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Abstract

This paper presents a neoclassical growth model comprising education and child labor with a focus on developing and aid-receiving countries to demonstrate cyclical growth and bifurcation in economic development. Numerous studies have explained the bifurcation in terms of the internal affairs of the recipient country, such as technology in production, subsistence minimum in consumption, and liquidity constraint in investment. The main argument of this paper is that the aid allocation policy employed by the donor countries, thereby the motive of the aid-providers, leads to divaricated and cyclical development in the recipient country.

(Key words) Aid allocation policy, Multiple equilibria, Cyclical growth, Economic development

(JEL Classification) F35, O11, O38

1 Introduction

Developed countries have made a large fiscal transfer to developing countries to aid their economic takeoff. The impact of foreign aid from the donors to the recipient countries varies from country to country, however. These variations could be primarily explained by a particular set of circumstances of the recipient. The empirical study of Burnside and Dollar (2000) stirs our interest in *good policies* in recipient countries. They find that development aid contributes to economic growth when the recipient country has a good policy environment, but it has a less beneficial effect on development if the recipient country is not well governed. This result has been reexamined by many researchers to foster better understanding of aid effectiveness [Collier and Dollar (2002), Hansen and Tarp (2001), Easterly et al. (2004), Clemens et al. (2004), and Dollar and Levin (2006)].

The persistent differences in growth rates among less-developed countries have also been explained by theoretical researchers. One of the contributory explanations involves the existence of the threshold effect arising from a discontinuity in technology, as formalized by Azariadis and Drazen (1990). When the production technology in the receiving country is a step function with a jump at some critical level of physical/human capital, the economy exhibits bifurcation; this leads to an environment where stagnant countries and countries succeeding in economic takeoff coexist[1]. This argument calls for a bifurcation mechanism on a technological feature in receiving countries. Other factors causing bifurcation in economic growth in most of the preceding theoretical studies have been, for instance, the existence of subsistence minimum in consumption, liquidity constraint in investment, and nature of

[1]It is, of course, true that the discontinuity in technology is not strictly required, as Azariadis and Drazen (1990, p.509) states. In fact, what is actually required is a shift from decreasing to increasing returns-to-scale technology at any level of state variables. Though we do not have much studies, we should take a notice of a proof against the idea of poverty trap induced by the equilibrium multiplicity. Using a simple growth model in which poverty traps can arise due to either low saving or low technology at low levels of development, Kraay and Raddatz (2007) do not find much evidence of the existence of poverty traps based on these mechanisms.

increasing returns in production[2]. All of these are based on internal affairs, i.e., preference, technology, and market conditions in the target country [see the excellent survey by Azariadis and Stachurski, 2004].

The aim of this paper is to arouse interests in the possibility that the bifurcation in economic development is not only generated by the internal conditions, but is arose from the donor-side. Specifically, the feature, which differentiates our model from other related studies, is the reason that the multiplicity and cyclical growth is caused by the form of foreign aid allocation the donor employs[3]. The form of foreign aid considered in this paper is not odd; we simply assume that the donor provides developing countries with assistance under a co-finance regime to stimulate human capital accumulation until the recipient's economic standard reaches the benchmark level. However, after the recipient exceeds this benchmark, the donor ceases to support it, so that the developing country is no longer on the list of aid recipients.

In this paper, the donor's aid policy is not only characterized by the benchmark level, but also aid allocation between various types of public spending. This standpoint is based on the evidences that suggest the importance of effective aid allocation among various types of public spending in the recipient country[4]. In our model, two types of policy options are considered; one is education aid to improve the quality of public education, and the other is cash transfer to ensure poor families with schooling-age children

[2]See, for instance, Galor and Zeria (1993), Galor and Weil (2000), Hazan and Berdugo (2002), Tabata (2003), and Moav (2005).

[3]Although few studies have depicted the relationship between the donor's aid policy and growth path in economic development, a study by Dalgaard (2008) deserves attention. Using the model of Arrow and Kurz (1970), Dalgaard succeeds in showing that the foreign aid policy may cause cyclical growth. While Dalgaard does not consider the allocation of foreign aid in alleviating poverty, our results argue that the aid allocation rule employed by donor countries, thereby the motive of aid provider, causes not only cyclical growth, but also multiple equilibrium in the recipient countries, which has not been mentioned.

[4]For instance, Hansen and Tarp (2001) point out that the aid-growth relationship depends not only on the level of aid, but also on the aid allocation. World Bank (1998) argues that the decision on aid allocation would have a greater impact on poverty reduction if it were targeted the poorest countries.

go to school. This approach enables us to examine how the allocation rule determined by the donor affects the economic development in the recipient countries.

Employing various styles of foreign aid modeling, this paper presents a neoclassical growth model with aid allocation policy to argue that the persistent differences among developing countries are created by the donor's choice on the benchmark level and the aid allocation. This bifurcation can be observed even among countries with the same technology, preferences, and market structure.

The rest of this paper is organized as follows. Section 2 presents the model. Section 3 examines the growth paths and steady states. Section 4 discusses the validity of the main results by assuming alternative forms of foreign aid. Finally, Section 5 concludes the paper.

2 Model

We employ a three-periods-overlapping-generations model in a small open economy. In our analysis, there exist individuals who live for three-periods and a recipient government that receives support from the developed countries until it reaches a certain level of development. The subscript $t(= 1, 2, \cdots)$ denotes the time.

2.1 Individuals

All individuals live for three periods and are endowed with one unit of time in both the first and second periods of their life. In the first period (childhood), they spend their time not only in schooling to acquire human capital, but also by working as child laborers. In the second period (parenthood), they work, plan their family, and rear children. Finally, they retire in the third period.

Individuals are considered to inherit the human capital of their parents. Further, they attend school to acquire human capital. The function of human capital accumulation is given as

$$h_t = e_{t-1}^{\alpha} E_{t-1}^{\eta} h_{t-1}^{\gamma}. \tag{1}$$

It is assumed that the human capital of the individual born at time $t-1$ depends on the schooling time, e_{t-1}, quality of public education, E_{t-1}, and human capital of their parent, h_{t-1}. Note that human capital is accumulated both by the schooling time and public expenditure for education, both of which are considered to be complementary. The lifetime utility of the individual of generation t, born in period $t-1$, is assumed to be log-linear, and is given by the form

$$U_t = (1-\beta)\ln c_{t+1} + \beta \ln n_t h_{t+1}, \tag{2}$$

where β is the preference parameter for children. The utility of the individuals of generation t depends on the consumption in the third period, c_{t+1}, the number of children they rear, n_t, and the level of human capital of their children, h_{t+1}.

In the second period of life, as parents, individuals decide how to allocate the endowed time of unit one to their children between schooling and working as child laborers. Assuming that the working ability of children is inferior to that of parents ($0 < \theta < 1$), the provision of efficient labor by a child is expressed as $(1-e_t)\theta h_t$, where $1-e_t$ and θ represents the time devoted to working and the working ability of the child respectively[5]. Moreover, parents decide their own time allocation of unit one between working and child-rearing. We denote the rearing time per child as z; then, the time devoted to rearing n_t children is zn_t, while that devoted to working is $1-zn_t$. Since we assume that individuals consume only in the third period of their life, they save all of their income in the second period. Thus, the budget constraints of the individuals born at $t-1$ are given as

[5]Hazan and Berdugo (2002) and Chakraborty and Das (2005) also assume that the productivity of child labor is relatively low.

$$s_t = n_t(1-e_t)\theta h_t + (1-zn_t)h_t(1-\tau) + R_t, \quad (3)$$

$$c_{t+1} = s_t(1+\bar{r}), \quad (4)$$

where s_t is the saving, τ is the income tax rate, and $\bar{r}$ is the world interest rate. The right-hand side of (3) is the income in the second period of their life; this comprises the income from child labor after considering the taxed adult's labor income and cash transfer, R_t. The wage per unit of human capital is normalized to one because we implicitly assume that the production function is linear in human capital.

2.2 Government

The government in the recipient country provides both public education and cash transfer to its citizens. It is financed by income tax revenue and foreign aid. The government receives foreign aid, F_t, from the foreign country until the recipient country reaches a certain level of development. The benchmark level is exogenous for the recipient country and, in any case, is determined by the donor who in turn refers to criteria such as the world standard level. We begin by describing the formula for foreign aid in its simplest form, deferring the discussion of various extensions. The form of foreign aid is assumed to be a type of a matching grant aimed at stimulating human capital development, as shown below:

$$F_t = f(h_t)h_t,$$

where

$$f(h_t) = \begin{cases} f > 0, & \text{if } \ h_t < \bar{h} \\ 0, & \text{if } \ h_t \geq \bar{h}. \end{cases} \quad (5)$$

This equation shows that the foreign aid received by the country depends on its level of human capital. When the level of human capital in the recipient

country is relatively low, i.e., less than a benchmark level, $\bar{h}_t$, foreign aid will be provided. Since human capital accumulates with time, foreign aid will not be provided after the human capital reaches a benchmark level, $\bar{h}_t$[6].

Given the level of foreign aid that it receives, the recipient country at time t allocates foreign aid as a part of the financial source for public education, E_t, and cash transfer to the residents, R_t. In addition, the revenue from income tax is also allocated for public education and cash transfer. That is, since public education and cash transfer are co-financed both by domestic income tax revenue and foreign aid, the government's budget constraints for public education and cash transfer are given by[7]

$$E_t = p\tau(1 - zn_t)h_t + qF_t, \tag{6}$$

$$R_t = (1 - p)\tau(1 - zn_t)h_t + (1 - q)F_t, \tag{7}$$

where p denotes the share of tax revenue allocated to public education, and q is the ear-marked by the donor for the public education.

In the following analysis, we assume that p and q are exogenous to the recipient economy, and that they are fixed at a certain level. The assumption that the foreign aid allocation is exogenous to recipient can be related to the notion of foreign aid ownership and fungibility. The former has been applied to describe the environment in which the donor and/or the recipient has a responsibility for the design of development program [Ole (2001)]. The assumption made in our model suggests that the donor has a full ownership in foreign aid allocation in recipient countries. The full ownership by

[6]Although we cannot denote the in-depth rule of foreign aid in individual countries, the aid policy rule of DAC in OECD is helpful. It creates a list of ODA recipients by categorizing them into four groups based on their income levels. Within the list, if the income level of a certain country consistently exceeds the maximum level for three years, that country graduates from the list. Twenty-five countries had graduated from this list by 2003. See OECD (2009).

[7]A first attempt to introduce co-financing foreign aid transfer is made by Chatterjee et al.(2003). They investigate the link between foreign aid, growth and welfare using an endogenous growth model with public capital accumulation. Moreover, in the same setting, Chatterjee and Turnovsky (2006) examine the recipient government's intertemporal fiscal balance introducing endogenous labor supply.

donor would be partly justified by applying the argument of Hjertholm and White (2001), which suggests that, as the donors have a comparative advantage in allocating resources efficiently, they tend to dominate the foreign aid programs in developing countries, so that they are reluctant to allow the recipients more than a limited role.

The assumption is also based on the condition that the foreign aid is not fungible. As Healey and Klillick (2001) pointed out, if the aid resources are fungible, donors can do little without domestic ownership[8].

2.3 Optimization

The problem faced by adult individuals at time t is to choose consumption, c_{t+1}, number of children, n_t, and the children's schooling time, e_t, such that their lifetime utility is maximized. From (1)-(4), the first-order conditions for the individuals are derived as

$$c_{t+1} \quad : \quad \frac{1-\beta}{c_{t+1}} = \frac{\mu_t}{1+\bar{r}}, \tag{8}$$

$$n_t \quad : \quad \frac{\beta}{n_t} = \mu_t[zh_t(1-\tau) - (1-e_t)\theta h_t], \tag{9}$$

$$e_t \quad : \quad \frac{\alpha\beta}{e_t} = \mu_t \theta n_t h_t, \tag{10}$$

where μ_t is the Lagrange multiplier. Equation (9) means that the marginal utility of having an additional child is equal to the net marginal cost of children, which is the cost of rearing a child minus the child labor income. Equation (10) shows that the marginal utility of schooling is equal to the marginal cost, which is the marginal return on child labor.

From (8)–(10), we can represent the demand functions of n_t and e_t as

[8]See Pack and Pack (1993), Feyzioglu et al. (1998), Chatterjee et al.(2007) and Kitaura(2009) for the fungibility problem. See also McGillivray and Morrissey (2001) which reviews the studies focusing on the fungibility problem.

$$n_t = \frac{\beta(1-\alpha)[(1-\tau)h_t + R_t]}{[z(1-\tau)-\theta]h_t}, \tag{11}$$

$$e_t = \frac{\alpha[z(1-\tau)-\theta]}{\theta(1-\alpha)}. \tag{12}$$

Since the schooling time of the child cannot be negative, we assume here that $z(1-\tau) > \theta$, where the working ability of the child as compared to an adult is sufficiently small. Since (7) holds, (11) can be rewritten as

$$n^* = \frac{\beta(1-\alpha)[(1-\tau) + f(1-q) + \tau(1-p)]}{z(1-\tau) + \beta\tau z(1-\alpha)(1-p) - \theta}. \tag{13}$$

Using (6) and (13), the expenditure for public education can be derived as

$$E_t = \left[p\tau\left(1 - \frac{z\beta(1-\alpha)[(1-\tau) + f(1-q) + \tau(1-p)]}{z(1-\tau) + \beta\tau z(1-\alpha)(1-p) - \theta}\right) + fq\right] h_t. \tag{14}$$

Substituting (12) and (14) into (1), the human capital accumulation can be derived as

$$h_{t+1} = A^{\alpha}(Bf + C)^{\eta} h_t^{\eta+\gamma}, \tag{15}$$

where

$$A \equiv \frac{\alpha(1-\tau-\Theta)}{\Theta(1-\alpha)}, \tag{16}$$

$$B \equiv \frac{q(1-\tau-\Theta) + \beta\tau(1-\alpha)(q-p)}{1-\tau-\Theta+\beta\tau(1-\alpha)(1-p)}, \tag{17}$$

$$C \equiv \frac{p\tau[1-\tau-\Theta-\beta(1-\tau)(1-\alpha)]}{1-\tau-\Theta+\beta\tau(1-\alpha)(1-p)}, \tag{18}$$

and $\Theta = \theta z^{-1}$. The form of (15) depends on the sign of A, B, and C. Owing to the assumption that the schooling time of child is positive, $1-\tau-\Theta > 0$, the sign of A is positive. It implies that the denominators of B and C are

positive. However, the signs of B and C cannot be determined because the sign of the numerators in B and C are ambiguous. Since $h_{t+1} = h_t$ in the steady-state, the steady-state level of human capital, $\hat{h}^*$, is derived from (15) as[9]

$$\hat{h}^* = A^{\frac{\alpha}{1-\eta-\gamma}}(Bf + C)^{\frac{\eta}{1-\eta-\gamma}}. \tag{19}$$

3 Analysis

3.1 Preliminary Consideration

In this section, we analyze how the benchmark level of human capital affects the bifurcation of economic development. For our analysis, we will specify the form of (15), and assume that the sign of C is positive. Since the sign of the denominator in C is always positive, assuming that $C > 0$ is equivalent to assuming that the sign of the numerator in C is positive; that is,

$$1 - \tau - \Theta > \beta(1 - \tau)(1 - \alpha). \tag{20}$$

Moreover, the form of human capital accumulation depends on the sign of B. To determine this sign, let us denote the numerator of B as B_n,

$$B_n \equiv q(1 - \tau - \Theta) + \beta\tau(1 - \alpha)(q - p). \tag{21}$$

(21) can be modified to $1 - \tau - \Theta = (B_n - \beta\tau(1 - \alpha)(q - p))/q$, and by combining with (20), we have

$$B_n > q\beta(1 - \tau)(1 - \alpha) + \beta\tau(1 - \alpha)(q - p) = \beta(1 - \alpha)(q - \tau p). \tag{22}$$

(22) implies that B_n is always greater than $\beta(1 - \alpha)(q - \tau p)$, and the sign of B_n, which is crucial for determining the sign of B, can be either positive or

[9]This is stable equilibrium because $0 < (\partial h_{t+1}/\partial h_t)|_{h_t=\hat{h}^*} = \eta + \gamma < 1$.

negative depending on the relative level of q and τp. When $q \geq \tau p$, i.e., in the case where the share of income tax revenue allocated for public education is relatively large, B_n is always positive. However, when $q < \tau p$, it does not exclude the possibility of B_n, and therefore B, from being negative[10]. This occurs when q is so small that it does not exceed τp.

The sign of B is crucial for our analysis in order to determine the benchmark level of foreign aid. We will show that in the case of $B < 0$, the donor must set the benchmark level $\bar{h}$ effectively; otherwise, multiple steady-state equilibria may emerge. Specifically, our analysis in subsection 3.2 focuses on the case of $B < 0$, where multiple equilibria are observed. In contrast, if q is larger than τp, such that it satisfies $B > 0$, a dynamic property arises wherein human capital always converges to a unique steady-state equilibrium in the country, irrespective of how high or low the benchmark level $\bar{h}$ is. In addition, an alternative property of dynamics arises wherein the country experiences cyclical growth.

In the following analysis, note that

$$\begin{aligned} \frac{\partial h_{t+1}}{\partial h_t} &= \frac{(\eta+\gamma)A^{\alpha}(Bf+C)^{\eta}}{h_t^{1-\eta-\gamma}} > 0, \\ \frac{\partial^2 h_{t+1}}{\partial h_t^2} &= -\frac{(1-\eta-\gamma)(\eta+\gamma)A^{\alpha}(Bf+C)^{\eta}}{h_t^{2-\eta-\gamma}} < 0 \end{aligned}$$

for both $B < 0$ and $B > 0$. Further, note that when the human capital of the recipient country reaches the benchmark level $\bar{h}$, $f(h)$ equals zero. This means that the recipient country will no longer receive any foreign aid, and therefore, (15) will become

$$h_{t+1} = A^{\alpha}(C)^{\eta} h_t^{\eta+\gamma}, \tag{23}$$

[10]The share of income tax revenue devoted to public education does not necessarily have to be zero for B to be negative. The discussion in the case of $B < 0$ still holds; at least q is small enough not to exceed τp. This is likely to hold when the foreign aid is mainly spent on cash transfer rather than on public education, and the income tax revenue is mainly spent on public education rather than on cash transfer.

where public education is financed solely by the income tax revenue generated within the country. Denoting the steady-state level of human capital when $f(h) = 0$ as $\tilde{h}^*$, we have $\tilde{h}^* = A^{\frac{\alpha}{1-\eta-\gamma}} C^{\frac{\eta}{1-\eta-\gamma}}$.

3.2 Case $B < 0$ $(q < \tau p)$

When $B < 0$ $(q < \tau p)$, the accumulation of human capital according to (23) is faster than that of (15) because $Bf + C < C$. Furthermore, it is clear that $\hat{h}^* < \tilde{h}^*$; this means that when $f > 0$, the steady state level of human capital is smaller than that when $f = 0$. The intuition of this result is as follows. An increase in the share of cash transfers raises fertility rate and decreases the labor supply, since the rearing time per child is constant. This would reduce the human capital in the recipient country. That is, the level of human capital decreases with the provision of foreign aid. This is the point suggested by Dalgaard (2008), which shows that, as the transfer is made in cash, the donor will be faced with the Samaritan's dilemma; An increase in the cash transfer reduces the human capital investment, and that it induces the recipient economy to fall into poverty trap.

Since the human capital accumulation is faster when accumulation occurs according to (23), and the steady state level of human capital ($\tilde{h}^*$) is greater than $\hat{h}^*$, we can depict both functions as shown in Figure 1.

Figures 1-a and 1-c depict the case when human capital converges to a unique equilibrium. In contrast, Figure 1-b shows the case when multiple equilibria emerge. In Figure 1-a, we show the case $\hat{h}^* < \tilde{h}^* < \bar{h}$, where the benchmark level of human capital is set substantially high. In this case, human capital converges to a steady state level $\hat{h}^*$ regardless of the initial human capital h_0. Figure 1-b shows the case when the benchmark level $\bar{h}$ is set between the steady state levels of both $f > 0$ and $f = 0$, i.e., $\hat{h}^* < \bar{h} < \tilde{h}^*$. In this case, there exists a possibility of multiple equilibria wherein the initial level of human capital plays a crucial role. If an economy has a relatively low level of initial human capital, i.e., $h_0 < \bar{h}$, it will converge to a low level of human capital, $\hat{h}^*$. On the other hand, in an economy wherein the initial level of human capital is relatively high, human capital will converge to $\tilde{h}^*$.

Therefore, in this case, developing countries, which are usually considered to have a relatively low level of initial human capital, tend to converge to a low steady state. Figure 1-c displays the third case, where the benchmark level of human capital is substantially low, i.e., $\bar{h} < \hat{h}^* < \tilde{h}^*$. When benchmark level of human capital is set at a relatively low level, human capital will converge to $h^* = \tilde{h}^*$, irrespective of the level of initial human capital.

3.3 Case $B > 0$ $(q > \tau p)$

When $B > 0$ $(q > \tau p)$, we have three different cases; one of these involves the possibility that human capital does not converge to a steady state. Note that when $B > 0$, the speed of human capital accumulation according to (15) is faster than that of (23), and $\hat{h}^* > \tilde{h}^*$. Figure 2 shows the case where human capital convergence does not occur and the steady state cannot be achieved[11]. This can be achieved when the benchmark level, $\bar{h}$, is set between $\tilde{h}^*$ and $\hat{h}^*$. The intuition behind the result is as follows. If the level of human capital in the recipient country is smaller than the benchmark level, the government of the recipient country will receive foreign aid. When $q > \tau p$, the government will then use it to provide public education. An increase in the ear-marked aid for the public education affects human capital in the following two ways. First, an increase in q drops the fertility rate, n_t (see (13)), and increases the labor supply, $1 - zn_t$. Second, a higher q leads to improve the quality of public education (see (14)). Thus, the level of human capital will increase with the provision of foreign aid. When the level of human capital exceeds the benchmark level, the donor country's government ceases to provide foreign aid. As a result, educational expenditure by the recipient may reduce, and

[11]In the case that $\hat{h}^* > \tilde{h}^*$, high steady state equilibrium is possible. This can happen when the benchmark level, $\bar{h}$, is set at a relatively high level, $\bar{h} > \hat{h}^*$. Human capital converges to $\hat{h}^*$ regardless of its initial level. In another case, the benchmark level of human capital is set at a relatively low level, $\bar{h} < \tilde{h}^*$. Here, human capital converges to a unique steady state, $\tilde{h}^*$, regardless of its initial level. Although both cases converge to a unique steady state equilibrium, the equilibrium for the latter is lower than that for the former. Therefore, when the economy is in a situation such that $B > 0$, it is preferable to set a relatively high benchmark level of human capital in order to achieve a higher steady state equilibrium.

therefore, the level of human capital will become lower than the benchmark level. Thus, the recipient country will again receive foreign aid, leading to cyclical growth.

We summarize our main results focusing on multiple equilibria and cyclical growth as follows.

Proposition. *When $\hat{h^*} < \bar{h} < \tilde{h^*}$, multiple equilibria emerge if $q < \tau p$; otherwise, the economy experiences cyclical growth.*

4 Remarks on the alternative form of foreign aid

In the previous section, we discussed the effects of foreign aid on the basis of a model wherein the level of foreign aid is determined according to the level of human capital in the recipient country. Here, we analyze and employ an alternative form of foreign aid that depends on the income level of adults in the recipient country.

Let us assume that foreign aid takes the form $F_t = f(1-zn_t)h_t$, where (5) holds. Then, the budget constraints for public education and cash transfer are given as

$$E_t = p\tau(1-zn_t)h_t + qf(1-zn_t)h_t, \tag{24}$$

$$R_t = (1-zn_t)h_t[(1-p)\tau + (1-q)f]. \tag{25}$$

Since individuals' decisions are made according to the policy variables E_t and R_t, the demand functions for n_t and e_t are determined in the same manner as in (11) and (12). From (11) and (25), we have

$$n^{**} = \frac{\beta(1-\alpha)[1-\tau+(1-p)\tau+(1-q)f]}{z(1-\tau)+\beta z(1-\alpha)[(1-p)\tau+(1-q)f]-\theta}. \tag{26}$$

Substituting (26) into (24), we get the expenditure for public education as

$$E_t = \frac{(1-\tau)[1-\beta(1-\alpha)]-\Theta}{(1-\tau)+\beta(1-\alpha)[(1-p)\tau+(1-q)f]-\Theta} h_t(p\tau+fq), \qquad (27)$$

Then, from (12) and (27), the human capital accumulation can be derived as $h_{t+1} = e_t^{\alpha} E_t^{\eta} h_t^{\gamma} = A^{\alpha} D^{\eta} h_t^{\eta+\gamma}$, where A is given as (16) and

$$D = \frac{(1-\tau)[1-\beta(1-\alpha)]-\Theta}{(1-\tau)+\beta(1-\alpha)[(1-p)\tau+(1-q)f]-\Theta}(p\tau+fq). \qquad (28)$$

Note that f has no impact on A, while D is a function of f. This means that to clarify the effect of f on the form of human capital accumulation, we need to derive $\partial D/\partial f$ using (28). This can be derived as

$$\frac{\partial D}{\partial f} = \frac{[(1-\tau)[1-\beta(1-\alpha)]-\Theta][q(1-\tau-\Theta)+\beta\tau(1-\alpha)(q-p)]}{[(1-\tau)+\beta(1-\alpha)[(1-p)\tau+(1-q)f]-\Theta]^2}. \qquad (29)$$

From the assumption that $e_t > 0$, the sign of the denominator in (29) is always positive. Moreover, when we assume that $C > 0$, we have $1-\tau-\Theta-\beta(1-\tau)(1-\alpha) > 0$, and hence, the sign of the first square bracket in the numerator is positive. Thus, the sign of (29) depends on the sign of $q(1-\tau-\Theta)+\beta\tau(1-\alpha)(q-p)$. This means that the sign of D is determined according to the relative magnitudes of q and p; this is essentially the same argument as that discussed in the previous section.

5 Conclusion

In this paper, we have formulated a neoclassical growth model comprising education, child labor, and cash transfer, with a focus on developing and aid-receiving countries. While numerous preceding studies have explained the bifurcation in terms of internal affairs, the main argument of this paper is that the aid allocation policy employed by donor countries, thereby the motive of aid providers, leads to divaricated and cyclical growth in economic development.

This analysis is important for several reasons. First, empirical researchers may wish to test how the changes in the critical income level of aid policy affect the growth paths in developing countries. This paper offers a simple but basic model to associate the donor's policy on critical income level with economic development. Second, researchers in applied work require additional reasons for explaining the various growth paths that we observe in economic development. The present work is also useful because it formally incorporates critical factors in developing countries, e.g., fertility, cash transfer, and children's labor-education trade-off. This enables us to examine the impact of internal policies related to these factors on the growth path of economic development.

Furthermore, since our main interest is to present a simple model showing that the foreign aid policy employed by donor countries causes divaricated and cyclical growth in economic development, we simply assume that the government policies are fixed; The current model consider neither the objectives nor strategic behaviors of the donor country, although Alesina and Dollar (2000) among others shows considerable evidence supporting that the pattern of aid is dictated by the political and strategic considerations of the donor. The extension of the present model, which is left for future investigation, to the one that considers endogenous policy choices could provide insightful implications on the optimal policies adopted in both the donor and recipient countries.

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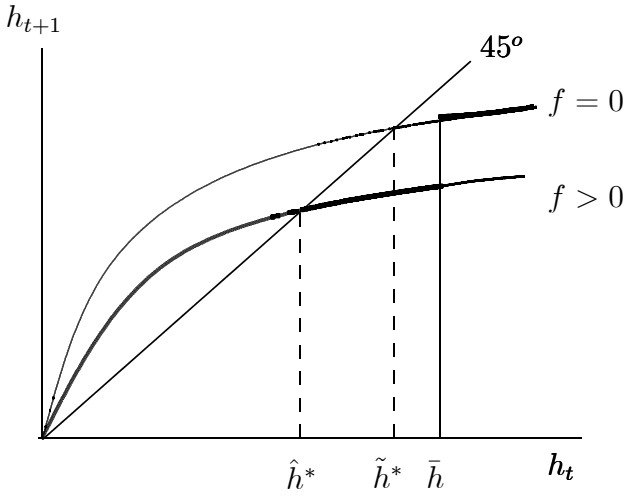
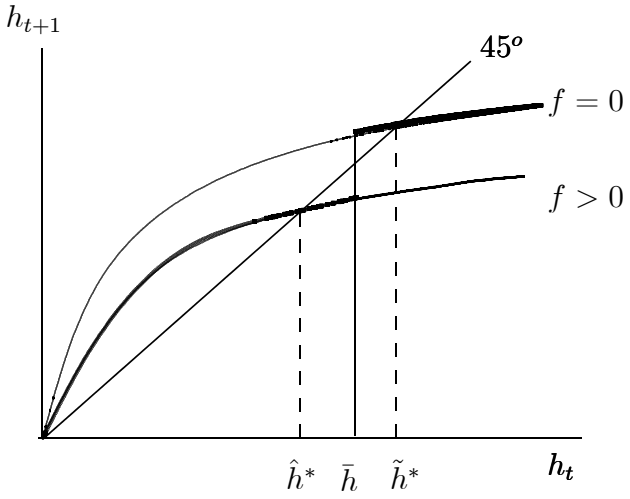


Figure 1-a



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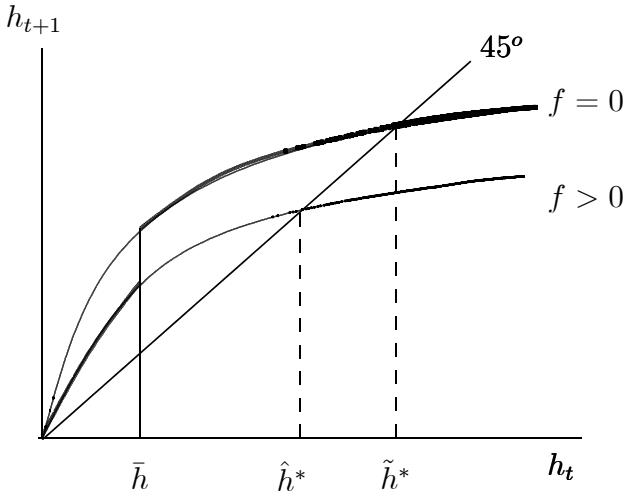

Figure 1-c

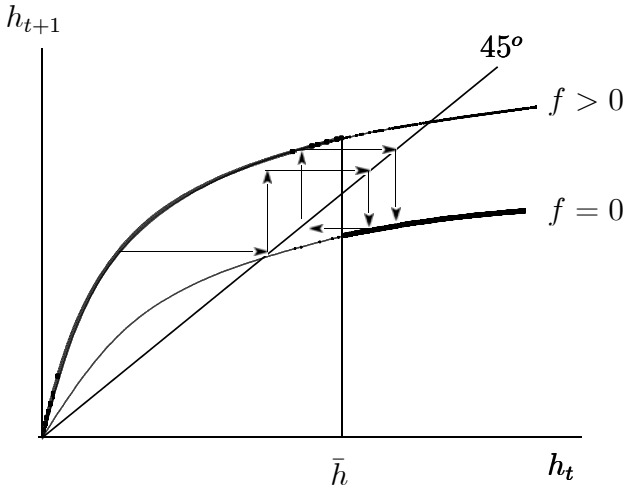

Figure 2