Foreign Aid in the Presence of Learning-by-Doing: Grants vs Loans

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Abstract

In a simple two-sector dynamic model with learning by doing and growth promoting and welfare enhancing tied-aid policies are investigated. Two new forms of tying, grant aid and loan aid are considered in the paper. Granting food aid are shown to have negative impact on growth, while providing capital transfers to manufacturing sectors with learning by doing gives a big-push to accelerated growth. It is shown that loan aids to manufacturing sector may lead to higher intertemporal welfare compared to grant loans in the absence of international capital markets. The existence of international trade and international capital markets matter for the tied aids to be effective.

Keywords: Tied aid, Learning by doing, Welfare

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1 Introduction

Providing effective aid has long been a major concern among economists and policy makers. In order to achieve Millennium Development Goals, aid donor countries and multilateral development banks shifted their focus on poverty alleviation, which lead to the belief that aids in the form of outright grants rather than loans are more preferable.[2] After active debates,[3] the actual patterns of aid disinbursement show that the donor countries and the multilateral development banks in fact switched from loans to grants. Japan, providing the highest proportion of bilateral loans to the total bilateral ODA among the DAC countries, has reduced the proportion of bilateral loans since 2000.[4]

The drastic change in the forms of aid is a consequence of less than satisfactory performance of aid in promoting sustainable growth in the aid-recipient countries, creating highly debt-indebted countries and sluggish improvement in poverty reduction. Among numerous studies estimating the effectiveness of aid on growth, an influential paper by Burnside and Dollar (2000) showed the importance of good policy environment for aid to be effective. The evidence shows that although the direct effect of aid on growth is not that significant, aid does promote growth if the recipient country has a sound policy environments, while aid is dissipated under a distorted policy environment. For policy makers, aid effectiveness is far from satisfactory, and resulted in the redirection of aid policies toward reducing poverty in the 1990's.[5] The primary goal of providing aid was thus replaced by poverty alleviation, and pro-poor aid policies were encouraged. Aid transfers are not given in the form of unilateral lump-sum transfers, but rather they are tied in the sense that they are associated with a specific policy objective of poverty alleviation. This paper is motivated to analyze the effects of poverty targeted tied aids on recipients" economic growth.

[2] See Meltzer Commission (2000) and Paris Declaration.
[3] See, for example, Bulow and Rogoff (2005).
[4] For the discussion of Japan's ODA policies see Ishikawa (2006).
[5] The report by DAC committee Meltzer Commission (2000) summarizes such view;

> For the globe's truly poor, the provision of improved levels of health care, primary education and physical infrastructure, once the original focus for development funding, should again become the starting point for raising living standards. Yet, poverty is often most entrenched and widespread in countries where corrupt and inefficient governments undermine the ability to benefit from aid or repay debt. Loans to these governments are too often wasted, squandered, or stolen. Outright grants rather than loans provide a realistic vehicle for poverty alleviation.

Despite active policy debates on the effectiveness of aid on growth, theoretical works has not caught up with them. Only a few paid attention to the effects of tied aid on economic growth in a dynamic framework, but certainly have brought new insights to the discussion of the effectiveness of tied aids[6] by examining the effects of aid on productivity, capital accumulation and terms of trade. Chao and Yu (2001) considered aids tied to the purchase of an imported capital good subject to import quota, and showed the possibility of the paradoxical effects of tied aid on capital accumulation; aid tied to the imports of capital goods may reduce the level of capital stock, which leads to welfare deterioration. The negative effects of tied aids on capital accumulation are also identified in a growing economy with learning by doing. Chi-Chur Chao et al. (2007) constructed a two-country growth model with learning by doing, hence focusing on the effects of endogenously determined international output prices on capital accumulation, and simulated the welfare effects of aids tied to the purchase of quota-restricted imports. The effects of tied aid on productivity is explicitly characterized by Benarroch and Gaisford (2004) in a dynamic Ricardian model with learning by doing. Aid tied to technological transfer from the North to the South expedites the process of product cycle in the South through adoption of new technology and learning, and were shown to be welfare improving for both donors and recipients.

The purpose of the paper is to construct a simple two-sector dynamic model with learning by doing and characterize growth promoting and welfare enhancing aid policies. We depart from the previous literature by considering two new forms of tying, grant aids and loan aids. In particular, humanitarian grant aids (characterized as capital transfer to production) and loan aids to manufacturing sector will be shown to have distinct effects on growth, which may provide some insights on the ongoing policy debate regarding the forms of aid. The question is not whether aid should be aimed at reducing poverty or promoting growth, nor should aid be given in the form of grants rather than loans. The paper is motivated to characterize the forms of aid that can promote economic growth in a small open economy. The trading patterns and the access to international capital markets are shown to be important factors in determining the welfare effects of tied aids.

The organization of the paper is as follows. In the following section, a two-sector

[6] In Kemp and Kojima (1985) aids are said to be "tied in the recipient if it is spent inefficiently in terms of individual preferences and that aid is tied in the donor if it is financed inefficiently." See Brakman and Marrewijk (1998) for a comprehensive survey on both non-tied and tied aids.

model with a basic commodity (say food) produced under constant returns to scale and manufactured goods produced under increasing returns to scale with learning by doing is presented. As a benchmark analysis, effects of un-tied aid are also analyzed. Section 3 turns to the welfare analysis of tied aid in the form of grants and loans. In particular, the aid tied to food production and manufactured good productions are going to be analyzed. Related literature is discussed in Section 4, and the final section concludes with some remarks.

2 A Model

In this section, I present a model of a small open economy that consists of two sectors producing a manufactured good and an agricultural good, denoted by m and a respectively. Technology available to this economy is assumed to be time invariant and is given by:

$$X_m(t) = M(t)F_m(L_m(t), \mathcal{K}_m(t)) = M(t)L_m(t)f_m(k_m(t)) \tag{1}$$

$$X_a(t) = F_a(L_a(t), \mathcal{K}_a(t)) = L_a(t)f_a(k_a(t)) \tag{2}$$

where $X_i(t)$ denotes the output levels of sector i at time t, $L_i(t)$ the amount of labor allocated to sector i at time t $(i = m, a)$, $\mathcal{K}_i$ the exogenously given amount of capital specific to each sector at time t, and $k_i(t)$ the capital-labor ratio in sector i at time t. Production function, F_i is assumed to be continuously differentiable and exhibits constant returns to scale technology with diminishing marginal productivity to each factors of production, which gives us the intensive form production function f_i, $f_i'(k_i(t)) > 0$, $f_i''(k_i(t)) < 0$. The learning-by-doing in the manufacturing sector is modeled a la Matsuyama (1992). $M(t)$ indicates the pre-determined level of productivity in manufacturing sector at time t. $M(t)$ can be thought as knowledge capital in manufacturing sector, which accumulates over time through learning-by-doing;[7]

$$\frac{\dot{M}(t)}{M(t)} = \delta X_m(t), \delta > 0 \tag{3}$$

where a dot notation denotes the time derivative. The learning-by-doing effects are assumed to never depreciate and are purely external to firms.

[7] Learning is enhanced by cumulative output, not by cumulative investment as in Chi-Chur Chao et al. (2007). See Solow (1997) for insightful discussions on the formalization of learning by doing in a growth model and the relationship with the endogenous growth model.

Exogenously given amounts of capital are available and are used specifically for the production of manufactured and agricultural goods. Labor, on the other hand, is assumed to be mobile between two sectors.

$$\lambda_a(t) + \lambda_m(t) = 1 \tag{4}$$

$$\lambda_i(t)k_i(t) = \kappa_i(t) \tag{5}$$

where $\lambda_i(t) \equiv \frac{L_i(t)}{\mathcal{L}}$ denotes the fraction of labor allocated to sector i, and $\kappa_i(t) = \frac{\mathcal{K}_i(t)}{\mathcal{L}}$ is the capital-labor endowment ratio. The amount of labor supplied, $\mathcal{L}$, is given exogenously and assumed to be constant over time.

The marginal productivity pricing rule applies under perfect competition;

$$\begin{aligned} w(t) &= p_m(t)M(t)[f_m(k_m(t)) - f_m'(k_m(t))k_m(t)] \\ &= p_a(t)[f_a(k_a(t)) - f_a'(k_a(t))k_a(t)] \end{aligned} \tag{6}$$

$$R_m(t) = p_m(t)f_m'(k_m(t)), \quad R_a(t) = p_a(t)f_a'(k_a(t)) \tag{7}$$

where $p_i(t)$ are the international prices of output i.

We define the per-capita income as $y(t) = \lambda_a p_a(t) f_a(k_a(t)) + \lambda_m p_m(t) M_t f_m(k_m(t))$. Assuming no factor accumulation, $y(t)$ grows at a rate

$$\frac{\dot{y}(t)}{y(t)} = \alpha_m \delta f_m(k_m(t)) \tag{8}$$

where $\alpha_m = \frac{p_m(t)M(t)f_m(k_m(t))}{y(t)}$ is the output share of manufactured good. (**??**) indicates that the growth rate of the per-capita income depends on the relative size of the manufactured-good sector and not on the agricultural sector.[8]

2.1 Growth Rate

To see how the economy evolves over time, (**??**) is differentiated with respect to time, using (**??**) and (**??**) and suppressing time notations to obtain

$$(\mu_a \frac{k_a}{\lambda_a} + \mu_m \frac{k_m}{\lambda_m})\dot{\lambda_m} = -\delta X_m + (\frac{\dot{p}_a(t)}{p_a(t)} - \frac{\dot{p}_m(t)}{p_m(t)}) + \frac{\mu_m}{\lambda_m}\dot{\kappa}_m(t) - \frac{\mu_a}{\lambda_a}\dot{\kappa}_a(t) \tag{9}$$

where $\mu_i = \frac{f_i'' k_i}{f_i - f_i' k_i} < 0$. By interpreting the signs of each terms, the following result is in order.

[8] The model exhibits unbounded growth due to learning by doing in manufacturing sector. Such characterization may not be unrealistic, however, it allows us to qualitatively analyze the effects of aid on growth.

Claim 1 *An economy grows faster if*

1) the output of manufactured goods expands.

2) the relative international price of manufactured goods increases.

3) the capital endowment in manufacturing sector increases.

4) the capital endowment in agriculture sector decreases.

The dynamics of economic growth reveal a knife-edge property of the model. Once an economy achieves higher economic growth rate, the productivity in the manufacturing sector grows faster through learning by doing, and the economic growth further accelerates. On the other hand, if economic growth rate slows down, it has perpetual effects on learning by doing, and the economy slows down even further. To better understand the movement of the growth rate, the output level of manufactured goods are examined in the following subsection.

2.2 Instantaneous Equilibrium

In a perfectly competitive market, cost minimization implies the input requirement for each factor, $j = L, K$, to be written as a function of factor prices and the level of knowledge capital; $a_{jm}(w, R_i, M(t))$ and $a_{ja}(w, R_i)$. By interpreting experience as the cumulative manufactured output, the learning-by-doing improves productivity in the following way.

$$\hat{a}_{Km} = \theta_{Lm}\gamma_{Lm}(\hat{w}(t) - \hat{p}_m(t)) - b\hat{M}(t) \tag{10}$$

$$\hat{a}_{Lm} = -\theta_{Km}\gamma_{Lm}(\hat{w}(t) - \hat{p}_m(t)) - b\hat{M}(t) \tag{11}$$

where b is the proportionate reduction in factor input requirement due to learning-by-doing, and the hat notations indicates the rate of change in that variable. It is assumed that the learning-by-doing effect does not alter the capital-labor ratio at constant factor prices; thus the factor input requirement is reduced by the same proportion for each factor.

Material balance equations can be written as, by using $X_i(t) = \frac{\mathcal{K}_i(t)}{a_{Ki}}$

$$\frac{a_{Lm}}{a_{Km}}\mathcal{K}_m(t) + \frac{a_{La}}{a_{Ka}}\mathcal{K}_a(t) = \mathcal{L} \tag{12}$$

or, using the expression for the input requirement function;

$$\lambda_m(t)(\hat{a}_{Lm} - \hat{a}_{Km} + \hat{\mathcal{K}}_m(t)) + \lambda_a(t)(\hat{a}_{La} - \hat{a}_{Ka} + \hat{\mathcal{K}}_a(t)) = 0 \tag{13}$$

By defining the elasticity of marginal product of labor, à la Jones, $\gamma_{Li} \equiv -\frac{(\hat{a}_{Li}-\hat{a}_{Ki})}{\hat{w}(t)-\hat{p}_i(t)}$ and after some calculation,

$$\hat{w}(t) = \beta_m \hat{p}_m(t) + \beta_a \hat{p}_a(t) + \lambda_m(t)\hat{\mathcal{K}}_m(t) + \lambda_a(t)\hat{\mathcal{K}}_a(t) \tag{14}$$

where $\beta_i \equiv \lambda_i(t)\frac{\gamma_{Li}}{gamma}$, $\gamma \equiv \lambda_m(t)\gamma_{Lm} + \lambda_a(t)\gamma_{La}$ the weighted average of the elasticity of marginal productivity.

By substituting (**??**), we can now present the following expression for the supply function of manufactured goods.

$$\begin{aligned}
\hat{X}_m(t) &= \hat{\mathcal{K}}_m(t) - \hat{a}_{Km} = \hat{\mathcal{K}}_m(t) - [\theta_{Lm}\gamma_{Lm}(\hat{w}(t) - \hat{p}_m(t)) - b\hat{M}(t)] \\
&= \theta_{Lm}\gamma_{Lm}\beta_m(\hat{p}_m(t) - \hat{p}_a(t)) + (1 - \theta_{Lm}\gamma_{Lm}\lambda_m(t))\hat{\mathcal{K}}_m(t) \\
&- \theta_{Lm}\gamma_{Lm}\lambda_a(t)\hat{\mathcal{K}}_a(t) + b\hat{M}(t)
\end{aligned} \tag{15}$$

We can now present the following.

Claim 2 *Manufacturing sector expands, and consequently, an economy grows faster, if*
1) the relative price of manufactured goods increases.
2) $\mathcal{K}_m$ increases if the elasticity of labor demand in the manufacture sector is less than one, $\theta_{Lm}\gamma_{Lm} < 1$.
3) $\mathcal{K}_a$ decreases.

2.3 Consumer's Problem

The representative consumer in the recipient country is allowed to freely lend and borrow from the international capital market at the interest rate r. The intertemporal utility maximization problem can be written as follows.

$$max. \quad \int_0^\infty U(C_a(t), C_m(t))e^{-\rho t}dt \tag{16}$$

$$s.t. \quad C_a(t) + p(t)C_m(t) + \dot{A}(t) = Y(t) + iA(t), \forall t \tag{17}$$

$$A(0) = A_0, \quad \lim_{t\to\infty} A(t)e^{-\rho t} = 0 \tag{18}$$

where $A(t)$ is the beginning of the period holdings of one-period bonds (worth a claim to one unit output). $U(\cdot)$ is the instantaneous utility function, ρ the rate of time preference, and i is the world interest rate earned on assets. Letting an agricultural good be the numeraire and denoting the relative international price of manufactured good as $p(t)$.

Using (**??**), the flow budget constraint (**??**) integrates to the following intertemporal budget constraint.

$$\int_0^\infty E(t)e^{-it}dt = A_0 + Y_0 \tag{19}$$

$$Y_0 \equiv \int_0^\infty Y(t)e^{-it}dt \tag{20}$$

$$E(t) = C_a(t) + p(t)C_m(t) \tag{21}$$

By setting up a Hamiltonian, we obtain the following necessary and sufficient conditions:

$$\frac{\dot{U'}}{U'} = \rho - i \tag{22}$$

$$\lim_{t\to\infty} a(t)U'(\cdot)e^{\rho t} = 0 \tag{23}$$

Assuming the log linear utility function $U(C_a(t), C_m(t)) = \beta \ln C_a(t) + \ln C_m(t)$, (**??**) becomes

$$\frac{\dot{C}_i(t)}{C_i(t)} = i - \rho \tag{24}$$

$$C_i(t) = C_{i0}\ e^{(i-\rho)t} \tag{25}$$

By using the intertemporal budget constraint (**??**), consumption can be written as a linear function of wealth, i.e., the net discounted sum of lending and output values.

$$C_{a0} = \frac{\beta}{1+\beta}\rho(A_0 + Y_0) \tag{26}$$

$$C_{m0} = \frac{1}{(1+\beta)p(0)}\rho(A_0 + Y_0) \tag{27}$$

The indirect utility function, $v(t)$ can be written as

$$\begin{aligned} v(t) &= \beta \ln(\frac{\beta}{1+\beta}(A_0 + Y_0))e^{-\rho t} + \ln \frac{1}{(1+\beta)p(0)}(A_0 + Y_0)e^{-\rho t} \\ &= (1+\beta)\ln(A_0 + Y_0)e^{-\rho t} + De^{-\rho t} \end{aligned} \tag{28}$$

$$D = \ln \frac{1}{p(t)} + \beta \ln(\frac{\beta}{1+\beta}) + \ln(\frac{1}{1+\beta}) \tag{29}$$

D is a constant term capturing the effects of the changes in the relative prices. In the presence of perfect international capital market, an economy can freely lend and borrow at the constant world interest rate i, hence $i = \rho$, in equilibrium. The intertemporal welfare level W relates to the discounted value of output stream;

$$W = (1+\beta)\int_0^\infty \ln(A_0 + Y_0)\ e^{-\rho t}dt + \int_0^\infty D\ e^{-\rho t}dt \tag{30}$$

As a benchmark for later analysis, we define W_0 such that $A_0 = 0$;

$$W_0 = (1+\beta)\rho^{-1}\ln(\rho Y_0) + \int_0^\infty D\ e^{-\rho t}dt \tag{31}$$

We are now ready to proceed with the welfare analysis of aid policies.

3 Welfare Analysis of Tied Aids

3.1 Grant Aids

Consider an aid being granted in the form of capital in the initial period. The amount of capital transferred is G_{i0}; $\mathcal{K}_{i0} = \mathcal{K}_i(0) + G_{io}$. Let $Y_{G_{io}} \equiv \int_0^\infty Y(t; G_{io})e^{-it}dt$ be the discounted output values with capital transfer to sector i in the initial period. Then, from (**??**),(**??**) and (**??**), $Y_{G_{mo}} > Y_0$, $Y_{G_{ao}} < Y_0$, the welfare effects of grant aids in the presence of a perfect capital market,

$$\overline{W}_{G_{io}} = (1+\beta)\rho^{-1}\ln(\rho Y_{G_{io}}) + \int_0^\infty D\ e^{-\rho t}dt \tag{32}$$

The effects of grant aid in the form of capital transfer are summarized as follows.

Proposition 1 *(1) In the absence of population growth, grant aid to agricultural sector in the form of capital transfer is immiserizing and slows down the economic growth.*
(2) In the absence of population growth, grant aid to manufacturing sector in the form of capital transfer improves intertemporal welfare and promotes economic growth if the elasticity of labor demand in the manufacture sector is less than one, $\theta_{Lm}\gamma_{Lm} < 1$.

In order to alleviate poverty, providing food aid appears to be a obvious solution. However, many economists casted doubts on the effectiveness of food aid in a static analysis with various forms of distortions.[9] The above result verifies that grant aid for food production deteriorates intertemporal welfare in presence of dynamic learning-by-doing in manufacturing sector. Capital transfer to the agricultural sector stimulates food production, which in turn diverts resources away from the manufacturing sector exhibiting increasing returns to scale, generating the negative effects on economic growth.

[9] See, for example, Brecher and Bhagwati (1982) and Lahiri and Raimondos (1996).

3.2 Loan Aid

Suppose instead that the aid is provided in the form of loans. The recipient government receives aids in the form of capital, which is to be repaid to the foreign donors at the world interest rate i. Let foreign debt be denoted by $B(t)$. Assuming the government budget to be balanced at every moment, the flow budget constraint for the government is

$$G_{io} + iB(t) = \dot{B}(t) \tag{33}$$

The foreign borrowing is equal to the loan-aid transfer and the interest payments. By integrating, we obtain the following intertemporal government budget constraint.

$$G_{io} = B(0) \tag{34}$$

$$B(0) = B_0, \quad \lim_{t\to\infty} B(t)e^{-\rho t} = 0 \tag{35}$$

In the presence of foreign debt, the flow and intertemporal budget constraint of the representative consumer becomes, noting the fact that $A(t) = -B(t)$ for all t,

$$C_a(t) + p(t)C_m(t) + iB(t) = Y(t) + \dot{B}(t), \forall t \tag{36}$$

Combined with an assumption that the foreign debt grows at a rate less than the interest rate, the intertemporal budget constraint can be integrated to yield:

$$\int_0^\infty E(t)e^{-it}dt \quad = \quad -B_0 + Y_{G_{io}} \tag{37}$$

The present value of consumption is equal to the discounted value of GDP, $Y_{G_{io}}$, plus the initial foreign debt,B_0.

Intertemporal welfare level is, by using (**??**),

$$\widetilde{W}_{G_{io}} = (1+\beta)\rho^{-1}\ln\rho\int_0^\infty(-B_0 + Y_{G_{io}})e^{-\rho t}dt + \int_0^\infty D\ e^{-\rho t}dt \tag{38}$$

Welfare effects of loan aids, thus, depend on the term $(-B_0 + Y_{G_{io}})$. Clearly, $\widetilde{W}_{G_{io}} < \overline{W}_{G_{io}}$; the grant aids in the presence of international capital markets yield higher intertemporal welfare than the loan aids.

Proposition 2 *When international capital markets exist, grant aids in the form of capital transfer yield higher intertemporal welfare compared to loan aids.*

Let us introduce another reference point where there exists no international capital markets. If no international lending and borrowing are allowed, $E(t) = Y(t)$ for all t. The intertemporal welfare, then, becomes

$$\overline{W}'_{G_{io}} = (1+\beta)\int_0^\infty \ln Y_{G_{io}}\ e^{-\rho t}dt + \int_0^\infty D\ e^{-\rho t}dt \tag{39}$$

By comparing $\widetilde{W}_{G_{io}}$ with respect to $\overline{W}'_{G_{io}}$

$$\begin{aligned}\widetilde{W}_{G_{io}} - \overline{W}'_{G_{io}} &= (1+\beta)[\rho^{-1}\ln\rho\int_0^\infty(-B_0+Y_{G_{io}})e^{-\rho t}dt - \int_0^\infty \ln Y_{G_{io}}\ e^{-\rho t}dt] \\ &= (1+\beta)[\rho^{-1}\ln\rho + \rho^{-1}\ln\int_0^\infty(-B_0+Y_{G_{io}})e^{-\rho t}dt - \int_0^\infty \ln Y_{G_{io}}\ e^{-\rho t}dt] \end{aligned} \tag{40}$$

As $\rho \to 1$, $(\rho^{-1}\ln\rho) \to 0$, and hence $\widetilde{W}_{G_{io}} < \overline{W}'_{G_{io}}$. On the other hand, as $\rho \to 0$, the first and second terms in the square bracket goes to infinity, and $\widetilde{W}_{G_{io}} > \overline{W}'_{G_{io}}$: For a sufficiently small ρ, loan aid yields higher intertemporal welfare than grant aid without international capital market; $\widetilde{W}_{G_{io}} > \overline{W}'_{G_{io}}$.

Proposition 3 *When international capital markets do not exist, for a sufficiently small discount rate, loan aids in the form of capital transfer yield higher intertemporal welfare compared to grant aids.*

4 Related Literature

Compared to the literature on the welfare effects of un-tied transfer, the literature on tied aid is rather small but growing. Studies on tied aid inherits the discussion for un-tied lump-sump aid transfers by focusing on the conflict of interest between donors and recipients. Tying of aid was considered to be aiming at either promoting donor's interest in exporting, alleviating poverty or sustaining balance of payments for recipient's by imposing restrictions on imports.

The possibilities of transfer paradox were analyzed for various forms of tied-aids. Aids tied to private consumption of imports were analyzed by Brecher and Bhagwati (1982), Kemp and Kojima (1985), Schweinberger (1990), and more recently by Abe and Takarada (2005). Tying of aid to specific expenditure patterns can in principle create transfer paradoxes in a stable equilibrium in a two country model, because it induces the changes in the terms of trade caused by what Schweinberger (1990) calls it 'endogenous' quantity restrictions, and thus leads to transfer paradoxes.

Another strand of literature on tied aid relates to distortions. Primary concern for tying aids was to improve recipients' welfare. Studies show that in the presence of distortions, tying of aids may magnify distortions and lead to paradoxical welfare effects in a small country. Various forms of distortions, such as tariffs and import quota, increasing returns to scale technologies and externalities are considered. In the presence of trade policies, tying of aids to imports may immizerize the recipient. Ohyama (1974) pointed out the possibility of transfer paradoxes of aid tied to imports in the presence of tariffs, and Lahiri and Raimondos (1995) in the presence of import quota. Lahiri and Raimondos (1997), in turn, showed that aids tied to reducing import tariffs in the recipient country can be welfare improving. Welfare effects of tied-aid on capital accumulation are analyzed in the presence of import quotas by Chao and Yu (2001), in which aids are tied to imported capital goods.

Production and other factor market distortions are also discussed in the literature. Brecher and Bhagwati (1982) demonstrated that in the presence of exogenous production distortions, tied-aid that shifts an economy away from the efficient allocation may be immizerizing in a stable equilibrium for a small open economy. Aids tied to nontraded goods (Yano and Nugent (1999) and Choi (2004)), public consumption goods, (Hatzipanayotou and Michael (1993), Michael and Hatzipanayotou (1996), Schweinberger (2002)) and public inputs (Takarada (2000), Yamashige (2001)) can also be immiserizing in a small open economy. In the presence of urban unemployment of the Harrris-Todaro type in the recipient country, tied aid in the form of capital transfer to import sectors are shown to be welfare immizerizing in a small open economy by Khan (1982) , Marjit and Beladi (2003) and by Michael(1998) in a two country model. Brakman and Marrewijk (1995) analyzes the effects of tied-aid in an economy with differentiated goods produced under monopolistically competitive markets.

Depending on the source of distortions, tied-aids that intensify distortions may have adverse welfare effects on the recipients. Dynamic analysis of tied aid in Chi-Chur Chao et al. (2007), Benarroch and Gaisford (2004) as well as this paper all highlight the effect of learning by doing, which generate externality. They can be thought of as an extension of the static analysis of tied aid in a distortion driven economy to a intertemporal framework.

Tying of aids takes the form of not just restricting how transfer resources are utilized,

but also imposing conditions on recipients' economic policies. Donors may tie aids (or impose conditionality) to imposing restrictions on trade policies and/or industrial policies to promote economic performance of the recipient countries. Svensson (2000) points out the moral hazard problem regarding the recipient government's incentives in reducing poverty and tied aid can serve as commitments by donors and thus improve the effectiveness of aids. In Adam and O'Connell (2004), aids are tied to trade liberalization by donors, and discussed the substitutability between offering aid and trade.

5 Conclusion

In this paper, the growth effects of grant aids and loan aids were analyzed in a small open economy with learning by doing. It has been shown that pro-poor transfers may have negative impact on growth; granting productive factor to agricultural sector slows down the growth rate and reduce intertemporal welfare. Capital transfers to the manufacturing sector stimulate learning by doing and accelerate growth. Furthermore, loan aids to manufacturing sector with international lending and borrowing lead to higher intertemporal welfare compared to grant aids without an access to international capital markets.

The results do not suggest for eliminating food production aid nor encourage capital transfers to manufacturing sectors to give a big-push to industrialization. What we identified in the paper is that the existence of international trade and international capital markets matter in determining the effectiveness of aids tied to specific sectors both in the form of grants and loans. If no international lending and borrowing are allowed for the recipient country, the loan aids can have more significant effects on growth relative to humanitarian grant aids.

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