

Parental Migration, Family Migration, and Human Capital Formation*

Akira Shimada**

I clarify how internal migration affects child's human capital formation via home education, i.e., the parental care of the child as well as school education. If home education is less effective in building human capital, parental migration is preferred and it produces larger human capital. On the other hand, if home education is highly effective and the parent is not less altruistic towards the child, family migration is preferred and it produces larger human capital. However, even if it is highly effective, parental migration is preferred if he is less altruistic. Therefore, the role of home education in building human capital depends on the degree of the parent's altruism as well as its effectiveness.

JEL Classification: J13, J22, J24, J61, O15, R23

Keywords: human capital formation, parental migration,
family migration, altruism, home education

* Received July 17, 2014. Revised September 29, 2014. Accepted November 20, 2014. An earlier draft of this paper was presented at the 12th International Conference of the Japan Economic Policy Association held at Sapporo University, Japan; the 13th Annual Conference of the European Economics and Finance Society held at the Electra Palace Hotel Thessaloniki, Greece; and the International Conference of the Association of the Korean Economics Studies on Korea and the World Economy, XIII held at Sungkyunkwan University, Korea. I am grateful to Nobue Suzuki, George Agiomirgianakis, G. K. Randolph Tan, Dipak Basu, and participants at these conferences for their valuable comments. I would like to thank Yeonho Lee (Editor) and the anonymous referees for making constructive comments to improve this paper. Financial support by the Japan Society of the Promotion of Science is gratefully acknowledged. Needless to say, any remaining errors are my own.

** Associate Professor at Faculty of Economics, Nagasaki University, 4-2-1, Katafuchi, Nagasaki City, 850-8506, Japan, Tel: +81-95-820-6353, E-mail: shimada@nagasaki-u.ac.jp

1. INTRODUCTION

In this study, I deal with internal migration, that is, rural to urban migration. I consider its effect on the child's human capital formation under different types of internal migration. For this purpose, I emphasise that human capital is built not only by school education but also by home education (i.e., parental care of the child). The latter factor has been rarely included in human capital formation under internal migration. I clarify how internal migration affects child's human capital formation through home education as well as school education.

Rural to urban migration has been one of the most contentious issues in economics since Lewis (1954) and Harris and Todaro (1970).¹⁾

Because of the large income disparity between rural and urban areas, a growing number of people in China have attempted to internally migrate despite the fact that the household registration system (*hukou*) works as a constraint on internal migration. National Bureau of Statistics of China (2013) reports significant differences in income among regions. In 2012, the per capita gross domestic product of eastern provinces was highest (57722 yuan), followed by northeastern provinces (46014 yuan), central provinces (32427 yuan) and western provinces (31357 yuan). Utilising China's census date, Sun and Fan (2011) estimate the number of rural to urban migrants and found an increase from 3.1 million in 1990 to 12.6 million (migrants from townships or villagers' committees to cities) or 18.1 million (migrants from townships or villagers' committees to cities and towns) in 2000.

In China, labour mobility from rural to urban areas is a likely contributor of economic growth. This has renewed interests on rural to urban migration. One of them is whether internal migration alleviates or aggravates income disparities. Keidel (2009) suggests that high regional inequality and the ensuing migration may help ensure sustainable

¹⁾ See Williamson (1988) for the survey on empirical literatures and Bhattacharya (1993) for the survey on theoretical literatures in the early stages of research.

improvements in individual well-being. However, Lu (2009) finds capital and labour movements have played a limited role in equalising their returns across regions.

Clearly, income disparity cannot be alleviated in a short period, even if it is possible. This suggests that rural to urban migration will affect the course of income disparity through changes in accumulation of human capital.

Rural to urban migration can be broadly divided into family migration and parental migration, each of which has its own properties. Under family migration, the parents move with other family members to urban areas where wages are higher. In such regions, children can receive better school education than in their hometowns. However, the migrants' children do not necessarily have the same access to school education in urban areas as the local children.²⁾ Under parental migration, parents alone migrate to urban areas leaving children and other family members in rural areas. They mostly stay in the migrated area and send money to their family members as remittances. Children of such migrating parents go to school in their hometown. While their opportunities for school education are not limited, its quality is lower than in urban areas.³⁾ Accordingly, these two types of internal migration differ not only in the cost but also in educational effects on children.

Accordingly, we infer that we cannot determine a priori which type of internal migration is advantageous in forming human capital via school education. We cannot determine a priori the type that enables a child to receive a larger amount of effective school education. This is because, as previously stated, under family migration, quality of school education is high but its availability is limited; whereas under parental migration opportunities are not limited but quality is not as high.

²⁾ Using National Bureau of Statistics (2000, 2005, 2005-2007, 2007), Wang (2008) estimates that family migration has gradually increased from 24.7 million in 2004 to 26.4 million in 2006. However, in urban areas, migrants' access to public services such as children's education is often limited. As suggested by Ngok (2012), urban governments are reluctant to treat migrants and their families equally with original urban residents.

³⁾ Guo *et al.* (2013) conclude that the education disparity between rural and urban areas in China has widened under globalisation and a growing market economy.

In addition, we cannot determine which type of internal migration is more effective in building human capital solely by school education. In general, human capital is formed not only by school education but also by home education, that is, the parental discipline of their children. Children that are not well disciplined by parents are likely to perform poorly at school, and even if they have done well at school, they are less likely to have the adequate qualities to be productive workers. These facts suggest that the duration and effectiveness of parental care can have effects on child's human capital formation. Glomm and Kaganovich (2003) include effective parental time as a factor for the production of human capital. They find that school and home education can complement each other. In the analysis in Casarico and Sommacal (2012), schooling and the quality of the early childhood environment, which is related with child care, enters the production function of human capital as complements.

Migration usually reduces the time that parents can spend with their children. The effects of reducing home education on children are mixed. Jingzhong and Lu (2011) conclude that parental migration has various negative effects on the lives of children, such as inadequate tutoring and supervision. Lu (2012) also finds the disruptive effect of parental migration on children.⁴⁾ However, Chen *et al.* (2009) find no significant negative effects on children's school performance who are left behind by their parents.

Even if the reduction of home education impairs children's human capital formation, we would not have to incorporate home education into the analysis if the amount of home education did not differ across different types of internal migration. However, how long the parent can be with his child to provide home education depends on its type. Therefore, we must pay explicit attention to home education as well as school education when analysing human capital formation under internal migration.

In this study, I clarify how human capital is formed under internal migration through home education and school education. I expressly

⁴⁾ Apart from the reduced parental care, Meyerhoefer and Chen (2011) found that in rural China reallocation of children's time towards home production hampers their educational progress.

assume that both types of education are imperative for building human capital. This assumption differs from previous studies, such as Vidal (1998) and Docquier *et al.* (2008). They regard school education as exclusively responsible for human capital formation. In doing so, I reveal how home education is associated with human capital formation when one or all members of the household migrate.

I find that as long as human capital formation function exhibits decreasing returns to scale, under parental migration, the parent resides in the urban area over the entire period, and does not provide the child with home education. Under parental migration, human capital formation has nothing to do with home education. On the other hand, under family migration, home education is provided to the child over the entire period, helping raise human capital.

When home education is less effective in human capital formation, parental migration results in higher utility. As a result, parental migration is chosen. Larger human capital is also formed than under family migration. In this case, the parent keeps staying in the urban area to maximise utility. Although the child receives no home education, effects of school education dominate and larger human capital is built without home education.

In contrast, when home education is highly effective, and the parent is not less altruistic towards the child, family migration is chosen since it results in higher utility. It also results in larger human capital than under parental migration. Home education contributes to enhancing human capital.

However, even if home education is highly effective, utility derived from parental migration is larger if the parent is less altruistic. Accordingly, in such a case, parental migration is chosen, and smaller human capital is realised. In this case, home education plays no role even though it can effectively build human capital.

My results suggest that home education does not always contribute to human capital formation. Its significance depends on the degree of parent's altruism towards the child as well as the effectiveness of home education.

The remainder of the study is organised as follows. Section 2 models

parental migration and family migration and presents the maximisation problem that the parent has to solve under each type of internal migration. Section 3 solves the problem and derives the evolution of human capital for each type. Section 4 compares the utility to choose the optimal internal migration type and shows how home education is related with human capital formation. Section 5 concludes.

2. THE MODEL

I assume a small open overlapping-generations economy that comprises rural and urban areas. I focus on the representative household in the rural area. The household consists of one parent and one child. Each agent lives two periods, that is, childhood and parenthood. In childhood, the agent receives school education in the rural or urban area and may also receive home education from the parent. In parenthood, an agent migrates and provides labour, utilising the human capital formed in childhood. He may also provide the child with home education while he resides in the same area as the child. No pecuniary costs incur for providing home education. Home education cannot be provided for the agent in parenthood because his parent is dead in that period. The parent is altruistic towards the child. He cares for how much the child earns after the child has grown up. Accordingly, the parent spends money not only on consumption but also on the child's school education. Although the parent shares the consumption with the child, this is exclusively to meet the child's survival needs; it is not shared because of altruism towards the child.

Since job opportunities are few and wages are low in the rural area, the parent attempts to find employment in the urban area. Of course, subsistence of the household is not the only reason for migration. Although I do not assume so explicitly, potential exposure to better technology for the child can also be an important motivation for migration.

For this purpose, the household has two options, parental migration and

family migration. Under parental migration, only the parent moves to the urban area, leaving the child in the rural area, where the child receives school education. The child receives home education from the parent while the parent is back in the rural area. Under family migration, both the agents move to the urban area, where the child receives school education. The parent can provide the child with home education during the entire period. Migration costs are higher under family migration. The parent decides the migration type to maximise utility.

In this paper I consider only two types of internal migration as prototypes. However, it would be possible to examine various types in a continuous manner if I parameterised the number of household members who migrate to work and the number of those who receive both types of education in urban area.⁵⁾

2.1. Parental Migration

The parent resides in the urban area to work for part or all of the period. The migration duration in period t is $0 < \bar{l} \leq l_t \leq 1$, where \bar{l} is the minimum duration to realise the minimum consumption for the family and school education for the child. His gross earnings in period t are $l_t w_t$, where w_t are wages in the urban area in period t . Migration and return migration of the parent incur a cost, which is proportional to his gross earnings with the ratio $0 < c < 1$. The net earnings in the urban area are $(1-c)l_t w_t$. Since the parent is not a permanent resident of the urban area, even if he works in urban area throughout the entire period, he returns to the rural area at the end of the period and again migrates to the urban area at the beginning of the next period.

Given the migration duration by l_t , the parent resides at the rural area in period t by $1-l_t$. Since job opportunities are scarce in the rural area, I assume that the parent cannot find employment, thereby earning nothing while he is back in the rural area.

⁵⁾ Parameterisation was suggested by the referee.

Even so, the parent can discipline his child more closely while in the rural area. The amount of home education is larger as the parent resides for a longer duration in the rural area. The amount is measured as $2-l_t$, where the maximum amount of home education is two. This is a technical assumption. If the maximum amount were one, the larger value of p would reduce human capital when the amount of home education is between zero and one (see equation 1.1). This is inconsistent with the assumption that p measures the effectiveness of home education, which will be defined shortly in this section.

The parent spends the net income on his child's school education by the ratio of $0 < \theta_t < 1$ and on consumption in period t by the ratio $1 - \theta_t$. Accordingly, the child's school education is $\theta_t(1-c)l_t w_t$, and consumption is $(1-\theta_t)(1-c)l_t w_t$.

I associate human capital formation with school education and home education. In particular, by receiving school education by $\theta_t(1-c)l_t w_t$ and home education by $2-l_t$ in period t , the child forms human capital by h_{t+1} , which is measured in terms of efficiency units of labour and is available for production when he becomes a parent (in period $t+1$). Thus,

$$h_{t+1} = \{\theta_t(1-c)l_t w_t\}^s (2-l_t)^p, \quad s, p > 0, \quad s + p < 1,$$

where p , which is equal to $\partial \ln h_{t+1} / \partial \ln(2-l_t)$, measures the effectiveness of home education. If p is large (small), then human capital is elastic (inelastic) with respect to home education, and a given change in the amount of home education leads to a large (small) increase in the amount of human capital. This applies to the case where home education is highly (less) effective. There is no variable that is directly associated with the effectiveness of home education. It might be affected by the parent's education and skill level. The highly educated and skilled parent will hope that his child also becomes a quality labourer, and will be eager to discipline him. Likewise, s measures the effectiveness of school education. The

human capital formation function exhibits decreasing returns to scale.⁶⁾

By replacing w_t with $h_t w$, where w represents wages per efficiency unit of labour in the urban area, given exogenously, human capital in period $t+1$ under parental migration is expressed as follows:

$$h_{t+1} = \{\theta_t(1-c)l_t h_t w\}^s (2-l_t)^p. \quad (1.1)$$

Equation (1.1) suggests that human capital evolves over time. Human capital in period t affects human capital in period $t+1$ through parent's wages in period t . Accordingly, as in Galor and Stark (1994) and Vidal (1998), intergenerational externality is operative. The evolution can be influenced by s and p .

Because the parent is altruistic towards his child, he concerns about how the child can be better off in the child's parenthood (period $t+1$), which does not matter directly to him since the parent in period t is dead in period $t+1$. Under this assumption, the parent derives utility in period t , u_t from consumption in period t and human capital available in period $t+1$. Thus,

$$u_t = \ln(1-\theta_t)(1-c)l_t h_t w + \varepsilon \ln \rho \{\theta_t(1-c)l_t h_t w\}^s (2-l_t)^p, \quad (2.1)$$

where $0 < \varepsilon < 1$ is the parent's degree of altruism towards the child and $0 < \rho \leq 1$ is the subjective time rate of discount. The parent manipulates the ratio of net income spent on school education in period t and the migration duration in period t to maximise his utility in period t .⁷⁾

Therefore, the parent's maximisation problem under parental migration is summarised as follows:

⁶⁾ Even with the same amount of school and home education, average human capital would take different values if the workers were heterogeneous in their skill and endogenously allocated into skilled and less-skilled sectors, as assumed by Kim (2013).

⁷⁾ I can extend the analysis by making the degree of altruism endogenous. By introducing dynamics in the degree of altruism, the results will not be directly linked to the degree of altruism. The referee suggested this possibility.

$$\max_{\theta_t, l_t} u_t \text{ subject to } 0 < \theta_t < 1, \bar{l} \leq l_t \leq 1.$$

2.2. Family Migration

Since the parent is always with the child in the urban area, he can give the maximum amount of home education to the child; as a result, he does not have to return to the rural area to provide home education. Accordingly, the parent works throughout the period in the urban area, in other words, labour provision is always equal to 1, and home education is always equal to 2. However, since the parent and the child are not permanent residents of the urban area, they return to the rural area at the end of the period and again migrate to the urban area at the beginning of the next period.

Therefore, human capital in period $t+1$ under family migration \tilde{h}_{t+1} is as follows:

$$\tilde{h}_{t+1} = \{\tilde{\theta}_t(1-\tilde{c})\tilde{h}_t w\}^s 2^p, \quad \tilde{c} > c, \quad (1.2)$$

where $0 < \tilde{c} < 1$ is the ratio of the earnings to pay the costs for migration and return migration. Naturally, family migration costs more than parental migration.

In general, school education is more effective in the urban area so that s might take the larger value under family migration. However, as in China, I envisage the situation in which the children of the migrants from the rural area have limited access to school education in the urban area due to the household registration system.

As a result, the effectiveness of school education for the migrants' children in a real sense is not high, which is measured as a product of the probability of the migrants' children to be admitted to school in the urban area and the effectiveness of school education. It cannot be determined a priori whether school education is more effective in the urban area than in the rural area in a real sense. Empirical analyses are necessary to determine it. By adding cases where the effectiveness of school education differs between the rural

and urban areas, I could extend the model analysis. However, the role of home education in building human capital would be less clear in such situations. For this reason, I assume that the effectiveness of school education does not differ between rural and urban areas. Accordingly, the same power s is used to expand the amount of school education under family migration $\tilde{\theta}_t(1-\tilde{c})\tilde{h}_t w$.

Parent's utility in period t under family migration \tilde{u}_t is as follows:

$$\tilde{u}_t = \ln(1-\tilde{\theta}_t)(1-\tilde{c})\tilde{h}_t w + \varepsilon \ln \rho \{ \tilde{\theta}_t(1-\tilde{c})\tilde{h}_t w \}^s 2^p. \quad (2.2)$$

Therefore, the parent's maximisation problem under family migration is as follows:

$$\max_{\tilde{\theta}_t} \tilde{u}_t, \text{ subject to } 0 < \tilde{\theta}_t < 1.$$

Unlike the maximisation problem under parental migration, the parent manipulates only the ratio of the spending on the child's education.

3. HUMAN CAPITAL FORMATION UNDER INTERNAL MIGRATION

In this section, I solve the maximisation problem and derive the evolution of human capital under each type of internal migration.

3.1. Human Capital Formation under Parental Migration

Differentiating equation (2.1) with respect to θ_t , the optimal ratio of net earnings spent on school education θ_t^* is determined as follows:

$$\theta_i^* = \frac{\varepsilon s}{1 + \varepsilon s}. \quad (3)$$

According to equation (3), as the parent is more altruistic or as school education is more effective, the parent spends a larger portion of net income on the child's school education ($\partial \theta_i^* / \partial \varepsilon, \partial \theta_i^* / \partial s > 0$). Intuitively, if the parent cares more about the child or if school education is more effective, then the parent sacrifices more of the consumption expenditure for the child's school education. The optimal ratio does not depend on the level of human capital and remains unchanged over time.

By differentiating u_i with respect to l_i , I find,

$$\frac{1}{l_i(2-l_i)} \{2(1+\varepsilon s) - (1+\varepsilon s + \varepsilon p)l_i\} \begin{matrix} \geq 0 \\ \leq 0 \end{matrix}.$$

The optimal duration of parental migration l_i^* takes different values depending on the values of the parameters:

$$\text{If } \frac{2(1+\varepsilon s)}{1+\varepsilon s + \varepsilon p} > 1, \text{ then } l_i^* = 1. \quad (9)$$

$$\text{If } \bar{l} \leq \frac{2(1+\varepsilon s)}{1+\varepsilon s + \varepsilon p} \leq 1, \text{ then } l_i^* = \frac{2(1+\varepsilon s)}{1+\varepsilon s + \varepsilon p}. \quad (10)$$

$$\text{If } \frac{2(1+\varepsilon s)}{1+\varepsilon s + \varepsilon p} < \bar{l}, \text{ then } l_i^* = \bar{l}. \quad (11)$$

⁸⁾ Since $\lim_{\varepsilon \rightarrow 0} \theta_i^* = \lim_{s \rightarrow 0} \theta_i^* = 0$, $\lim_{s \rightarrow 1} l_i = s/(1+s)$, and $\lim_{s \rightarrow 1} \theta_i^* = \varepsilon/(1+\varepsilon)$, θ_i^* is always between 0 and 1.

⁹⁾ This corresponds to the case where $2(1+\varepsilon s) - (1+\varepsilon s + \varepsilon p)l_i|_{l_i=1} > 0$ and thereby $\partial u_i / \partial l_i > 0$.

¹⁰⁾ This corresponds to the case where $2(1+\varepsilon s) - (1+\varepsilon s + \varepsilon p)l_i|_{l_i=\bar{l}} \leq 0$ and $2(1+\varepsilon s) - (1+\varepsilon s + \varepsilon p)l_i|_{l_i=\bar{l}} \geq 0$, thereby $\partial u_i / \partial l_i > 0$, $\partial u_i / \partial l_i = 0$, or $\partial u_i / \partial l_i < 0$.

I rewrite these solutions to show how the optimal migration duration varies across different levels of effectiveness of home education for the given values of s and ε . Disregarding the restriction $s + p < 1$, the optimal duration can be expressed as a function of p .

$$\text{If } p < \frac{1 + \varepsilon s}{\varepsilon}, \text{ then } l_t^* = 1. \quad (4.1)$$

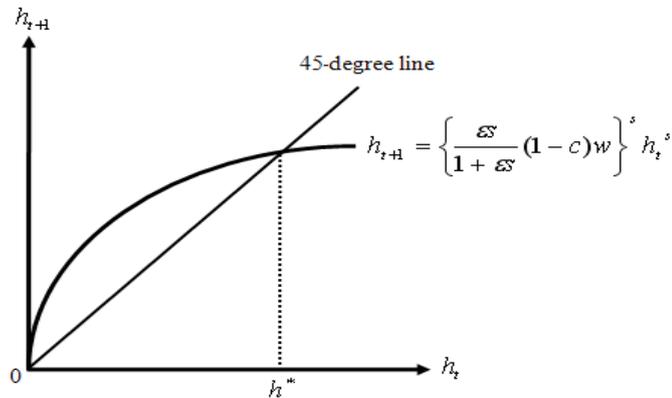
$$\text{If } \frac{1 + \varepsilon s}{\varepsilon} \leq p \leq \frac{(2 - \bar{l})(1 + \varepsilon s)}{\bar{l} \varepsilon}, \text{ then} \quad (4.2)$$

$$l_t^* = \frac{2(1 + \varepsilon s)}{1 + \varepsilon s + \varepsilon p} \left(\equiv l_t^* \Big|_{(1 + \varepsilon s)/\varepsilon \leq p \leq (2 - \bar{l})(1 + \varepsilon s)/\bar{l} \varepsilon} \right).$$

$$\text{If } p > \frac{(2 - \bar{l})(1 + \varepsilon s)}{\bar{l} \varepsilon}, \text{ then } l_t^* = \bar{l}. \quad (4.3)$$

Equation (4.1) indicates that if home education is least effective, then the migration duration is maximum. On the other hand, equation (4.3) indicates that if home education is most effective, then the migration duration is minimum. As in equation (4.2), between these cases, migration duration is shorter as home education is more effective ($\partial l_t^* \Big|_{(1 + \varepsilon s)/\varepsilon \leq p \leq (2 - \bar{l})(1 + \varepsilon s)/\bar{l} \varepsilon} / \partial p < 0$). Therefore, if we disregard the restriction on the value of p , the parent would reside for a shorter duration in the urban area, as home education is more effective. Intuitively, if home education is more effective, the opportunity cost for not taking care of the child is larger, and thereby the parent shortens the migration duration. This raises human capital via larger home education. However, due to the shorter migration duration and a smaller resultant net income, human capital is negatively affected by a smaller amount of school education. Consumption also decreases. In my model, the former positive effect dominates the latter negative effects; thus, more

¹¹⁾ This corresponds to the case where $2(1 + \varepsilon s) - (1 + \varepsilon s + \varepsilon p) \Big|_{l_t = \bar{l}} < 0$ and thereby $\partial u_t / \partial l_t < 0$.

Figure 1 The Evolution of Human Capital under Parental Migration

effective home education leads to shorter migration duration.

Under the assumption of decreasing returns to scale, that is, $s + p < 1$, p cannot exceed 1. Since $(1 + \varepsilon s)/\varepsilon > 1$, the cases described by equations (4.2) and (4.3) do not hold. Accordingly, the optimal duration is determined as 1 by equation (4.1).

Therefore, under parental migration, the parent resides throughout the period in the urban area and does not provide the child with home education. To maximise utility, the parent intentionally chooses not to provide home education.

By substituting $l_t^* = 1$ into equation (1.1), I derive the evolution of human capital:

$$h_{t+1} = \left\{ \frac{\varepsilon s}{1 + \varepsilon s} (1 - c) w \right\}^s h_t^s. \quad (5)$$

This is illustrated by figure 1. Equation (5) does not include p . Even if home education is highly effective, it does not contribute to human capital formation. Therefore, there is no scope for home education to raise human

capital.

Except for 0, human capital is in equilibrium at,

$$\left\{ \frac{\varepsilon s}{1 + \varepsilon s} (1 - c)w \right\}^{s/(1-s)} (\equiv h^*). \quad (6)$$

It is evident that equilibrium is locally stable. As the parent is more altruistic or as school education is more effective or as the migration costs are lower, the equilibrium human capital is larger ($\partial h^*/\partial \varepsilon$, $\partial h^*/\partial s > 0$, $\partial h^*/\partial c < 0$).

3.2. Human Capital Formation under Family Migration

Differentiating equation (2.2) with respect to $\tilde{\theta}_t$, the optimal ratio of the net earnings spent on school education $\tilde{\theta}_t^*$ is determined as follows:

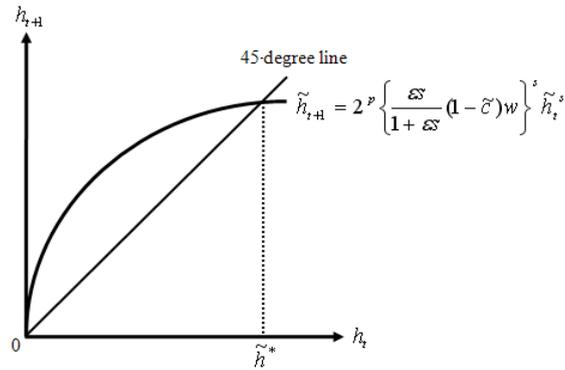
$$\tilde{\theta}_t^* = \frac{\varepsilon s}{1 + \varepsilon s}. \quad (7)$$

Equations (3) and (7) suggest that the ratio of net income spent on school education does not differ across the types of internal migration.

Substituting equation (7) into equation (1.2), I derive the evolution of human capital:

$$\tilde{h}_{t+1} = 2^p \left\{ \frac{\varepsilon s}{1 + \varepsilon s} (1 - \tilde{c})w \right\}^s \tilde{h}_t^s. \quad (8)$$

This is illustrated by figure 2. According to equation (8), unlike under parental migration, p always has positive effects on human capital in period $t+1$ given the human capital in period t . Since the parent is always with the child during the period, more effective home education leads to larger human capital.

Figure 2 The Evolution of Human Capital under Family Migration

Except for 0, human capital is in equilibrium at,

$$2^{p/(1-s)} \left\{ \frac{\varepsilon s}{1 + \varepsilon s} (1 - \tilde{c}) w \right\}^{s/(1-s)} \quad (\equiv \tilde{h}^*). \quad (9)$$

The equilibrium is locally stable under family migration as well. As the parent is more altruistic, or as school education is more effective, or as home education is more effective, or as the migration costs are lower, equilibrium human capital is larger ($\partial \tilde{h}^* / \partial \varepsilon > 0$, $\partial \tilde{h}^* / \partial s > 0$, $\partial \tilde{h}^* / \partial p > 0$, $\partial \tilde{h}^* / \partial \tilde{c} < 0$).

4. HOME EDUCATION AND HUMAN CAPITAL FORMATION

In this section, first, I compare human capital under the two types of internal migration, and then compare parent's utility to determine the migration type chosen by the parent. On the basis of these comparisons, I reveal the role of home education in human capital formation.

4.1. The Comparison of Human Capital

From equations (5) and (8), the difference of human capital in the period t , given the same positive human capital in period $t-1$, that is, $h_{t-1} = \tilde{h}_{t-1} > 0$, can be calculated as follows:

$$h_t - \tilde{h}_t = \left\{ 1 - 2^p \frac{(1-\tilde{c})^s}{(1-c)^s} \right\} \left\{ \frac{\varepsilon s}{1+\varepsilon s} (1-c)w \right\}^s h_{t-1}^s. \tag{10}$$

The sign of equation (10) cannot be determined a priori. Denoting $(1-\tilde{c})/(1-c)$ by $0 < k < 1$,

if $2^p k^s < 1 \Leftrightarrow p < (-\ln k / \ln 2)s$, then $h_t > \tilde{h}_t$ and $h^* > \tilde{h}^*$,

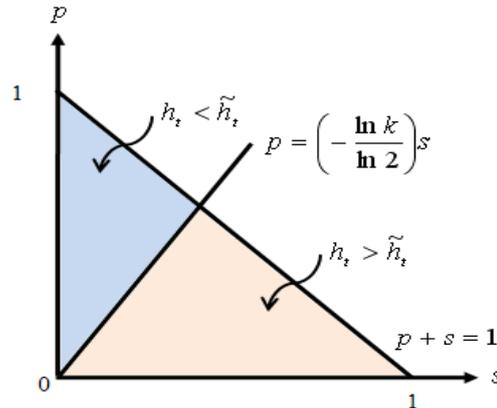
if $2^p k^s = 1 \Leftrightarrow p = (-\ln k / \ln 2)s$, then $h_t = \tilde{h}_t$ and $h^* = \tilde{h}^*$, and

if $2^p k^s > 1 \Leftrightarrow p > (-\ln k / \ln 2)s$, then $h_t < \tilde{h}_t$ and $h^* < \tilde{h}^*$.

Figure 3 illustrates these relationships. The curve $p = (-\ln k / \ln 2)s$ divides the region $s + p < 1$ into two, which differ in the ranking of human capital. If family migration costs much more than parental migration, whereby \tilde{c} is significantly larger than c , curve $p = (-\ln k / \ln 2)s$ is steeper, and the area for $h_t < \tilde{h}_t$ is narrower and the area for $h_t > \tilde{h}_t$ is wider.¹²⁾ In other words, in such a case, it is more likely that human capital is larger under parental migration than under family migration. The migration costs determine the relative advantage of internal migration in building human capital.

According to figure 3, if the effectiveness of home education is low, that is, p is close to 0, then h_t is likely to be larger than \tilde{h}_t . In such a case, the curve which illustrates equation (5) lies above the curve for equation (8). In

¹²⁾ Figure 3 corresponds with the case where $-\ln k / \ln 2$ is larger than one. However, $-\ln k / \ln 2$ can be equal to or smaller than one.

Figure 3 The Comparison of Human Capital

other words, parental migration realises larger human capital than family migration throughout the evolution process.

Even if the parent does not return to the rural area during the period and does not provide home education, parental migration enables the child to build larger human capital than family migration if the effectiveness of home education is low. This result is contrasted with the usual inference that the parent's absence negatively affects the child's education and hampers human capital formation. Of course, even under parental migration, larger human capital would be built if the parent would shorten the migration duration, but this does not conform to utility maximisation by the parent.

Figure 3 also suggests that if the effectiveness of home education is high, that is, p is close to 1, then \tilde{h}_t is likely to be larger than h_t . Accordingly, the curve for equation (8) is above the curve for equation (5). In other words, family migration provides larger human capital than parental migration throughout the evolution process. Moreover, in this case $\tilde{h}_t - h_t$ increases with p . Family migration becomes more advantageous in forming human capital as the parental discipline becomes more effective.

Based on these results, we *might* infer that the parent prefers parental migration when home education is not effective and that he prefers family

migration when home education is effective. I examine whether this inference is true or not in the next section.

To summarise the results, which type of migration is better to attain larger human capital cannot be determined a priori. The answer depends on the effectiveness of home education. Also, home education does not necessarily contribute to raising human capital.

4.2. The Comparison of Parent's Utility

In order to determine which type of internal migration the parent chooses, I make a comparison between parent's utility under parental migration and the one under family migration.

Substituting equations (3) and (4.1) into equation (2.1), the parent's utility under parental migration can be represented as a function of human capital in period t :

$$u_t = \ln \frac{1}{1 + \varepsilon s} (1 - c) h_t w + \varepsilon \ln \rho \left\{ \frac{\varepsilon s}{1 + \varepsilon s} (1 - c) w \right\}^s h_t^s. \quad (11)$$

The parent's utility does not depend on the effectiveness of home education under parental migration. Parent's utility approaches to the utility in equilibrium u^* as h_t approaches to h^* :

$$u^* = \ln \frac{1}{1 + \varepsilon s} (1 - c) \left\{ \frac{\varepsilon s}{1 + \varepsilon s} (1 - c) w \right\}^{s(1-s)} w + \varepsilon \ln \rho \left\{ \frac{\varepsilon s}{1 + \varepsilon s} (1 - c) w \right\}^{s(1-s)}.$$

Substituting equation (7) into equation (2.2), the parent's utility under family migration can be represented as functions of human capital in period t :

$$\tilde{u}_t = \ln \frac{1}{1 + \varepsilon s} (1 - \tilde{c}) \tilde{h}_t w + \varepsilon \ln 2^p \rho \left\{ \frac{\varepsilon s}{1 + \varepsilon s} (1 - \tilde{c}) w \right\}^s \tilde{h}_t^s. \quad (12)$$

Unlike parental migration, the parent's utility under family migration is higher as the effectiveness of home education is higher. Parent's utility approaches to the utility in equilibrium \tilde{u}^* as \tilde{h}_t approaches to \tilde{h}^* :

$$\begin{aligned} \tilde{u}^* = & \ln \frac{1}{1+\varepsilon s} (1-\tilde{c}) 2^{p/(1-s)} \left\{ \frac{\varepsilon s}{1+\varepsilon s} (1-\tilde{c}) w \right\}^{s/(1-s)} w \\ & + \varepsilon \ln 2^{p/(1-s)} \rho \left\{ \frac{\varepsilon s}{1+\varepsilon s} (1-\tilde{c}) w \right\}^{s/(1-s)}. \end{aligned}$$

Given the same positive human capital in period t , that is, $h_t = \tilde{h}_t > 0$, the difference of utility between the two types of migration in period t is given as follows:

$$u_t - \tilde{u}_t = (1+\varepsilon s) \{ \ln(1-c) - \ln(1-\tilde{c}) \} - \varepsilon p \ln 2. \quad (13)$$

The sign of equation (13) cannot be determined a priori. The first term on the right-hand side is positive, whereas the second term is negative. This suggests that the type of migration that gives higher utility depends on the values of the parameters. Equation (13) suggests that,

if $2^{p\varepsilon} k^{1+\varepsilon s} < 1 \Leftrightarrow p < (-\ln k / \ln 2)(1/\varepsilon) + (-\ln k / \ln 2)s$, then $u_t > \tilde{u}_t$ and $u^* > \tilde{u}^*$,

if $2^{p\varepsilon} k^{1+\varepsilon s} = 1 \Leftrightarrow p = (-\ln k / \ln 2)(1/\varepsilon) + (-\ln k / \ln 2)s$, then $u_t = \tilde{u}_t$ and $u^* = \tilde{u}^*$, and

if $2^{p\varepsilon} k^{1+\varepsilon s} > 1 \Leftrightarrow p > (-\ln k / \ln 2)(1/\varepsilon) + (-\ln k / \ln 2)s$, then $u_t < \tilde{u}_t$ and $u^* < \tilde{u}^*$.

Figures 4a and 4b illustrate these relations. As long as $(-\ln k / \ln 2)(1/\varepsilon)$ is smaller than 1, as illustrated by figure 4a, the curve $p = (-\ln k / \ln 2)(1/\varepsilon) + (-\ln k / \ln 2)s$ intersects with the curve $p = -s + 1$. Accordingly, the

Figure 4a The Comparison of Utility When $(-\ln k/\ln 2)(1/\varepsilon) < 1$

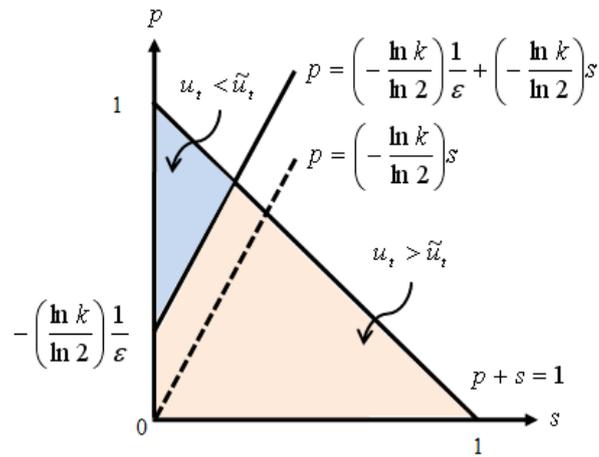
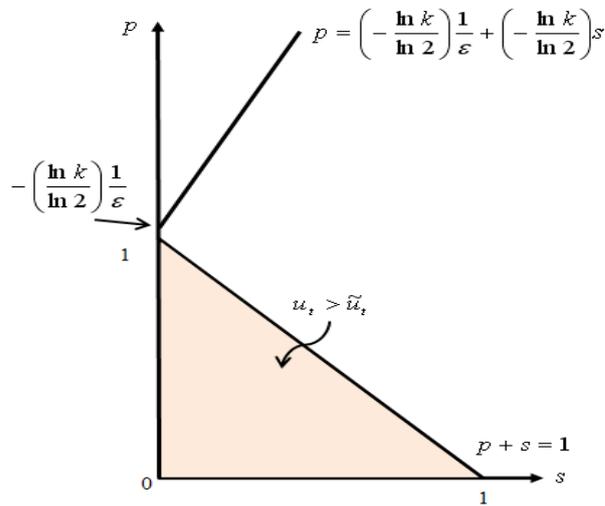


Figure 4b The Comparison of Utility When $(-\ln k/\ln 2)(1/\varepsilon) > 1$



region $s + p < 1$ can be divided into two parts, each of which has a distinct ranking of utility. On the other hand, if $(-\ln k / \ln 2)(1/\varepsilon)$ is larger than 1, as illustrated by figure 4b, then the curves do not intersect, the region cannot be divided and the ranking of utility is unique.

From figures 4a and 4b, we infer that if the effectiveness of home education is low, that is, p is close to 0, then u_i is likely to be larger than \tilde{u}_i . In such a case, parental migration is chosen.

Figure 4a suggests that if the effectiveness of home education is high, that is, p is close to 1, and the parent is not so less altruistic towards the child, that is, ε is not close to 0 such that $(-\ln k / \ln 2)(1/\varepsilon)$ is smaller than 1, then \tilde{u}_i is likely to be larger than u_i . In such a case, family migration results in larger utility than parental migration for any levels of human capital, thereby the parent chooses family migration.

However, as Figure 4b shows, even if the effectiveness of home education is high, u_i is larger than \tilde{u}_i if the parent is less altruistic towards the child, that is, ε is so small that $(-\ln k / \ln 2)(1/\varepsilon)$ is larger than 1.¹³⁾ As a result, the parent prefers parental migration to family migration.

To summarise the results, not only the effectiveness of home education but also the degree of the parent's altruism towards the child determines which type of migration gives higher utility to the parent.

4.3. The Role of Home Education in Human Capital Formation

From the results derived in the previous subsections, the role of home education in human capital formation can be revealed.

When the effectiveness of home education is low, parental migration without home education results in larger human capital and higher utility. In such a case, parental migration is chosen. Therefore, home education has

¹³⁾ If family migration costs sufficiently more than parental migration, this condition holds even if the degree of altruism is not so small. For example, when $\tilde{c} = 0.1$ and $c = 0.01$, for this condition to hold, ε has to be smaller than 0.1735. However, when $\tilde{c} = 0.3$ and $c = 0.01$, ε only has to be smaller than 0.5000.

no role to play in human capital formation.

On the other hand, when the effectiveness of home education is high and the parent is not less altruistic towards the child, family migration results in larger human capital and higher utility. In such a case, family migration is chosen. Therefore, home education influences human capital formation, and the higher effectiveness of home education results in larger human capital.

However, when the parent is less altruistic towards the child, the ranking of human capital does not necessarily coincide with that of utility. In particular, even if home education is highly effective and family migration can produce larger human capital, parental migration is preferred when the parent is less altruistic since it realises higher utility. In such a case, home education does not influence human capital formation and the individual choice of the migration type is not socially optimal.¹⁴⁾

Therefore, I conclude that whether home education contributes to human capital formation under internal migration depends not only on its effectiveness of home education but also on the degree of parent's altruism.

5. CONCLUDING REMARKS

Internal migration often causes the education problem. A child who moves with his parent cannot be assured of receiving quality school education in the urban area, whereas a child left behind in the rural area does not fail to receive school education; however, the quality of education tends to be lower than that in the urban area.

Although previous analyses tended to include only school education as a factor of human capital formation, in general, home education is also

¹⁴⁾ There is another case where the rankings of human capital and that of utility differ. Even if the effectiveness of home education is high and the parent is not less altruistic towards the child, in the area surrounded by $p = (-\ln k/\ln 2)s$, $p = (-\ln k/\ln 2)(1/\varepsilon) + (-\ln k/\ln 2)s$ and $p = -s + 1$ human capital is larger under family migration while utility is higher under parental migration (see figure 4a).

associated with human capital formation. In addition, under internal migration, the amount of the parental care for the child differs depending on how the family members migrate. Some studies have in fact found negative effects of parental absence on the child.

I attempted to clarify the role of home education in human capital formation in a dynamic context. I found that which type of internal migration results in larger human capital depends on the effectiveness of home education. I further found whether we can actually attain larger human capital is determined not only by the effectiveness of home education but also by the degree of the parent's altruism towards the child.

With an increase in the education level among parents, a trend currently seen in China, home education will become more effective. Accordingly, human capital will be enhanced under family migration, and this may ultimately lead to the alleviation of income disparity. However, even if home education has become effective, parental migration might be chosen for some reason, a trend common in China today. In such a case, the advancement in parent's education will not contribute to child's human capital formation and income disparity will not be alleviated.

REFERENCES

- Bhattacharya, P. C., "Rural-Urban Migration in Economic Development," *Journal of Economic Surveys*, 7(3), 1993, pp. 243-281.
- Casarico, A. and A. Sommacal, "Labor Income Taxation, Human Capital, and Growth: The Role of Childcare," *Scandinavian Journal of Economics*, 114(4), 2012, pp. 1182-1207.
- Chen, X., Q. Huang, S. Rozelle, Y. Shi, and L. Zhang, "Effect of Migration on Children's Educational Performance in Rural China," *Comparative Economic Studies*, 51(3), 2009, pp. 323-343.
- Docquier, F., O. Faye, and P. Pestieau, "Is Migration a Good Substitute for Education Subsidies?," *Journal of Development Economics*, 86(2),

2008, pp. 263-276.

- Galor, O. and O. Stark, "Migration, Human Capital Formation, and Long-Run Output," in H. Siebert, ed., *Migration: A Challenge for Europe: Symposium 1993*, Tübingen: J. C. B. Mohr, 1994, pp. 59-68.
- Glomm, G. and M. Kaganovich, "Distributional Effects of Public Education in an Economy with Public Pensions," *International Economic Review*, 44(3), 2003, pp. 917-937.
- Guo, S., Y. Guo, G. Beckett, Q. Li, and L. Guo, "Changes in Chinese Education under Globalisation and Market Economy: Emerging Issues and Debates," *Compare*, 43(2), 2013, pp. 244-264.
- Harris, J. R. and M. P. Todaro, "Migration, Unemployment and Development: A Two-Sector Analysis," *American Economic Review*, 60(1), 1970, pp. 126-142.
- Jingzhong, Y. and P. Lu, "Differentiated Childhoods: Impacts of Rural Labor Migration on Left-Behind Children in China," *Journal of Peasant Studies*, 38(2), 2011, pp. 355-377.
- Keidel, A., "Chinese Regional Inequalities in Income and Well-Being," *Review of Income and Wealth*, 55(1), 2009, pp. 538-561.
- Kim, Y.-J., "Effective Human Capital and Long-run Economic Growth," *Korea and the World Economy*, 14(3), 2013, pp. 475-515.
- Lewis, W. A., "Economic Development with Unlimited Supplies of Labour," *The Manchester School*, 22(2), 1954, pp. 139-191.
- Lu, D., "The Economic Consequence of Labor Mobility in China's Regional Development," *Asian Economic Papers*, 8(2), 2009, pp. 85-114.
- Lu, Y., "Education of Children Left Behind in Rural China," *Journal of Marriage and Family*, 74(2), 2012, pp. 328-341.
- Meyerhoefer, C. D. and C. J. Chen, "The Effect of Parental Labor Migration on Children's Educational Progress in Rural China," *Review of Economics of the Household*, 9(3), 2011, pp. 379-396.
- National Bureau of Statistics of China, *China Statistical Yearbook*, 2007, 2013, *China Rural Household Survey Yearbook*, 2005-2007, *Census Long-Form Data*, 2000, *Population Sampling Data*, 2005, *Living*

Quality Survey of Rural Migrant Workers, 2006, Beijing: China Statistic Press.

Ngok, K., "Serving Migrant Workers: A Challenging Public Service Issue in China," *Australian Journal of Public Administration*, 71(2), 2012, pp. 178-190.

Sun, M. and C. C. Fan, "China's Permanent and Temporary Migrants: Differentials and Changes, 1990-2000," *Professional Geographer*, 63(1), 2011, pp. 92-112.

Vidal, J.-P., "The Effect of Emigration on Human Capital Formation," *Journal of Population Economics*, 11(4), 1998, pp. 589-600.

Wang, D., "Rural-Urban Migration and Policy Responses in China: Challenges and Options," Working Paper No. 15, ILO Asian Regional Programme on Governance of Labour Migration, International Labour Organization, 2008.

Williamson, J. G., "Migration and Urbanization," in H. Chenery and T. N. Srinivasan, eds., *Handbook of Development Economics*, Volume 1, Amsterdam: Elsevier Science B. V., 1988, pp. 426-465.