Migration Possibilities, Education, and Human Capital Formation

Akira Shimada*
Faculty of Economics, Nagasaki University

Abstract
We investigate the effects of migration possibilities to the foreign (labour-receiving) country on the demand for education and human capital formation in the home (labour-sending) country. We assume that workers in the home country have heterogeneous innate abilities, demand education and form human capital to maximise their individual net earnings. Unlike previous analyses, we include the resource market for human capital formation, i.e. the education market in the home country, and assume that workers have to pay a pecuniary cost privately for obtaining education. Although previous analyses included the cost of human capital formation, it was primarily an opportunity cost, i.e. wages forgone by appropriating working hours for education. They did not explicitly consider the fact that private financing of education affects the demand for education, and thereby, human capital formation. We find that higher migration possibilities enable a larger number of workers in the home country to satisfy their individual budget constraint for demanding education; however, these workers lower the individual demand for education with increases in migration possibilities. When the supply of education is small, the latter negative effect dominates the former positive effect, and higher migration possibilities lower the average human capital in the home country. In other words, workers experience brain drain, i.e. decreases in the average human capital with increases in migration possibilities when the country cannot provide its people with sufficient education. This result is contrasted with the usual argument that emphasises an incentive for receiving education arising from higher migration possibilities. Our results conversely suggest that restrictive migration policies adopted by many labour-receiving developed countries cause brain gain, i.e. increases in the average human capital to labour-sending developing countries, where education is not sufficiently provided. Such positive effects arise not only from the reduced outflow of workers but also from the increased human capital formation through changes in the education price. Favourable effects of restrictive migration policies on the labour-sending developing countries have been left uninvestigated by previous studies.

JEL Classification: F22; I22; J24; O15
Keywords: Migration; Heterogeneous workers; Education market; Human capital formation; Brain drain; Brain gain

* Email address for correspondence: shimada@nagasaki-u.ac.jp
1. Introduction

We investigate the effects of migration possibilities to the foreign (labour-receiving) country on the demand for education and human capital formation by the workers in the home (labour-sending) country when they are heterogeneous in their innate ability and have to pay a pecuniary cost privately to receive education. We draw an inference on the positive effects of the foreign country’s restrictive attitude towards accepting migrants on the home country’s average human capital.

With an increase in the number of workers migrating internationally, many labour-receiving developed countries have become restrictive in accepting migrants (Boeri and Brücker, 2005; Facchini and Mayda, 2008; Felbermayr et al., 2010).\(^1\) This trend will be a serious problem to labour-sending developing countries that are heavily dependent on remittances sent by migrants.\(^2\)

In addition, many labour-receiving developed countries have become selective, i.e. they prefer to accept skilled migrants.\(^3\) For example, the Australian government has decided to implement the new Skilled Migrant Selection Register (SkillSelect) to accept migrants who are skilled and needed in occupational groups (Australian Government, 2011). This suggests that skilled workers, who are markedly scarce in developing countries, are more likely to leave their home countries than unskilled workers. Other convincing examples of skilled worker migration include the

\(^1\) According to World Bank (2011), the stock of migrants as of 2010 is 215.8 million, sharing 3.2 percent of the world population.

\(^2\) It is widely admitted that remittances sent by migrants are an important financial resource for these countries. See Shimada (2010, 2011a) for the effects of sending and receiving fees on the amount of remittances and the role of altruism in sending and spending remittances.

\(^3\) Huber et al. (2010) revealed that highly-skilled migrants play a positive role in productivity developments in the so-called skill intensive industry.
emigration rate for the tertiary-educated population of Guyana, Granada, Jamaica, St. Vincent, the Grenadines and Haiti in 2000, which exceeds 80 percent (World Bank, 2011). Moreover, using the data by Docquier and Marfouk (2006), Grogger and Hanson (2011) observed that emigrants are, in general, positively selected in terms of schooling. As a result, many labour-sending developing countries are experiencing a reduction in human capital, i.e. brain drain, because of emigration.

Based on these analyses, it is often argued that labour-sending countries are being negatively affected by the restrictive and selective migration policies adopted by labour-receiving developed countries.

The effects of emigration on labour-sending countries have been very controversial for a long time. Docquier and Rapoport (2009) divided the controversies into three generations. Grubel and Scott (1966) and Berry and Soligo (1969), which can be included in the first generation, illustrate emigration’s positive aspects. On the other hand, Bhagwati and Hamada (1974), Hamada and Bhagwati (1975), and Bhagwati and Rodriguez (1975), which can be included in the second generation, emphasize the negative effects.

Recent arguments put forth by Mountford (1997), Stark et al. (1997, 1998, 2009a, b), and Beine et al. (2001, 2008), which can be classified into the third generation, is gaining persuasiveness. They derived the positive effects of emigration. It is a fact that these countries lose part of their

---

4 We do not intend to survey the related literature here.

5 According to the empirical analysis by Beine et al. (2011), whether brain gain occurs or not depends on the labour-sending countries’ income. In particular, they found that low-income countries experience brain gain, but they found no such evidence in middle-income and high-income countries. Shimada (2011b) showed theoretically that brain drain and brain gain can occur simultaneously in the same labour-sending country.
human capital by the outflow of workers; however, migration possibilities raise the return on education. This induces workers to increase the demand for education, which enhances human capital formation in the labour-sending countries. In other words, workers in these countries experience brain gain.

As noted by these studies, obtaining education incurs costs. If workers do not have to work for fixed hours and can manipulate working hours, they will reduce their working hours and earnings to obtain education.\(^6\) Such an opportunity cost certainly affects the demand for education and human capital formation.

In addition to the opportunity cost, workers usually have to pay a pecuniary cost to obtain education. It is a fact that primary and secondary education is predominantly provided through taxes; however, tertiary education cannot be provided only by taxes. Whether it is optimal for an individual or an economy to finance tertiary education privately or not, most of us are actually paying portions or all for its pecuniary costs.\(^7\) Accordingly, individuals face financing problems when obtaining education. Similar to the opportunity cost, whether and to what extent individuals can afford the pecuniary cost will also affect demand for education and human capital formation. Nevertheless, previous studies have not given appropriate attention to such a constraint.

If workers have to pay the pecuniary cost for education privately, they will become sensitive to the education price, and it will affect human capital formation. For example, a larger demand for education due to migration possibilities to countries with higher wages and/or an insufficient

\(^6\) Stark et al. (1998) included an opportunity cost for obtaining education in the two-period model explicitly by assuming that the first period earnings are reduced through the portion of time allocated to human capital formation.

\(^7\) See Barr (2004) for the discussion on how higher education should be funded.
domestic supply of education may raise the education price. This may have negative effects on human capital formation. Another possibility is related to the effects of migration possibilities on the number of workers who satisfy the budget constraint through the changes in its return and its price. This will also affect human capital formation. These possibilities arising from price changes have almost been neglected in previous studies.  

Therefore, we incorporate the education market in the home country and attempt to illustrate the effects of migration possibilities on the demand for education and human capital formation through the education market and its price in order to draw some inferences on brain drain and brain gain.

We find that higher migration possibilities raise the education price and reduce the individual demand for education by workers who satisfy the budget constraint whereas a larger number of workers satisfy the budget constrain and demand education as migration possibilities increase. In case the home country cannot provide its people with education sufficiently, we find that the former effect dominates the latter effect and that higher migration possibilities hamper human capital formation. This result conversely suggests that restrictive migration policies adopted today by many labour-receiving developed countries bring about brain gain, i.e. increases in the average human capital to labour-sending developing countries. As noted previously, restrictive migration policies prevent workers’ outflow. This of course has positive effects on the human capital in the

---

8 Nakajima and Nakamura (2009) is an exception. They built a model that incorporates an educational institute and the education price; their model illustrates that because of the increases in the education price arising from the demand by the rich, the poor are gradually excluded from higher education, and consequently, income inequality between the rich and poor expands in the long run.
labour-sending countries. However, unlike previous analyses, in our model lower migration possibilities affect the individual demand for education and human capital formation positively. Favourable effects of restrictive migration polices on human capital formation have been left unnoticed by the previous studies.

The remainder of this paper is organised as follows: Section 2 models a two-country economy with migration possibilities from the home country to the foreign country. We assume that workers in the home country are heterogeneous and that there is an education market in the home country. Section 3 examines the effects of migration possibilities on the demand for education. Section 4 examines the effects of migration possibilities on the average human capital, and draws inferences on the outcome of restrictive migration policies through brain gain and/or brain drain. Section 5 provides concluding remarks.

2. The Model

We assume that an economy consists of home and foreign countries. Workers in the home country are heterogeneous in their innate ability and live for two periods. Workers are employed for both periods. In the first period, their productivity is determined by their innate ability. Although they may obtain education by paying its cost privately and build human capital during the first period, productivity increases due to human capital formation realise only in the second period. In addition, they have migration possibilities to the foreign country in the second period. They can earn higher wages in the foreign country.

We incorporate the resource market for human capital formation, i.e. the education market into the home country. Education is transacted competitively. Workers in the home country pay for their education privately and demand education in order to maximise their net earnings, i.e. the sum of wages in the first and second periods minus the education cost.
The worker, \( i \), has innate ability, \( a_i \). Innate ability is measured in efficiency units of labour and is distributed uniformly between \( \varepsilon \) and \( 1 + \varepsilon \), where \( \varepsilon \) is positive. In the first period, worker \( i \)'s efficiency units of labour is equal to \( a_i \). While working in the first period, he/she may demand education by \( e_i \) (> 1) and forms human capital by \( \ln e_i \). This raises his/her efficiency units of labour to \( a_i (1 + \ln e_i) \) in the second period. If he/she cannot pay for education privately due to the budget constraint, he/she receives education that is provided publicly by one unit. In such a case, his/her efficiency units of labour in the second period do not increase.

To demand education by \( e_i \) (> 1), worker \( i \) has to pay the pecuniary cost in the first period by \( \bar{c} + pe_i \), where \( \bar{c} \) (> 0) is a constant denoting the fixed cost for receiving education, expressed in pecuniary terms, and \( p \) is the price of education determined to equalise the demand and supply of education. Unlike Stark et al. (1998), workers in the home country are assumed to work for fixed hours, a frequent case in actual economies where working hours are given for many workers. Accordingly, gross earnings in the first period do not change, even if workers receive education.

In the second period, workers in the home country have migration possibilities to the foreign country with \( \theta \), where \( \theta \) is given exogenously and \( 0 < \theta < 1 \). Whether they have accumulated human capital in the first period or not, all workers in the home country have the same migration possibilities. That is, there is no selection of migrant workers on the part of the foreign country. Accordingly, \( \theta \) of the home country’s workers move to the foreign country in the second period.

Since worker \( i \) has to pay the education cost with his/her earnings, the cost must not exceed the sum of his/her wages. Particularly when demanding education, his net earnings have to be non-negative, i.e.

\[
a_i w_{it} - \bar{c} - pe_i + \rho a_i (1 + \ln e_i) \{\theta w_{it} + (1 - \theta)w_{it}\} \geq 0.
\]

We assume that worker \( i \) demands education to maximise his/her net earnings,

\[
U_i = a_i w_{it} - \bar{c} - pe_i + \rho a_i (1 + \ln e_i) \{\theta w_{it} + (1 - \theta)w_{it}\},
\]  
(1)
where $U_i$ is his/her utility, $w_h$ and $w_f$ ($> w_h > 0$) are wages per efficiency unit of labour in home and foreign countries, respectively, and $\rho$, where $0 < \rho \leq 1$ is the subjective time rate of discount. Apparently, we can assume worker $i$’s objective in a different manner, but in most cases, his/her utility increases with his/her net earnings. Accordingly, we represent it by them.\(^9\)

### 3. Effects of Migration Possibilities on the Demand for Education

In this section, we examine how migration possibilities affect the demand for education by workers in the home country. In particular, we attempt to find whether the number of workers who satisfy the budget constraint and demand education will increase and whether such workers will raise their individual demand for education due to higher migration possibilities.

We assume that the worker with innate ability, $\tilde{a}$, where $\varepsilon < \tilde{a} < 1 + \varepsilon$ satisfies the budget constraint with an equality, i.e. $U_i\big|_{a_i = \tilde{a}} = 0$. Subsequently, we show that by adding assumptions on $\tilde{c}$, the worker $i$ with innate ability, $a_i \in (\tilde{a}, 1 + \varepsilon]$, satisfies the budget constraint with an inequality, i.e. $U_i\big|_{\tilde{a} < a_i < 1 + \varepsilon} > 0$, and demands education. Whereas the worker with innate ability, $a_i \in [\varepsilon, \tilde{a})$, does not satisfy the budget constraint, i.e. $U_i\big|_{\varepsilon < a_i < \tilde{a}} < 0$, and thereby, cannot demand education. $\tilde{a}$ is an endogenous variable that is affected by $\theta$.

We derive the demand for education by the worker with innate ability, $a_i \in [\tilde{a}, 1 + \varepsilon]$, from $dU_i/d\tilde{e}_i = 0$. If he/she satisfies the budget constraint, then he/she demands it by

$$e_i = \frac{\rho a_i \{\theta w_f + (1 - \theta)w_h\}}{\rho}.$$  \hspace{1cm} (2)

Worker $i$ demands a larger amount of education if he/she is more innately talented or if migration

\(^9\) If a worker cannot satisfy his budget constraint, his/her utility function will take a different form from Equation (1) since he does not have to pay the cost for education privately. However, in such a case, his/her utility is a constant since the amount of education he/she receives is given to be one.
possibilities are higher since they raise the return on education \((\partial e_i / \partial \alpha_i > 0, \partial e_i / \partial \theta > 0)\). The higher price of education decreases his/her demand for education since the higher cost lowers its return \((\partial e_i / \partial p < 0)\).

Summing up an individual demand for education, the home country’s aggregate demand for education \(D\) is

\[
D = \int [\rho \alpha_i \{(1 - \theta)w_{iH}\}/p]da_i
\]

\[
= \frac{\rho\{(1 - \theta)w_{iH}\} (1 + \varepsilon)^2 - \tilde{a}^2}{2}.
\]

We assume that the home country’s aggregate supply of education is a constant,

\(S = \tilde{b}.\)

To be certain, we can make the supply of education dependent on its price and other variables. However, it will be inelastic in the short run, since the quantity of an effective education is determined not only by the quantity itself, such as the number of teachers or schools, but also by the quality, such as the provision of well-designed academic programs (World Bank, 2000) which is difficult to improve in a short instance. The supply of education is not necessarily large.

Assuming that the education market is competitive, the equilibrium condition \(D = S\) provides us with its equilibrium price.

\[
p = \frac{\rho\{(1 - \theta)w_{iH}\} (1 + \varepsilon)^2 - \tilde{a}^2}{2} (\equiv p(\tilde{a}, \theta)), \tag{3}
\]

where \(\tilde{a}\) is given exogenously here (subsequently, we illustrate how it will be affected by \(\theta\)). If \(\tilde{a}\) is smaller, that is, if a larger number of workers satisfy the budget constraint and demand education, then the aggregate demand is larger. As a result, the price is higher \((\partial p(\tilde{a}, \theta)/\partial \tilde{a} (\equiv p_{\tilde{a}}) < 0)\). Higher migration possibilities raise the return on education and thereby increase the aggregate demand, leading to the higher price \((\partial p(\tilde{a}, \theta)/\partial \theta > 0)\).
By substituting Equation (3) into Equation (2), worker i’s education demand is

\[ e_i = \frac{2\beta a_i}{(1 + \varepsilon)^2 - \bar{a}^2} (\equiv e_i(a_i, \bar{a})), \]

(4)

where \( \bar{a} \) is given exogenous here. A higher innate ability makes the individual demand for education larger since it makes the return on education higher. As a consequence, the individual demand increases with innate ability \((\partial e_i(a_i, \bar{a})/\partial a_i > 0)\). The larger is \( \bar{a} \), the lower is the price, as a smaller number of workers demand education. This induces individuals to demand more education \((\partial e_i(a_i, \bar{a})/\partial \bar{a} > 0)\). Migration possibilities raise the individual demand for education, owing to increases in its return, but this, in turn, increases the price, i.e. decreases its return and reduces its demand. The former positive effect is completely offset by the latter negative effect.

Therefore, through these effects, migration possibilities have no impact on the individual demand for education (however, we subsequently show that migration possibilities affect the individual demand through the effects on \( \bar{a} \)).

By substituting Equations (3) and (4) into Equation (1) and differentiating the resulting equation with respect to \( a_i \), we find that net earnings increase with innate ability, i.e. \( dU_i/da_i > 0 \). In other words, an individual worker attains larger net earnings if he/she is more innately talented.

We assume that the value of \( \bar{\varepsilon} \) is such that \( U_i\big|_{a_i=\varepsilon} < 0 \) and \( U_i\big|_{a_i=1+\varepsilon} > 0 \). Under such an additional assumption, as we conjectured, the worker with innate ability \( a_i \in (\bar{a}, 1 + \varepsilon] \) satisfies the budget constraint with the inequality, i.e. \( U_i\big|_{1 < a_i \leq 1+\varepsilon} > 0 \), and demands education, whereas the worker with innate ability, \( a_i \in [\varepsilon, \bar{a}) \), does not satisfy the budget constraint, i.e. \( U_i\big|_{\varepsilon < a_i < \bar{a}} < 0 \), and cannot demand education.

\[ dU_i/da_i = w_H + \rho[1 + \ln 2\bar{a} a_i((1 + \varepsilon)^2 - \bar{a}^2)^{-1}] \{\partial w_F + (1 - \theta)w_H\}. \]

\[ U_i\big|_{a_i=\varepsilon} = \varepsilon w_H + \rho\varepsilon[\ln 2\bar{a} \varepsilon((1 + \varepsilon)^2 - \bar{a}^2)^{-1}] \{\partial w_F + (1 - \theta)w_H\} - \bar{\varepsilon}. \]

\[ U_i\big|_{a_i=1+\varepsilon} = (1 + \varepsilon)w_H + \rho(1 + \varepsilon)[\ln 2\bar{a}(1 + \varepsilon)((1 + \varepsilon)^2 - \bar{a}^2)^{-1}] \{\partial w_F + (1 - \theta)w_H\} - \bar{\varepsilon}. \]
From Equation (4), the worker with innate ability \( \tilde{a} \) demands education by

\[
e_{\mid a=\tilde{a}} = \frac{2\beta \tilde{a}}{(1+\varepsilon)^2 - \tilde{a}^2} (\equiv \bar{e} (\tilde{a})).
\] (5)

To illustrate how migration possibilities affect \( \tilde{a} \), we substitute Equations (3) and (5) into Equation (1). From the assumption that \( U_{\mid a=\tilde{a}} = 0 \), we have

\[
\tilde{a}w_{H} - \bar{e} - p(\tilde{a},\theta)\bar{e} (\tilde{a}) + \rho \tilde{a} \{1 + \ln \bar{e} (\tilde{a})\} \{\theta w_{F} + (1-\theta)w_{H}\} = 0.
\]

Totally differentiating this equation with respect to \( \tilde{a} \) and \( \theta \), we derive

\[
Ad\tilde{a} + Bd\theta = 0,
\]

where

\[
A \equiv \frac{\partial U}{\partial \tilde{a}}_{\mid a=\tilde{a}} = w_{H} - p_{\tilde{a}}\bar{e} (\tilde{a}) + \rho \{1 + \ln \bar{e} (\tilde{a})\} \{\theta w_{F} + (1-\theta)w_{H}\}>0,
\]

\[
B \equiv \frac{\partial U}{\partial \theta}_{\mid a=\tilde{a}} = \rho (w_{F} - w_{H})\tilde{a} \ln \bar{e} (\tilde{a}) > 0.
\]

As \( \tilde{a} \) is larger, i.e. as the number of workers who satisfy the budget constraint is smaller, net earnings are larger (\( A > 0 \)). Since higher migration possibilities raise the return on education, this increases net earnings by \( \rho(w_{F} - w_{H})\tilde{a}\{1 + \ln \bar{e} (\tilde{a})\} \). Conversely, they increase the price and reduce net earnings by \( -\rho(w_{F} - w_{H})\tilde{a} \). Because the former positive effect outweighs the latter negative effect, higher migration possibilities lead to larger net earnings (\( B > 0 \)).

Accordingly,

\[
\frac{d\tilde{a}}{d\theta} < 0.
\] (6)

Therefore, the number of workers who satisfy the budget constraint and demand education increases with migration possibilities. This will probably have a positive effect on the economy’s overall human capital formation.

From Equations (3) and (6), migration possibilities increase the equilibrium price of education, both directly and indirectly through decreases in \( \tilde{a} \)

\[
\frac{dp}{d\theta} = \frac{\partial p(\tilde{a},\theta)}{\partial \theta} + \frac{\partial p(\tilde{a},\theta)}{\partial \tilde{a}} \frac{d\tilde{a}}{d\theta} > 0.
\] (7)

The higher return on education raises the individual demand for education, leading to a larger
aggregate demand and the higher price. This effect is described by the first term on the right-hand side on Equation (7). In addition, higher migration possibilities increase the number of workers who satisfy the budget constraint. This makes the aggregate demand larger and thereby the price higher. The second term on the right-hand side on Equation (7) corresponds to this effect.

We determine how migration possibilities affect the equilibrium amount of education for the worker with innate ability, \( a_i \in (\bar{a}, 1 + \epsilon) \), from Equations (4) and (6).

\[
\frac{de_i}{d\theta} = \hat{c}e_i (a_i, \bar{a}) \bar{d}a < 0.
\]  

(8)

As we have already shown, higher migration possibilities increase the number of workers who satisfy the budget constraint. This increases the price and thereby reduces the equilibrium amount of education for the individual worker.\(^{12}\) This will probably have a negative effect on the economy’s overall human capital formation.

To summarise, migration possibilities raise the return on education, and enable more workers to satisfy the budget constraint and demand education. However, at the same time, through increases in the education price, higher migration possibilities lower the return on education, and reduce such workers’ individual demand for education.

4. Effects of Migration Possibilities on the Average Human Capital

In this section, we examine how migration possibilities increase or decrease the home country’s average human capital, i.e. whether workers in that country experience brain gain or brain drain, and draw its implications for the effect of the labour-receiving countries’ restrictive migration

\(^{12}\) As mentioned, migration possibilities raise the individual demand for education, but this effect is absolutely offset by an increase in the education price. Therefore, migration possibilities do not have any effects on the individual demand for education through these effects.
policies on the labour-sending countries.

At the end of the first period, the home country’s average human capital in terms of efficiency units of labour is equal to

$$
\int_{\varepsilon}^{\bar{a}} a_i da_i + \int_{\mu}^{1+\varepsilon} a_i [1 + \ln e_i (a_i, \bar{a})] da_i (\equiv AHC_1). \tag{9}
$$

$AHC_1$ can be calculated as

$$
\frac{1 + 2\varepsilon + \bar{a}^2 - \varepsilon^2}{4} + \frac{(1 + \varepsilon)^2}{2} \ln \frac{2\bar{b}(1 + \varepsilon)}{(1 + \varepsilon)^2 - \bar{a}^2} - \frac{\bar{a}^2}{2} \ln \frac{2\bar{b}\bar{a}}{(1 + \varepsilon)^2 - \bar{a}^2}.
$$

This is positive.

According to Equation (9), migration possibilities affect the average human capital at the end of the first period through the changes in the aggregate demand for education by workers who satisfy the budget constraint. Regarding this, we have derived two opposing effects: the positive effect on the number of workers who actually demand education (Equation 6) and the negative effect on the individual demand for education (Equation 8). We infer that the former positive effect increases $AHC_1$, whereas the latter negative effect decreases $AHC_1$.

Since

$$
\frac{dAHC_1}{d\theta} = \bar{a} \left[ 1 - \ln \frac{2\bar{b}\bar{a}}{(1 + \varepsilon)^2 - \bar{a}^2} \right] \frac{d\bar{a}}{d\theta}, \tag{10}
$$

we cannot determine generally whether migration possibilities increase or decrease the average human capital before migration. Higher migration possibilities raise the return on education by increasing the possibility to receive higher wages in the foreign country. However, they also lower the return on education by raising the education price. Moreover, we cannot establish whether the net return on education is positive or negative. As a result, we cannot determine in general whether human capital formation will be encouraged or discouraged. If the education market did not exist as assumed by previous studies, then the latter negative effect would be non-existent and workers would be always encouraged to accumulate human capital.
However, if we put an additional assumption on the availability of education in the home country, then we find that $dAHC_i/d\theta < 0$ if $\tilde{b}$ is small such that $1 > \ln[2\tilde{b}\tilde{a}/\{(1+\varepsilon)^2 - \tilde{a}^2\}]$, and $dAHC_i/d\theta > 0$ if $\tilde{b}$ is large such that $1 < \ln[2\tilde{b}\tilde{a}/\{(1+\varepsilon)^2 - \tilde{a}^2\}]$. If the supply of education is small, then the negative effect dominates and human capital formation will be discouraged by higher migration possibilities. In the opposite case in which the supply of education is large, the positive effect dominates and human capital formation will be encouraged.

In the second period, from the assumption, $\theta$ of the home country’s workers migrate to the foreign country. Accordingly, at the end of the second period, the home country’s average human capital will be $(1-\theta)AHC_i (= AHC_2)$, and the effect of migration possibilities can be expressed as

$$
\frac{dAHC_2}{d\theta} = -AHC_1 + (1-\theta)\frac{dAHC_1}{d\theta}.
$$

(11)

Since higher migration possibilities lower the number of workers who remain in the home country after migration, the average human capital becomes smaller (the first term on the right-hand side of Equation 11). On the other hand, as Equation (10) suggests, higher migration possibilities either encourage or discourage human capital formation in the first period, depending on the size of $\tilde{b}$ (the second term on the right-hand side of Equation 11). Accordingly, it is impossible to determine in general how migration possibilities affect the average human capital after migration.

However, if the home country’s supply of education is small, then from Equations (10) and (11) migration possibilities certainly lower the average human capital at the end of the second. In other words, if the home country cannot provide education sufficiently, then workers in that country experience brain drain after some of them have left the country as the foreign country takes a more positive attitude towards accepting migrants. In our model, higher migration possibilities not only increase the outflow of workers in the second period but also discourage workers from
accumulating human capital in the first period if the education supply is limited. Accordingly, the post-migration average human capital is always smaller as workers are more likely accepted into the foreign country. There is no possibility that workers in the home country experience brain gain after migration has occurred. This result is contrasted with those by previous analyses, according that brain gain may occur with increases in migration possibilities after migration. It is true that a larger number of workers leave the home country at the end of the second period, but higher migration possibilities increase the return on education and encourage workers to accumulate human capital in the first period. This is because in their model there is no education market and no negative effect arising from the higher education price.

Our results conversely suggest that restrictive migration policies implemented by many labour-receiving developed countries will increase the post-migration average human capital of labour-sending developing countries, in which education is usually inadequately supplied.

Under such policies, as we expect, the outflow of workers will be checked and this will prevent the loss of human capital. In addition, contrasted with the previous analyses, individual demand for education by those who can afford it increases, and this contributes to human capital formation. This is because in our model the education price decreases as migration possibilities decreases. An opposite effect is operative in the previous analyses. Since the education market does not exit in their models, lower migration possibilities only lower the return on education. As a result, human capital formation is always hampered. This suggests that the positive effect of restrictive migration policies on the post-migration average human capital is much stronger in our analysis than in previous ones.

Therefore, we conclude that labour-receiving developed countries’ restrictive attitude can have the beneficial effect on labour-sending developing countries through brain gain.

To summarise results, we cannot determine the effect of migration possibilities on the home
country’s average human capital in general. However, if the home country’s supply of education is small, then higher migration possibilities decrease the average human capital after some of the workers in the home country have migrated to the foreign country. This conversely suggests that a labour-receiving developed countries’ restrictive attitude towards migrants will generate positive effects on labour-sending developing countries through brain gain.

5. Concluding Remarks

Recent studies on migration have indicated the possibility that emigration may have positive impacts on the home country. Migration prospects may encourage workers in the home country to build larger human capital. As a result, workers in that country may experience brain gain as well as brain drain.

Most of these studies implicitly assumed that workers can obtain as much education as they want and that they do not have to pay any pecuniary costs. However, these assumptions are not very realistic. We cannot supply education elastically and free. Many developing countries cannot provide adequate education to their people, and even in developed countries we have to pay part or all of the pecuniary cost when we receive tertiary education. Moreover, there is a growing trend of education markets becoming more competitive. Given these facts, we assumed that the supply of education is not necessarily large, workers pay the pecuniary cost for education, and its price is determined competitively in the education market. Most importantly, we assumed that they have to satisfy the budget constraint to demand education.

We found that migration possibilities increase the number of workers who demand education, but they reduce such workers’ individual demand for education. Based on this, we found that the home country’s average human capital decreases with migration possibilities if that country cannot supply education sufficiently. From this, we derived an inference that restrictive migration
policies by the labour-receiving countries increase the post-migration average human capital of the labour-sending countries in which the supply of education is not sufficient.

Today labour-receiving developed countries are becoming restrictive and selective in accepting them. Such a situation will not change soon. In addition, labour-sending developing countries will not be able to overcome the insufficient provision of education easily. We attempted to clarify how these trends affect labour-sending countries. Contrary to our intuition, the results derived in this paper were not necessarily negative.

We normally expect that restrictive migration policies of labour-receiving countries will reduce the number of emigrants from labour-sending countries, and thereby alleviate the outflow of human capital. However, in our analyses, positive effects of such policies also came from increased human capital formation due to lower migration possibilities. This is in a stark contrast with previous analyses; according to which lower migration possibilities discourage workers from accumulating human capital. Differences in these results are associated with existence or non-existence of the education market and the effects of the education price on its demand.

In the process of derivation, we put forth simplifying assumptions such as the competitiveness of the education market, the private financing of education, no selection of immigrants on the part of labour-receiving countries, and no intergenerational relationship. We can extend our analysis by relaxing these assumptions.
References


University of London in June 2011, the 2011 Asian Meeting of the *Econometric Society* held at Korea University in August 2011, and the 2011 Autumn Meeting of the *Japanese Economic Association* held at University of Tsukuba in October 2011.


