^{\alpha} > 0$).

In equation (4.16) of the recipient country, we obtain $R_g^{\beta} = (r_K - r_S)\phi'$ using equation (4.5). Since by assumption the rental price of the specific capital in the industry of good 1 is higher than that in the industry of good 2 in the initial equilibrium (i.e., $r_K - r_S > 0$), R_g^{β} is positive. For given prices, an increase in the amount of the public input ($dg > 0$) improves the welfare of the recipient. Thus, extension of the factor movement policy is beneficial to the recipient country. It will imply that the benefit from the factor adjustment is implicitly distributed to the households of the recipient by its government. Since the recipient imports good 1 ($z^{\beta 1} > 0$), improvement in the donor's terms of trade ($dp > 0$) has a negative effect on the recipient's welfare.

4.3 Preliminary analysis

In this section, we examine the effects of tied aid on terms of trade and the output of the public input. Using the system of equations (4.15)–(4.18), we obtain

$$\Delta(dp/dT) = G_{gp}^{\alpha} - \left\{ z_g^{\beta 1} + \left(p z_u^{\alpha 1} G_g^{\alpha} + p z_u^{\beta 1} R_g^{\beta} \right) / p \right\}, \tag{4.19}$$

$$\Delta(dg/dT) = z_p^1 - z^{\beta 1}(z_u^{\beta 1} - z_u^{\alpha 1}), \tag{4.20}$$

where

$$\begin{aligned} \Delta \equiv -(G_g^{\alpha} + g G_{gg}^{\alpha}) \left\{ z_p^1 - z^{\beta 1}(z_u^{\beta 1} - z_u^{\alpha 1}) \right\} \\ + g G_{gp}^{\alpha} \left(z_g^{\beta 1} + z_u^{\alpha 1} G_g^{\alpha} + z_u^{\beta 1} R_g^{\beta} - G_{gp}^{\alpha} \right) \end{aligned} . \tag{4.21}$$

Δ represents the Jacobian determinant of the system (4.11)–(4.14) and is negative if the Walrasian stability condition holds. We assume that $\Delta < 0$ throughout this chapter.

A change in the relative price of good 1 is denoted by equation (4.19). The first right hand side term of equation (4.19) is the change in the output of good 1 induced by an increase in the public input of the donor. If good 1 and the public input are substitutes $G_{gp}^{\alpha} < 0$ (complements $G_{gp}^{\alpha} > 0$) in production, then an increase in g decreases (increases) the output of good 1 and has a positive (negative) effect on the price p.[12]

The second right hand side term of equation (4.19) expresses the effects of the factor movement policy ($z_g^{\beta 1}$) and changes in demand for the first commodity ($(pz_u^{\alpha 1} G_g^{\alpha} + pz_u^{\beta 1} R_g^{\beta}) \big/ p$). First, the movement of the specific capital from the industry of good 2 to that of good 1 increases the output of good 1 in the recipient country, which has a negative effect on p; $z_g^{\beta 1} = (\tilde{R}_{pS}^{\beta} - \tilde{R}_{pK}^{\beta})\phi' < 0$ from equation (4.7). Second, since the income transfer finances production costs of the public input, aid that increases the recipient government's employment of the public input by one unit reduces the national income of the donor by G_g^{α}. Then, the expenditure on good 1 will decrease by $p z_u^{\alpha 1} G_g^{\alpha}$ when good 1 is normal in consumption in the donor. On the other hand, the recipient country's income increases by R_g^{β} with the movement of specific factors. The expenditure on good 1 will increase by $p z_u^{\beta 1} R_g^{\beta}$ when good 1 is normal in consumption in the recipient. Therefore, the term $z_g^{\beta 1} + \left(pz_u^{\alpha 1} G_g^{\alpha} + pz_u^{\beta 1} R_g^{\beta} \right) \big/ p$ has an ambiguous effect on p.

Using equations (4.7) and (4.9), we can rewrite the second right hand side term of

[12] See Abe (1992) for the definition of the interactive effects between the private good and the publicly produced good.

equation (4.19) as

$$z_g^{\beta 1} + \left(pz_u^{\alpha 1} G_g^{\alpha} + pz_u^{\beta 1} R_g^{\beta} \right) / \, p < \phi' \left\{ \tilde{R}_{ps}^{\beta} - z_u^{\beta 1} r_S - r_K (1 - pz_u^{\beta 1}) / p \right\} - z_u^{\alpha 1} C^g \,. \quad (4.22)$$

We obtain that tied aid inevitably improves the recipient country's terms of trade, if good 1 in both countries ($pz_u^{\alpha 1} \geq 0$ and $pz_u^{\beta 1} \geq 0$) and good 2 in the recipient country ($z_u^{\beta 2} = 1 - pz_u^{\beta 1} \geq 0$) are not inferior in consumption, and good 1 and the public input are complements in production ($G_{gp}^{\alpha} > 0$). It should be noted that the sign of equation (4.22) is independent of differences in the rental prices between the specific factors, r_K and r_S. Consider the case where tied aid increases the output of g and all goods are normal in consumption. The movement of specific factors increases the output of good 1 in the recipient country. On the other hand, the factor adjustment will cause an increase in the national income of the recipient, which has a positive effect on p. However, the former production effect is strong enough to decrease the price of good 1.

A change in the output of the public input is denoted by equation (4.20). Since the unit cost of the public input will change, it is not clear whether tied aid increases or decreases the output of the public input in the donor country. When initially there is no aid (i.e., $g = 0$), tied aid unambiguously increases the output of the public input from equation (4.21) and the stability condition.

4.4 Welfare effects of tied aid

4.4.1 The welfare effect in the donor country

Using the system of equations (4.15)–(4.18), we obtain the effect of tied aid on the donor country's welfare as follows:

$$\Delta\left(du^{\alpha}/dT\right)= z_{p}^{1}\,G_{g}^{\alpha}-z^{\beta 1}\left\{z_{g}^{\beta 1}+z_{u}^{\beta 1}(G_{g}^{\alpha}+R_{g}^{\beta})-G_{gp}^{\alpha}\right\}. \tag{4.23}$$

Tied aid reduces the donor's welfare when (i) all goods are not inferior in consumption in the recipient ($pz_{u}^{\beta 1}\geq 0$ and $z_{u}^{\beta 2}=1-pz_{u}^{\beta 1}\geq 0$) and (ii) good 1 and the public input are complements in production ($G_{gp}^{\alpha}>0$). If, however, one of these conditions does not hold, then there is possibility of the paradoxes of donor-enrichment.[13] To prove this, we use a similar method for obtaining equation (4.22). Note that this result on welfare is not reversed whatever the unit cost of the public input and the benefit (cost) from extension of the factor movement activity are under the normality condition in consumption. It is essential for the donor to know how production of the public input affects the output of its exported good, i.e., the sign of G_{gp}^{α}.

We can see the welfare effect of the donor country more clearly by rewriting equation (4.23) as[14]

$$\left(du^{\alpha}/dT\right)= z^{\beta 1}\left(dp/dT\right)+G_{g}^{\alpha}\left(dg/dT\right). \tag{4.24}$$

Equation (4.24) states that the donor country unambiguously suffers from tied aid if it (i) increases the output of the public input and (ii) deteriorates its terms of trade. First,

[13] The normality condition in consumption and the transfer paradox are closely related. For example, Turunen-red and Woodland (1988) showed that a Pareto-improving multilateral transfer does not exist if all commodities are normal and are net substitutes from a world point of view. See also Bhagwati et al. (1985).

[14] Substituting equations (4.19) and (4.20) into (4.24), equation (4.24) becomes identical to equation (4.23).

following the analysis of the previous section, tied aid will have a negative effect on the donor's terms of trade under the conditions that all goods are not inferior in consumption in the recipient, and good 1 and the public input are complements in production. Second, it is indeterminate whether tied aid increases or decreases the output of the public input from equation (4.20). The former terms of trade effect on welfare dominates the latter public input effect under the conditions. In general, however, it is possible for the welfare of the donor to improve, if terms of trade change sufficiently in favor of it or the output of the public input shrinks.

4.4.2 The welfare effect in the recipient country

Using the system of equations (4.15)–(4.18), we obtain the effect of tied aid on the recipient country's welfare as

$$\Delta\left(du^{\beta}/dT\right)=z_p^1 R_g^{\beta}+z^{\beta 1}\left\{z_g^{\beta 1}+z_u^{\alpha 1}(G_g^{\alpha}+R_g^{\beta})-G_{gp}^{\alpha}\right\}. \tag{4.25}$$

Equation (4.25) shows that tied aid improves the recipient country's welfare if (i) all goods are not inferior in consumption in the donor country ($pz_u^{\alpha 1}\geq 0$ and $z_u^{\alpha 2}=1-pz_u^{\alpha 1}\geq 0$) and (ii) good 1 and the public input are complements in production ($G_{gp}^{\alpha}>0$). This is easily obtained by using a similar method as in the donor country's welfare. Note that any relationship between the unit cost of the public input and the benefit derived from extension of the factor movement activity does not reverse the result on welfare. The income transfer can improve the recipient's welfare in spite of the cost level of the public input. Even if tied aid decreases the output of the public input,

which implies a decrease in the national income of the recipient, the recipient can benefit from the tied aid. To gain from tied aid, the recipient country should have the information about the differences in the returns from the specific factors.

Alternatively, the welfare effect of tied aid in the recipient country can be written as[15]

$$\left(du^{\beta}/dT\right) = -z^{\beta 1}\left(dp/dT\right) + R_g^{\beta}\left(dg/dT\right). \tag{4.26}$$

Equation (4.26) expresses that the recipient country's welfare unambiguously increases by tied aid if it (i) increases the output of the public input and (ii) improves its terms of trade.

Summing up, we obtain the following proposition on the welfare effects of tied aid.

Proposition. *Suppose that (i) tied aid finances a public input produced in the donor country, (ii) extension of the factor movement activity in the recipient country increases the factor specific to its imported industry and decreases that specific to its exported industry, and (iii) an increase in the public input increases the production of the donor country's exported good. Then, the donor country suffers from the tied aid, if all goods are not inferior in consumption in the recipient country. The recipient country benefits from the tied aid, if (i) all goods are not inferior in consumption in the donor country and (ii) extension of the factor movement activity is beneficial.*

We should notice that there is possibility of the paradoxes of recipient-impoverishment even if extension of the factor adjustment is beneficial to the recipient. The tied aid facilitates the recipient's factor adjustment through the increase in

[15] Substituting equations (4.19) and (4.20) into (4.26), equation (4.26) becomes identical to equation

the public input and will change the demand and supply of the private goods. In general, if the deterioration in terms of trade is severe relative to the increase in the output of the public input, the income transfer may deteriorate the welfare of the recipient country paradoxically from equation (4.26).

4.4.3 The effect on world welfare

From the system of equations (4.15)–(4.18), the effect of tied aid on world welfare is given by

$$\begin{aligned}\left(du^{\alpha}/dT + du^{\beta}/dT\right) &= (G_g^{\alpha} + R_g^{\beta})\left(dg/dT\right) \\ &= (G_g^{\alpha} + R_g^{\beta})\left\{z_p^1 - z^{\beta 1}(z_u^{\beta 1} - z_u^{\alpha 1})\right\}\Delta^{-1}. \qquad (4.27)\end{aligned}$$

Equation (4.27) shows that tied aid improves world welfare, if (i) the benefit from the marginal extension of the factor mobility exceeds the unit cost of the public input ($R_g^{\beta} > -G_g^{\alpha}$) and (ii) tied aid increases the output of the public input. To improve world welfare when the extension of the factor movement activity harms the recipient country ($R_g^{\beta} < 0$), the output of the public input must decrease. In these cases, both the donor and the recipient may benefit from the tied aid. There is, however, possibility for world welfare to deteriorate if some of the conditions do not hold.[16]

From the proposition, it is necessary for the recipient country to know whether the extension of the factor movement activity benefits it or not. To enhance the possibility of improvement in the donor country's welfare, it should calculate the benefit of the

(4.25).

[16] The possibility of transfer paradoxes including a Pareto-improving transfer will increase, if the factor movement is irreversible, i.e., the amount of each specific factor does not change when tied aid decreases the public input.

recipient country's industrial policy as well as the cost of the public input and estimate the change in the output of the public input.

Hatzipanayotou and Michael (1995) studied tied aid that finances the pubic consumption good produced in the recipient with a two-country model. The households of the recipient country consume the public good as well as tradable private goods. An increase in the consumption of the public good reduces expenditure on the private goods required to achieve the same level of utility. The public good is a utility increasing good. In their tied aid model, if a small income transfer (i.e., when initially there is no aid) improves the welfare of the recipient country and deteriorates that of the donor country, then the unit cost of the public good should exceed the consumer's marginal willingness to pay for it. Since a small income transfer unambiguously increases the output of the public good, it implies that the supply of the public good is not optimal and deteriorates world welfare. The efficient provision of the public good in terms of world welfare has a negative effect on the recipient country's welfare and a positive effect on the donor country's welfare.[17]

In this chapter, we show that the recipient country's welfare will improve if the factor adjustment with the public input itself benefits the recipient country. The efficient use of the public input in terms of world welfare may enhance the possibility of improvement in the donor country's welfare and never has a negative effect on the welfare of the recipient country in our tied aid model.

[17] Michael and Hatzipanayotou (1996) analyzed the case of the public input good and obtained a similar result on the efficient provision of it and world welfare.

4.5 Concluding remarks

The purpose of this chapter is to analyze the welfare effects of tied aid in a model with adjustment costs in the factor markets. We construct the model of tied aid that finances the public input used for the transformation of specific factors in the recipient country. The aid can be considered as one form of the industrial policy of the recipient's government supported by the income transfer. The tied aid will enable the recipient's government to adjust the amount of factors and gaps between the returns of them in the recipient. The public input is produced in the donor country. This describes a feature of tying that the recipient country's government must spend tied aid on goods that are produced using the factors of production such as labor and capital in the donor country.

Chapter 4 examines the effects of tied aid on the welfare of the donor and the recipient as well as world welfare. We identify the conditions under which the income transfer benefits the recipient country and harms the donor country. The tied aid can be welfare enriching for the donor and welfare immiserizing for the recipient. We show that the welfare of the recipient country may deteriorate by the transfer even if the factor adjustment is beneficial. The income transfer can raise world welfare depending on the relationship between the derived benefit and the cost of the public input, and in such case it may enrich both the donor and the recipient. The recipient and the donor have the different interests in the improvement of its own welfare. In the transfer problem, it is essential to consider different features in the markets and policies between the donor country and the recipient country. We should develop a new model to examine other features in the markets.

References

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

——— (1995), “The target rates of tariff and tax reform”, *International Economic Review*, 36, 875-885.

Balasko, Y. (1978), “The transfer problem and the theory of regular economies”, *International Economic Review*, 19, 687-694.

Bhagwati, J. N., R. A. Brecher and T. Hatta (1983), “The generalized theory of transfers and welfare: bilateral transfers in a multilateral world”, *American Economic Review*, 73, 606-618.

——— (1985), “The generalized theory of transfers and welfare: exogenous (policy-imposed) and endogenous (transfer-induced) distortions”, *Quarterly Journal of Economics*, 100, 697-714.

Brakman, S. and C. Marrewijk (1995), “Transfers, returns to scale, tied aid and monopolistic competition”, *Journal of Development Economics*, 47, 333-354.

——— (1998), *The Economics of International Transfers*, Cambridge: Cambridge University Press.

Brecher, R. A. and J. N. Bhagwati (1982), “Immiserizing transfers from abroad”, *Journal of International Economics*, 13, 353-364.

Dixit, A. K. and V. Norman (1980), *Theory of International Trade*, Cambridge: Cambridge University Press.

Gale, D. (1974) “Exchange equilibrium and coalitions: an example”, *Journal of Mathematical Economics*, 1, 63-66.

Hatzipanayotou, P. and M. S. Michael (1995), “Foreign aid and public goods”, *Journal*

of Development Economics, 47, 455-467.

Kemp, M. C. (1995), *The Gains from Trade and the Gains from Aid*, London: Routledge.

Kemp, M. C. and S. Kojima (1985), "Tied aid and the paradoxes of donor-enrichment and recipient-impoverishment", *International Economic Review*, 26, 721-729.

Lahiri, S. and P. Raimondos (1995), "Welfare effects of aid under quantitative trade restrictions", *Journal of International Economics*, 39, 297-315.

——— (1997), "On the tying of aid to tariff reform", *Journal of Development Economics*, 54, 479-491.

Leontief, W. (1936), "Note on the pure theory of capital transfer", in *Explorations in economics: Notes and essays contributed in honor of F.W. Taussig*, New York: McGraw-Hill, 84-92.

Li, J. and W. Mayer (1990), "The transfer problem with supply effects: presumption for terms of trade changes", *Canadian Journal of Economics*, 23, 896-907.

Mayer, W. (1974), "Short-run and long-run equilibrium for a small open economy", *Journal of Political Economy*, 82, 955-967.

Michael, M. S. and P. Hatzipanayotou (1996), "Foreign aid tied to public inputs", *Keio Economic Studies*, 33, 35-45.

Mussa, M. (1974), "Tariffs and the distribution of income: the importance of factor specificity, substitutability, and intensity in the short and long run", *Journal of Political Economy*, 82, 1191-1203.

——— (1978), "Dynamic adjustment in the Heckscher-Ohlin-Samuelson model", *Journal of Political Economy*, 86, 775-791.

Neary, J. P. (1978), "Short-run capital specificity and the pure theory of international

trade", *Economic Journal*, 88, 488-510.

Ohyama, M. (1974), "Tariffs and the transfer problem", *Keio Economic Studies*, 11, 29-45.

Samuelson, P. A. (1947), *Foundations of Economic Analysis*, Cambridge, Mass.: Harvard University Press.

Schweinberger, A. G. (1990), "On the welfare effects of tied aid", *International Economic Review*, 31, 457-462.

Takarada, Y. (1999a), "On tied aid with public goods and non-traded goods", *Osaka Economic Papers*, 49, 82-93.

——— (1999b), "Tied aid and the factor adjustment with public goods", mimeo.

Turunen-red, A. H. and A. D. Woodland (1988), "On the multilateral transfer problem: existence of Pareto improving international transfers", *Journal of International Economics*, 25, 249-269.

Wang, L. F. S. (1985), "Factor market distortions, the transfer problem, and welfare", *Keio Economic Studies*, 22, 57-64.

Yano, M. (1983), "Welfare aspects of the transfer problem", *Journal of International Economics*, 15, 277-289.

5 Conclusions

Since the remarkable dispute between Keynes and Ohlin in 1929, the transfer problem has been one of the important problems in economics. The possibility of transfer paradoxes, i.e., the donor country gains and/or the recipient country suffers from an income transfer, has attracted a lot of attention of economists. The main objective of foreign aid program is to improve welfare in the recipient country. We should know under what circumstances an international transfer benefits or harms the recipient country, and also for the donor country. For this purpose, we develop three trade models to study the economic consequences of international transfers.

In chapter 2, we examine aid by transfer of goods and aid by capital in a model with internationally mobile capital. An international transfer benefits the recipient and suffers the donor in a two-country model regardless of international capital movement. Also the ordinary welfare result remains valid in the case of transfer with the bystander, under some acceptable conditions for the Chipman flat to exist. Aid by capital can be treated as a transfer of rental subsidy. The international capital movement restrains the change of the goods price. If capital moves internationally, the country's welfare will change depending conversely on the direction of improvement in its terms of trade, in comparison with the case of transfers without mobile capital. This result implies the following foreign aid program, if we assume that the donor can only approve a fixed welfare loss through the income transfer. That is, the amount of aid under internationally mobile capital may be smaller (larger) than that of aid without internationally mobile capital when terms of trade improve in favor of the donor (recipient) country as a result of the aid. For next steps, we need other approaches to the

transfer problem and international capital movement. Foreign aid enhances the income level of the recipient and can be used for providing infrastructures that contribute to reduce the reluctance of private capital to migrate. This capital movement will increase world welfare and the outcome of a transfer may be Pareto-improving. We should construct another model with explicit description of incentives of international capital movement.

Chapter 3 introduces the generalized model to bridge the gap between Kemp-Kojima and Schweinberger. Our results complement their analyses. Our tied aid model turns out to be a comprehensive model that includes the Kemp and Kojima model and the Schweinberger model as special cases. Then, we show, in the Kemp-Kojima case, that whenever the transfer paradoxes occur, the households of the recipient country have an incentive to trade the goods purchased from their production income after they receive tied aid. We show, in the Schweinberger case, that the normality condition in consumption rules out a possibility of the recipient paradox, while the impossibility of the donor paradox has already proved. The basic difference between Kemp and Kojima and Schweinberger lies in a households' acquaintance with the government transfer and a possibility of re-allocation at the expense of production income after the transfer is carried out.

In chapter 4, we constructs a model of aid tied to financing public input goods that are produced in the donor and used for the factor adjustment in the recipient. The tied aid stimulates the recipient's industrial policy that adjusts the amount of factors available in the recipient with adjustment costs. We identify the conditions under which the income transfer benefits the recipient and harms the donor. The recipient may suffer from the transfer even if extension of the factor adjustment benefits it. The aid can raise

(reduce) world welfare and may enrich (harm) both the donor and the recipient. In the transfer problem, it is essential to consider different features in the markets and policies between the donor country and the recipient country. Tying may take the other form. We should develop a new model to examine other type of tying and features in the markets.