Parental migration, paid child labour, and human capital

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Abstract

Purpose – Households suffering from poverty often rely on parental migration and/or paid child labour for survival. The purpose of this paper is to investigate the effects of parental migration on paid child labour and human capital formation in a dynamic context, explicitly taking the effects of parental migration on child's school and home education into account.
Design/methodology/approach – The author utilises a mathematical method. In particular, an overlapping-generations model is built, with agents who have a two-period life. The amount of paid child labour is determined as a solution of the utility maximisation problem.
Findings – Contrary to intuition, parental migration possibilities do not necessarily reduce paid child labour. In addition, parental migration possibilities do not necessarily raise human capital. Moreover, a trade-off might exist between alleviating paid child labour and raising human capital under parental migration possibilities.
Research limitations/implications – Migration possibilities are given exogenously evenly among potential migrants by the foreign country. However, in general, they depend on potential migrants' human capital so that migration possibilities differ across agents.
Practical implications – Migration is usually considered effective in alleviating poverty. However, since it does not necessarily reduce paid child labour and raise human capital, migration should be regulated in some cases as a means to escape from poverty.
Originality/value – This paper deals with parental migration and paid child labour in an identical dynamic model. This paper assumes that human capital is built not only by school education but also home education, the amount of which changes with the duration of parental migration.

Keywords Human capital, Poverty, Home education, Paid child labour, Parental migration, School education

Paper type Research paper

1. Introduction

This paper examines paid child labour and parental migration in an identical dynamic model and attempts to clarify whether or not parental migration is effective in alleviating paid child labour and raising human capital.

Previous studies have treated paid child labour and parental migration separately as poverty reduction measures. In addition, home education has received less attention as a factor to build human capital under parental migration. Accordingly, this paper seeks to fill these gaps by examining the efficacy of paid child labour and parental migration in reducing poverty while also considering the impact of both these processes on the formation of human capital via the level of home education.

The author finds that possibilities for parental migration do not necessarily reduce paid child labour. On the contrary, it is possible that they aggravate paid child labour, suggesting that parental emigration should be regulated in some cases to alleviate paid child labour. The author also finds that parental migration possibilities do not necessarily enhance human capital formation. Moreover, it is found that a trade-off might exist between paid child labour alleviation and human capital formation in the presence of opportunities for parental migration.

JEL Classification — D10, J22, J24, J61, O15

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2. Review of literature

Poverty is the most serious problem facing many households in developing countries. Household survival often depends on children being sent to undertake work in the labour market. Paid child labour raises the household's present income. However, this practice has a negative effect in the long run as child labour in general hinders human capital formation by reducing the amount of time that children are able to go to school, making it difficult for these children to escape poverty. Accordingly, it is often argued that paid child labour must be abolished from both economic and non-economic perspectives. However, in actuality, it cannot be so easily eliminated or even reduced. Edmonds (2008) provided an overview of a recent economic literature on why and how children work and its consequences. In particular, he surveyed child labour problems and introduced studies which found the link between poverty and paid child labour. Emerson and Souza (2011) explored whether working as a child labourer is harmful to individual's adult earnings and found that paid child labour is associated with lower adult earnings partly because of the inability of child labourer to attain a high level of education. Webbink *et al.* (2015) drew attention to the number of hours a child engaged in paid labour and found that poverty and other household-level factors mainly affect the variation in the hours of paid child labour. Emerson and Souza (2003) examined whether there is the intergenerational persistence of paid child labour empirically and found that children are more likely to be child labourers if their parents are and less likely to be paid child labourers if their parents are well educated, suggesting that paid child labour might produce the chain of poverty over generations. After surveying theoretical models for the analyses of child labour, Basu (1999) examined effectiveness of policies to reduce child labour and found that their effectiveness cannot be determined a priori. Basu (2005, 2006) investigated whether paid child labour can be alleviated by punishment and showed that contrary to intuitions, imposing fines on firms employing child can actually increase paid child labour. Sen (2013) referred to the consequence of the abolition of child labour when he presented four concepts that are essential to the achievement of "decent work". He stated that it is not clear why it must be presumed that the abolition of child labour will lead to a reduction of household income and further negligence of children, without any other economic or social or educational adjustment when explaining a broad and inclusive approach which is included in four concepts.

Migration offers another way to overcome poverty. Many studies found an association between poverty and migration. Waddington and Sabates-Wheeler (2003) investigated poverty and vulnerability as determinants of migration and concluded that poverty and vulnerability provide incentives to migrate although they might also have opposite effects, i.e. extreme poverty might reduce migration possibilities. Naudé (2008) sought the reasons for migration in Sub-Saharan Africa and found that lack of job opportunities as well as armed conflicts is the main reasons. de Haan and Yaqub (2009) studied the links between poverty and migration and argued that linkages between migration and poverty should be investigated based on the knowledge about poverty itself.

Under parental migration, a parent moves to a foreign country to find a job and earn higher wages than in the home country. In this scenario, the child is left behind in the home country. As a result, the child cannot receive sufficient parental care.

Although studies on human capital formation usually focus on school education, Glomm and Kaganovich (2003) and Casarico and Sommacal (2012) included parental care of the child, i.e. home education as a factor of human capital formation. Glomm and Kaganovich (2003), by including both school and home education as a factor of human capital formation, studied how the allocation of government expenditures between education and pay-as-you-go social security affects human capital distribution and showed that increased spending on public education may lead to higher inequality, and Casarico and Sommacal (2012), also by including both school and home education as a factor of human capital formation, examined the effects of labour income taxation on growth and showed

that parental care in the process of skill formation plays an important role in determining the long-term effects of taxation on growth. Bell and Gersbach (2009) included child rearing as a factor of human capital formation. They analysed policies by which an illiterate and less productive society can raise itself into a condition of literacy and continuous growth and showed that an escape from the initial state is possible by various second-best programmes of redistributive taxes and income support even without outside aid.

Under parental migration, it can be inferred that parental absence reduces time for parental care and human capital formation is negatively affected. This was actually confirmed by Jingzhong and Lu (2011). In particular, they investigated the impacts of rural parents' migration on children left behind in rural communities in China and revealed that parental absence has negative effects on children's human capital formation due to insufficient parental care.

3. Research gap

Previous studies on paid child labour (e.g. Webbink *et al.*, 2015) did not assume parental migration explicitly as another possible measure of poverty reduction. Similarly, those on parental migration (e.g. Jingzhong and Lu, 2011) did not include paid child labour as a way to reduce poverty. In other words, they tended to assume that poverty may motivate a parent to send a child to undertake market work; however, if this is the case, he/she is assumed not to migrate; where a parent is assumed to migrate for the household's subsistence, he/she is likewise assumed not to send his/her child to the market work.

However, in reality, a parent can simultaneously implement both of these measures. It is more realistic to envisage a situation where decisions on paid child labour and parental migration are made in tandem. Accordingly, analyses of these issues should consider them in an identical model.

In such an environment, it can be naturally inferred that if the parent earns a substantial amount of money following migration, then he/she will let his child not provide labour in the market or reduce the number of hours worked. It appears that parental migration might alleviate both poverty and paid child labour and encourage human capital formation. Previous studies have not put a lot of thoughts into such possibilities. Clearly, it is necessary to examine these possibilities by assuming a more general situation.

4. Objectives

To clarify whether or not such inferences are true, the author investigates whether higher parental migration possibilities help reduce paid child labour and encourage human capital formation in a dynamic context by putting paid child labour and parental migration into an identical problem. Unlike previous analyses, the author explicitly introduces home education, in addition to school education as a factor of human capital formation since the amount of home education changes in line with migration duration.

5. Methodology and model

The author utilises a mathematical method to analyse the problem. Similar to Emerson and Souza (2003), Bell and Gersbach (2009) and others, the author derives the results by solving a maximisation problem. This method enables us to abstract matters that are inessential to parental paid child labour and parental migration.

For this purpose, a small open overlapping-generations economy is built, which is treated as the home country. This economy is connected with the rest of the world through emigration of labour. The rest of the world is treated as a foreign country.

The author focusses on a representative household in the home country comprising a parent and a child. Each agent is assumed to live for two periods, childhood and parenthood. As a

child, the agent goes to school and receives parental care, i.e. home education while the parent is at home. In contrast with previous studies such as Vidal (1998) and Docquier *et al.* (2008), here human capital formation is associated with not only school education but also home education.

Utilising human capital accumulated through these two education types in childhood, an agent provides labour during parenthood in the home country or the foreign country. As the parent is altruistic towards the child, he/she derives utility not only from the present period's consumption available to him and his child but also from the next period's consumption available to his child and grandchild. Although the parent shares present consumption with the child, this is not because he/she is altruistic towards the child but to satisfy the child's survival needs.

The home country is implicitly considered a developing country, and wages in that country are not sufficient for the household's subsistence. In particular, the wages that the parent earns by providing labour in the home country throughout the period are smaller than the household's subsistence consumption in that period, denoted as s_t.

To survive, a household has two options. The first is for the child to undertake market work, wherein the child can be employed in the home country's labour market. However, the child's wages are of course lower than those received by the parent. Moreover, if the child provides labour, time otherwise available for school education is allocated to work instead. This reduces the amount of school education the child receives, with resulting negative effects on human capital formation. School education is provided only by the government, financed by tax.

A second option is parental migration. Since wages for adult labourers are higher in the foreign country than in the home country, migration for all or part of the period enables the parent to earn a higher income. Although parental migration brings pecuniary benefits to the household, it produces negative effects regarding the child's human capital formation by reducing the amount of home education received.

Wages per efficiency unit of the parent's labour in the home country are denoted by w_p. Human capital measured by efficiency units of the parent's labour in period t is denoted by h_t, and wages in the home country in period t are $w_p h_t$. Parental wages in the foreign country are $\alpha^* w_p h_t$. Since, as previously mentioned, the foreign country is a developed economy with abundant physical capital, wages per efficiency unit are higher than those in the home country, i.e. $\alpha^* > 1$. The parent migrates to the foreign country in period t with probabilities equal to or less than $0 \leqslant l^*_{p_t} \leqslant 1$, which is exogenous and independent of parental human capital. Adult and child labour are substitutes; this is one of two axioms postulated by Basu and Van (1998, p. 416). The author follows their assumption that the child is less productive than the parent. In particular, one unit of child labour is equivalent to $\alpha_c < 1$ of one adult labour. The child receives $\alpha_c w_p h_t$ for providing labour throughout the period.

Given the parental migration possibilities and by sending the child to work by $0 \leqslant l_{c_t} \leqslant 1$, the household expects to earn:

$$\left(1-l^*_{p_t}\right) w_p h_t + l^*_{p_t} \alpha^* w_p h_t + l_{c_t} \alpha_c w_p h_t$$

in period t. For the household to survive, its total earnings after tax must equal or exceed the household's subsistence consumption. This paper assumes that they spend all of their net income on consumption.

The level of subsistence consumption increases over time with human capital, i.e. $s_t = \bar{s}' h_t$ due to the fact that subsistence consumption includes not only food but also non-biological necessities that increase with human capital. Under this consideration, household subsistence is determined by:

$$(1-\tau)\left(1-l^*_{p_t} + l^*_{p_t}\alpha^* + l_{c_t}\alpha_c\right) w_p h_t \geqslant \bar{s}' h_t \tag{1a}$$

where $1 > \tau > 0$ is the exogenous tax rate, which does not change throughout the analysis. Denoting $\bar{s}'/(1-\tau)$ by $\bar{s}$, Equation (1a) can be rewritten as:

$$l_{c_t} \geqslant -\frac{\alpha^*-1}{\alpha_c} l^*_{p_t} + \frac{1}{\alpha_c}\frac{\bar{s}-w_p}{w_p}. \tag{1b}$$

Since, as mentioned previously, the household cannot survive if the child does not work and the parent does not migrate, $(1-\tau)w_p h_t < \bar{s}' h_t$, i.e. $\bar{s}-w_p > 0$.

The author assumes that parental migration and paid child labour are effective in alleviating household poverty in the following two senses. The household can survive without paid child labour if the parent is absolutely able to provide labour in the foreign country:

$$\bar{s} h_t \leqslant \alpha^* h_t w_p. \tag{2}$$

Conversely, if the child works throughout the period, the household can survive without parental migration:

$$\bar{s} h_t \leqslant h_t w_p + \alpha_c h_t w_p. \tag{3}$$

Under conditions described by Equations (1b), (2) and (3), the child provides labour in the coloured area in Figure 1 for each parental migration possibility. The vertical intercept is $l^*_{p_t} = \{1/(\alpha^*-1)\}\{(\bar{s}-w_p)/w_p\} \leqslant 1$ by Equation (2), and the horizontal intercept is $l_{c_t} = (\bar{s}-w_p)/\alpha_c w_p \leqslant 1$ by Equation (3).

Constraints on child labour can be summarised as follows[1]:

$$0 \leqslant l_{c_t} \leqslant 1 \text{ for } 1 \geqslant l^*_{p_t} > \frac{1}{\alpha^*-1}\frac{\bar{s}-w_p}{w_p},$$

$$-\frac{\alpha^*-1}{\alpha_c} l^*_{p_t} + \frac{1}{\alpha_c}\frac{\bar{s}-w_p}{w_p} \leqslant l_{c_t} \leqslant 1 \text{ for } \frac{1}{\alpha^*-1}\frac{\bar{s}-w_p}{w_p} \geqslant l^*_{p_t} \geqslant 0. \tag{4}$$

The minimum amount of child labour necessary to subsist is larger as the parent is less likely to migrate.

To provide labour by l_{c_t}, the child has to give up school education by $g_c l_{c_t}$, where $0 < g_c \leqslant 1$ is a constant that measures the child's access to school education while providing labour. If school education is more accessible, g_c is smaller. For example, if children can

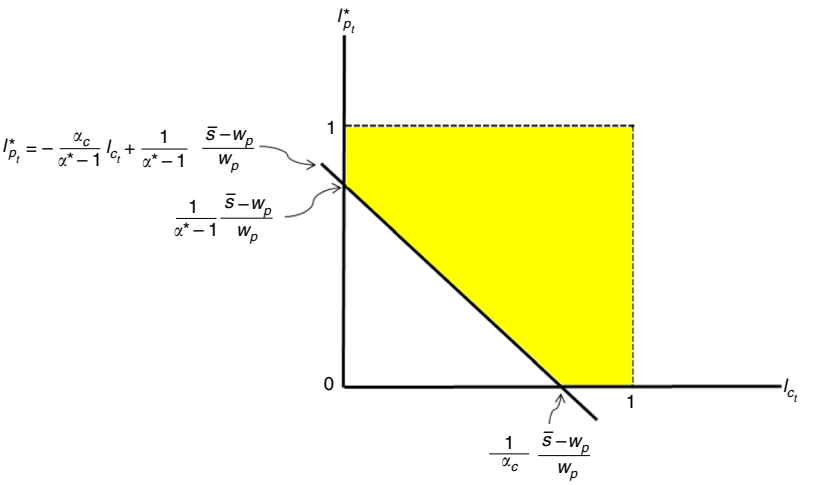

Figure 1.
The constraints on child labour

easily attend classes out of working hours, the amount of school education foregone is smaller for the given amount of child labour. Accordingly, the child receives school education by $1-g_c l_{c_t}$.

Given that the parent is away from home with probability $l^*_{p_t}$, he/she cannot provide the child with parental care with probability $g_p l^*_{p_t}$, where $0 < g_p \leqslant 1$ is a constant that measures the child's access to home education while the parent is away. If home education is more readily available, g_p is smaller. For example, if the parent can correspond with the child easily via the internet during migration, the possible negative effects of parental absence on home education are reduced and the expected amount of home education (parent's probability of staying in the home country multiplied by the amount of home education provided directly plus the parent's probability of migrating to the foreign country multiplied by the amount of home education provided indirectly) $1-g_p l^*_{p_t}$ is larger for the given parental migration probability.

School education and home education are complements to each other as factors of human capital formation in that school education's (home education's) marginal effects on human capital increase with the amount of home education (school education).

Additionally, an intergenerational externality is operative in the sense that part of the present period's human capital is passed on to the next period (Galor and Stark, 1994, Equation (6); Vidal, 1998, Equation (2.1)).

Accordingly, human capital is represented as a function of school and home education during the past periods, with smaller effects in the more distant past. Since in each period, only one generation receives school and home education, the marginal effect of each type of education in period t on human capital in period $t+1$, i.e. $\partial h_{t+1}/\partial(1-g_c l_{c_t})$ $(\partial h_{t+1}/\partial(1-g_p l^*_{p_t}))$ is independent of education in the past periods, i.e. $1-g_c l_{c_{t-i}}$ $(1-g_p l^*_{p_{t-i}})$, $i = 1, 2, 3, \ldots$. For this reason, human capital is expressed as a sum of education in the past periods rather than as a product.

Given these considerations, human capital in period $t+1$ is determined as follows:

$$h_{t+1} = \beta_1 h_t + \beta_2 \left(1-g_c l_{c_t}\right)\left(1-g_p l^*_{p_t}\right),\ 0 < \beta_1 < 1,\ \beta_2 > 0. \tag{5}$$

Using Equation (5), consumption in period t, c_t, is:

$$(1-\tau)\left\{\beta_1 h_{t-1} + \beta_2 \left(1-g_c l_{c_{t-1}}\right)\left(1-g_p l^*_{p_{t-1}}\right)\right\}\left(1-l^*_{p_t} + l^*_{p_t}\alpha^* + l_{c_t}\alpha_c\right)w_p$$

and consumption in period $t+1$, c_{t+1}, is:

$$(1-\tau)\left\{\beta_1 h_t + \beta_2 \left(1-g_c l_{c_t}\right)\left(1-g_p l^*_{p_t}\right)\right\}\left(1-l^*_{p_{t+1}} + l^*_{p_{t+1}}\alpha^* + l_{c_{t+1}}\alpha_c\right)w_p.$$

The parent cares about the child's well-being even after the parent's own death since he/she is altruistic towards the child. Accordingly, consumption in period $t+1$ also raises parental utility. Denoting the parent's degree of altruism towards the child by $0 < \varepsilon < 1$, the parent's utility in period t, u_t, is described by:

$$u_t = (1-\varepsilon)\ln c_t + \varepsilon \ln \rho c_{t+1} \tag{6}$$

where $0 < \rho \leqslant 1$ is the subjective time rate of discount.

Therefore, the parent's maximisation problem is summarised as:

$$\max_{l_{c_t}} u_t \text{ subject to Equation (4)}$$

6. Paid child labour under parental migration possibilities

This section solves the parent's maximisation problem to derive the optimal amount of child labour.

Differentiating Equation (6) with respect to l_{c_t}, the first-order condition of the parent's problem is obtained as follows:

$$h_t+\frac{(1-\varepsilon)\alpha_c-\varepsilon g_c\left(1-l^*_{p_t}+l^*_{p_t}\alpha^*\right)}{(1-\varepsilon)\alpha_c\beta_1}\beta_2\left(1-g_p l^*_{p_t}\right)-\frac{\beta_2}{(1-\varepsilon)\beta_1}\left(1-g_p l^*_{p_t}\right)g_c l_{c_t}\left\{\begin{array}{c}>\\=\\<\end{array}\right\}0. \quad (7)$$

First, the author considers the case where parental migration possibilities are high, i.e. $1\geqslant l^*_{p_t}>\{1/(\alpha^*-1)\}\{(\bar{s}-w_p)/w_p\}$.

If human capital in period t is sufficiently large so that:

$$h_t>-\frac{(1-\varepsilon)\alpha_c-\varepsilon g_c\left(1-l^*_{p_t}+l^*_{p_t}\alpha^*\right)}{(1-\varepsilon)\alpha_c\beta_1}\beta_2\left(1-g_p l^*_{p_t}\right)+\frac{\beta_2}{(1-\varepsilon)\beta_1}\left(1-g_p l^*_{p_t}\right)g_c\left(\equiv\hat{h}_t^{\text{high}}\right),$$

then $\partial u_t/\partial l_{c_t}>0$. Accordingly, the optimal amount of child labour, $l_{c_t,h_t>\hat{h}_t^{\text{high}}}$, is 1.

In contrast, if human capital in period t is sufficiently small so that:

$$h_t<-\frac{(1-\varepsilon)\alpha_c-\varepsilon g_c\left(1-l^*_{p_t}+l^*_{p_t}\alpha^*\right)}{(1-\varepsilon)\alpha_c\beta_1}\beta_2\left(1-g_p l^*_{p_t}\right)\left(\equiv\tilde{h}_t^{\text{high}}\right),$$

then $\partial u_t/\partial l_{c_t}<0$. Accordingly, the optimal amount of child labour, $l_{c_t,h_t<\tilde{h}_t^{\text{high}}}$, is 0.

Between these two cases, i.e. if:

$$\tilde{h}_t^{\text{high}}\leqslant h_t\leqslant\hat{h}_t^{\text{high}},$$

then the optimal amount of child labour, $l_{c_t,\tilde{h}_t^{\text{high}}\leqslant h_t\leqslant\hat{h}_t^{\text{high}}}$, is determined so that Equation (7) holds with equality:

$$l_{c_t,\tilde{h}_t^{\text{high}}\leqslant h_t\leqslant\hat{h}_t^{\text{high}}}=$$

$$\frac{1}{\left\{\beta_2/(1-\varepsilon)\beta_1\right\}\left(1-g_p l^*_{p_t}\right)g_c}\left\{h_t+\frac{(1-\varepsilon)\alpha_c-\varepsilon g_c\left(1-l^*_{p_t}+l^*_{p_t}\alpha^*\right)}{(1-\varepsilon)\alpha_c\beta_1}\beta_2\left(1-g_p l^*_{p_t}\right)\right\}.$$

The optimal amount of child labour for high possibilities of parental migration is summarised as follows:

$$\text{If } h_t>\hat{h}_t^{\text{high}},\ \text{then } l_{c_t}=l_{c_t,h_t>\hat{h}_t^{\text{high}}}.$$

$$\text{If } \tilde{h}_t^{\text{high}}\leqslant h_t\leqslant\hat{h}_t^{\text{high}},\ \text{then } l_{c_t}=l_{c_t,\tilde{h}_t^{\text{high}}\leqslant h_t\leqslant\hat{h}_t^{\text{high}}}.$$

$$\text{If } h_t<\tilde{h}_t^{\text{high}},\ \text{then } l_{c_t}=l_{c_t,h_t<\tilde{h}_t^{\text{high}}}. \quad (8a)$$

Second, the author considers the case where parental migration possibilities are low, i.e. $\{1/(\alpha^*-1)\}\{(\bar{s}-w_p)/w_p\}\geqslant l^*_{p_t}\geqslant 0$.

If human capital in period t is sufficiently large so that:

$$h_t > -\frac{(1-\varepsilon)\alpha_c - \varepsilon g_c\left(1-l^*_{p_t}+l^*_{p_t}\alpha^*\right)}{(1-\varepsilon)\alpha_c\beta_1}\beta_2\left(1-g_p l^*_{p_t}\right)+\frac{\beta_2}{(1-\varepsilon)\beta_1}\left(1-g_p l^*_{p_t}\right)g_c\left(\equiv \hat{h}_t^{\text{low}}\right),$$

then $\partial u_t/\partial l_{c_t} > 0$. Accordingly, the optimal amount of child labour, $l_{c_t,h_t > \hat{h}_t^{\text{low}}}$, is 1.

In contrast, if human capital in period t is sufficiently small so that:

$$h_t < -\frac{(1-\varepsilon)\alpha_c - \varepsilon g_c\left(1-l^*_{p_t}+l^*_{p_t}\alpha^*\right)}{(1-\varepsilon)\alpha_c\beta_1}\beta_2\left(1-g_p l^*_{p_t}\right)$$
$$+\frac{\beta_2}{(1-\varepsilon)\beta_1}\left(1-g_p l^*_{p_t}\right)g_c\left(-\frac{\alpha^*-1}{\alpha_c}l^*_{p_t}+\frac{1}{\alpha_c}\frac{\bar{s}-w_p}{w_p}\right)\left(\equiv \tilde{h}_t^{\text{low}}\right),$$

then $\partial u_t/\partial l_{c_t} < 0$. Accordingly, the optimal amount of child labour is:

$$l_{c_t,h_t < \tilde{h}_t^{\text{low}}} = -\frac{\alpha^*-1}{\alpha_c}l^*_{p_t}+\frac{1}{\alpha_c}\frac{\bar{s}-w_p}{w_p}.$$

Solutions are on the boundary and are negatively associated with migration possibilities.

Between these two cases, i.e. if:

$$\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}},$$

then the optimal amount of child labour, $l_{c_t,\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}}$, is determined to satisfy Equation (7) with equality:

$$l_{c_t,\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}} =$$
$$\frac{1}{\left\{\beta_2/(1-\varepsilon)\beta_1\right\}\left(1-g_p l^*_{p_t}\right)g_c}\left\{h_t+\frac{(1-\varepsilon)\alpha_c-\varepsilon g_c\left(1-l^*_{p_t}+l^*_{p_t}\alpha^*\right)}{(1-\varepsilon)\alpha_c\beta_1}\beta_2\left(1-g_p l^*_{p_t}\right)\right\}.$$

The optimal amount of child labour for low possibilities of parental migration is summarised as follows:

$$\text{If } h_t > \hat{h}_t^{\text{low}}, \text{ then } l_{c_t} = l_{c_t,h_t > \hat{h}_t^{\text{low}}}.$$

$$\text{If } \tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}, \text{ then } l_{c_t} = l_{c_t,\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}}.$$

$$\text{If } h_t < \tilde{h}_t^{\text{low}}, \text{ then } l_{c_t} = l_{c_t,h_t < \tilde{h}_t^{\text{low}}}. \tag{8b}$$

Equations (8a) and (8b) suggest that paid child labour changes with the level of human capital.

7. Effects of parental migration possibilities on paid child labour and human capital

This section first examines the effects of parental migration possibilities on paid child labour and the evolution of human capital, and then examines whether paid child labour can be reduced and human capital simultaneously increased under parental migration possibilities.

7.1 Effects of parental migration possibilities on paid child labour

With higher paid child labour during period t, both consumption and direct utility in that period increase due to a larger household income, whereas the parent's indirect utility in period t shrinks because of the lower amount of human capital available in period t+1.

If human capital is sufficiently large, present consumption increases by a high amount with a given increase of child labour. In such a case, the former positive effect dominates the latter negative effect. Since present gains are larger than future losses, the parent has an incentive to maximise child labour.

Therefore, when human capital is sufficiently large, changes in parental migration possibilities do not have any impact on child labour patterns, regardless of whether parental migration possibilities are high or low ($\partial l_{c_t,h_t > \hat{h}_t^{\text{high}}}/\partial l_{p_t}^{*},\ \partial l_{c_t,h_t > \hat{h}_t^{\text{low}}}/\partial l_{p_t}^{*} = 0$).

This suggests that even if the foreign country would become more likely to accept the home country's workers, child labour would not be alleviated given the sufficiently high amount of human capital.

In contrast, if human capital is sufficiently small, the negative effect of paid child labour on parental utility via smaller human capital in the next period outweighs the positive effect on parental utility via larger consumption in period t.

Accordingly, when human capital is sufficiently small and migration possibilities are high, the child does not have to provide labour, i.e. $l_{c_t,h_t < \tilde{h}_t^{\text{high}}} = 0$. Changes in parental migration possibilities do not affect child labour. Even if the foreign country would become restrictive in accepting migrants and thereby the parent would become less likely to earn higher wages in the foreign country, the child would not have to engage in paid labour.

On the other hand, when human capital is sufficiently small and migration possibilities are low, the child has to provide labour in the amount of $0 < l_{c_t,h_t < \tilde{h}_t^{\text{low}}} < 1$. Changes in parental migration possibilities affect child labour. Migration possibilities may alleviate child labour:

$$\frac{\partial l_{c_t,h_t < \tilde{h}_t^{\text{low}}}}{\partial l_{p_t}^{*}} \lessgtr 0.$$

The results so far suggest that when human capital is either sufficiently large or sufficiently small, parental migration possibilities do not exacerbate child labour.

However, if human capital is neither sufficiently large nor sufficiently small, child labour might increase with parental migration possibilities:

$$\frac{\partial l_{c_t,\tilde{h}_t^{\text{high}} \leqslant h_t \leqslant \hat{h}_t^{\text{high}}}}{\partial l_{p_t}^{*}} \left\{ \begin{matrix} > \\ = \\ < \end{matrix} \right\} 0,\ \frac{\partial l_{c_t,\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}}}{\partial l_{p_t}^{*}} \left\{ \begin{matrix} > \\ = \\ < \end{matrix} \right\} 0.$$

If the child's wages are sufficiently low, i.e. $\alpha_c \cong 0$, then parental migration possibilities reduce child labour ($\partial l_{c_t,\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}}/\partial l_{p_t}^{*} < 0,\ \partial l_{c_t,\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}}/\partial l_{p_t}^{*} < 0$). In other words, when the child earns almost nothing, increases in migration possibilities alleviate child labour.

However, if wages in the foreign country are sufficiently near those in the home country, i.e. $\alpha^{*} \cong 1$, then increases in parental migration possibilities lead to a larger amount of child labour ($\partial l_{c_t,\tilde{h}_t^{\text{high}} \leqslant h_t \leqslant \hat{h}_t^{\text{high}}}/\partial l_{p_t}^{*},\ \partial l_{c_t,\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}}/\partial l_{p_t}^{*} > 0$). Accordingly, possibilities of parental migration aggravate child labour.

To summarise the results regarding the effects of migration possibilities on child labour, when human capital is either sufficiently large or sufficiently small, parental migration possibilities have non-negative effects in reducing child labour. On the other hand, when human capital is neither sufficiently large nor sufficiently small, migration

possibilities have both non-negative and negative effects in reducing child labour. Therefore, it can be concluded that parental migration possibilities do not necessarily alleviate child labour.

7.2 Effects of parental migration possibilities on human capital

Substituting Equation (8a) into Equation (5), the evolution of human capital when parental migration possibilities are high, i.e. $1 \geqslant l_{p_t}^{*} > \{1/(\alpha^{*}-1)\}\{(\bar{s}-w_p)/w_p\}$ can be summarised as follows:

$$\text{If } h_t > \hat{h}_t^{\text{high}}, \text{ then } h_{t+1} = \beta_1 h_t + \beta_2(1-g_c)\left(1-g_p l_{p_t}^{*}\right)\left(\equiv h_{t+1,h_t > \hat{h}_t^{\text{high}}}\right).$$

$$\text{If } \tilde{h}_t^{\text{high}} \leqslant h_t \leqslant \hat{h}_t^{\text{high}},$$

$$\text{then } h_{t+1} = \varepsilon\beta_1 h_t + \frac{\beta_2}{\alpha_c}\varepsilon\left\{\alpha_c + g_c(\alpha^{*}-1)l_{p_t}^{*}\right\}\left(1-g_p l_{p_t}^{*}\right)\left(\equiv h_{t+1,\tilde{h}_t^{\text{high}} \leqslant h_t \leqslant \hat{h}_t^{\text{high}}}\right).$$

$$\text{If } h_t < \tilde{h}_t^{\text{high}}, \text{ then } h_{t+1} = \beta_1 h_t + \beta_2\left(1-g_p l_{p_t}^{*}\right)\left(\equiv h_{t+1,h_t < \tilde{h}_t^{\text{high}}}\right). \tag{9a}$$

Similarly, substituting Equation (8b) into Equation (5), the evolution of human capital when parental migration possibilities are low, i.e. $\{1/(\alpha^{*}-1)\}\{(\bar{s}-w_p)/w_p\} \geqslant l_{p_t}^{*} \geqslant 0$ can be summarised as follows:

$$\text{If } h_t > \hat{h}_t^{\text{low}}, \text{ then } h_{t+1} = \beta_1 h_t + \beta_2(1-g_c)\left(1-g_p l_{p_t}^{*}\right)\left(\equiv h_{t+1,h_t > \hat{h}_t^{\text{low}}}\right).$$

$$\text{If } \tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}},$$

$$\text{then } h_{t+1} = \varepsilon\beta_1 h_t + \frac{\beta_2}{\alpha_c}\varepsilon\left\{\alpha_c + g_c(\alpha^{*}-1)l_{p_t}^{*}\right\}\left(1-g_p l_{p_t}^{*}\right)\left(\equiv h_{t+1,\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}}\right).$$

$$\text{If } h_t < \tilde{h}_t^{\text{low}},$$

$$\text{then } h_{t+1} = \beta_1 h_t + \beta_2\left\{1-g_c\left(-\frac{\alpha^{*}-1}{\alpha_c}l_{p_t}^{*} + \frac{1}{\alpha_c}\frac{\bar{s}-w_p}{w_p}\right)\right\}\left(1-g_p l_{p_t}^{*}\right)\left(\equiv h_{t+1,h_t < \tilde{h}_t^{\text{low}}}\right). \tag{9b}$$

According to Equations (9a) and (9b), when human capital is sufficiently large, migration possibilities shrink human capital ($\partial h_{t+1,h_t > \hat{h}_t^{\text{high}}}/\partial l_{p_t}^{*} = \partial h_{t+1,h_t > \hat{h}_t^{\text{low}}}/\partial l_{p_t}^{*} < 0$). Steady-state equilibrium human capital $h^{*} > \hat{h}_t^{\text{high}} (= \hat{h}_t^{\text{low}})$ such that $h^{*} = \beta_1 h^{*} + \beta_2(1-g_c)(1-g_p l_{p_t}^{*})$ also decreases with migration possibilities ($\partial h^{*}/\partial l_{p_t}^{*} < 0$). Therefore, migration possibilities always hinder human capital formation in both the short and long runs when human capital is sufficiently large.

When human capital is sufficiently small and parental migration possibilities are high, migration possibilities shrink human capital ($\partial h_{t+1,h_t < \tilde{h}_t^{\text{high}}}/\partial l_{p_t}^{*} < 0$). Steady-state equilibrium human capital $h^{*} < \tilde{h}_t^{\text{high}}$ such that $h^{*} = \beta_1 h^{*} + \beta_2(1-g_p l_{p_t}^{*})$ also decreases with parental migration possibilities ($\partial h^{*}/\partial l_{p_t}^{*} < 0$). Therefore, parental migration possibilities always aggravate human capital formation in both the short and long runs when human capital is sufficiently low and migration possibilities are high.

In the above two cases, child labour and therefore school education remain unchanged with migration possibilities, whereas home education decreases with migration possibilities. This is the reason why migration possibilities hinder human capital formation.

However, even when human capital is sufficiently small, the effects of migration possibilities on human capital are not determined in general if migration possibilities are low:

$$\frac{\partial h_{t+1,h_t \leqslant \hat{h}_t^{\text{low}}}}{\partial l_{p_t}^*} \left\{ \begin{array}{c} > \\ = \\ < \end{array} \right\} 0.$$

The effects depend on the values of g_c and g_p.

Moreover, if human capital is neither sufficiently large nor sufficiently small, migration possibilities have positive or negative effects on human capital:

$$\frac{\partial h_{t+1,\tilde{h}_t^{\text{high}} \leqslant h_t \leqslant \hat{h}_t^{\text{high}}}}{\partial l_{p_t}^*} \left\{ \begin{array}{c} > \\ = \\ < \end{array} \right\} 0, \quad \frac{\partial h_{t+1,\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}}}{\partial l_{p_t}^*} \left\{ \begin{array}{c} > \\ = \\ < \end{array} \right\} 0.$$

For example, if child wages are sufficiently low, i.e. $\alpha_c \cong 0$, then migration possibilities increase human capital ($\partial h_{t+1,\tilde{h}_t^{\text{high}} \leqslant h_t \leqslant \hat{h}_t^{\text{high}}} / \partial l_{p_t}^* > 0$, $\partial h_{t+1,\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}} / \partial l_{p_t}^* > 0$). The same results hold for steady-state equilibrium human capital. In this case, the possibility of migration increases school education but decreases home education, and the former effect is dominant.

On the other hand, if wages in the foreign country are sufficiently close to those in the home country, i.e. $\alpha^* \cong 1$, then increased parental migration possibilities decrease human capital ($\partial h_{t+1,\tilde{h}_t^{\text{high}} \leqslant h_t \leqslant \hat{h}_t^{\text{high}}} / \partial l_{p_t}^* < 0$, $\partial h_{t+1,\tilde{h}_t^{\text{low}} \leqslant h_t \leqslant \hat{h}_t^{\text{low}}} / \partial l_{p_t}^* < 0$). The same results hold for steady-state equilibrium human capital. In this case, migration possibilities reduce both school and home education.

In summary, whether parental migration possibilities increase or decrease human capital cannot be determined in general as outcomes vary according to specific combinations of factors. Therefore, it can be concluded that parental migration possibilities do not inherently enhance human capital formation.

7.3 Relationship between the alleviation of paid child labour and the enhancement of human capital

Utilising the results regarding the effects of parental migration on paid child labour and human capital, this subsection examines whether paid child labour can be reduced simultaneous with human capital being increased.

When human capital is sufficiently large or when it is sufficiently small and parental migration possibilities are high, regulation of emigration allows human capital to increase without affecting the amount of child labour. Accordingly, there is no trade-off between reducing paid child labour and increasing human capital in these cases.

However, when human capital is sufficiently small and migration possibilities are low, it is possible that child labour cannot be reduced without hindering human capital formation merely by raising migration possibilities. Accordingly, a trade-off scenario might arise.

When human capital is neither sufficiently large nor sufficiently small, child labour can be reduced and human capital simultaneously increased in the following cases. If the child's wages are sufficiently low, i.e. $\alpha_c \cong 0$, then child labour decreases and

human capital increases when the foreign country relaxes immigration regulations. If wages in the foreign country are sufficiently close to those in the home country, i.e. $\alpha^{*} \cong 1$, then child labour can be alleviated and human capital formation encouraged by regulating emigration. However, these are special cases; it cannot be determined that a trade-off does not exist when human capital is neither sufficiently large nor sufficiently small.

Therefore, it can be concluded that alleviation of paid child labour and enhancement of human capital might exist in a trade-off relationship in general under opportunities for parental migration possibilities.

8. Conclusion

This paper dealt with the problem of paid child labour and human capital formation under the possibilities of parental migration.

Households suffering from poverty often resort to parental migration and/or paid child labour. These measures enable the household to survive but exert negative effects on human capital formation. Previous studies sought to determine these effects of parental migration and paid child labour separately.

In contrast, this paper investigated how paid child labour and human capital formation are affected simultaneously by parental migration possibilities and determined the relationship between these factors by using an identical dynamic model. Since no studies have so far been conducted on the relationship between parental migration and paid child labour as a method of poverty reduction, this paper intended to provide the analytical and theoretical framework for further studies on this issue.

This paper utilised the mathematical method to address the above problem and revealed that parental migration does not necessarily help alleviate paid child labour and raise human capital based on the solution of the maximisation problem that migration possibilities for the parent might increase paid child labour and decrease human capital. This paper also revealed that a trade-off might exist between reducing paid child labour and raising human capital under parental migration possibilities based on the solution that human capital formation might be hindered if paid child labour is to be reduced with increases in migration possibilities[2].

In general, migration is assumed to be effective in alleviating poverty. However, the analysis showed that it is not necessarily effective in reducing paid child labour and enhancing human capital. This suggests that migration should be regulated in some cases.

The analysis can be extended in the following directions. First, individual migrants' migration possibilities can be positively associated with their own human capital. Migration possibilities can be assumed to be unevenly distributed among individual workers in the home country. Second, as discussed by Shimada (2015), it is more general to consider the fact that parental migration reduces the child's school education as well as home education through increases in unpaid child labour. Third, if school education is also provided privately, parental migration may have a positive pecuniary effect on human capital formation.

Notes

1. In the special case where $\{1/(\alpha^{*}-1)\}\{(\bar{s}-w_p)/w_p\} = 1$, there is only one case, i.e. $-\{(\alpha^{*}-1)/\alpha_c\}l^{*}_{p_t} + (1/\alpha_c)\{(\bar{s}-w_p)/w_p\} \leqslant l_{c_t} \leqslant 1$ for $1 \geqslant l^{*}_{p_t} \geqslant 0$.

2. As suggested by the reviewer, the field study might also be effective. However, as mentioned in the text, the author attempted to provide the analytical and theoretical framework that can be extended for further studies. The quantitative analysis is not given here.

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