Increasing the Effectiveness of the Study Migrants' Acceptance Policy[*]

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This study investigates analytically how the country can increase the effectiveness of the study migrants' acceptance policy. In particular, this study attempts to find a way of increasing domestic human capital by accepting study migrants. This study reveals that to raise the effectiveness of the policy, the host country's government should regulate acceptance according to their innate ability. Also, if unskilled regular jobs are available to study migrants in the host country after education, the host country's government should implement policies to encourage them to receive an education.

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1. INTRODUCTION

This study deals with the problem of human capital accumulation under the mobility of workers and students. This study investigates analytically how we can raise the effectiveness of the study migrants' acceptance policy in increasing the host country's human capital. This study draws attention to the case in which study migrants can be employed in both skilled and unskilled jobs as regular workers in the host country after education. Also, unlike previous analyses, this study combines labor migration with study migration in a dynamic context.

Globalization has increased the mobility of workers and students. People do not necessarily receive education or provide labor in their home countries. As a result, both the inflow and the outflow of human capital from a country have become more likely.

To increase domestic human capital, many countries have attempted to accept skilled workers from abroad. However, such a policy was not easy to accomplish since competition for skilled workers has become fierce among countries. Additionally, the human capital that migrant workers bring is not necessarily suitable to the host country. Their human capital does not always increase the host country's total human capital.

As a complement to this policy, some governments have begun to accept study migrants. Rather than *importing* it, the study migrants' acceptance policy aims to *produce* human capital domestically. It is implicitly assumed that providing migrants with an education helps build human capital *transferable* to the host country and they tend to remain in the country after education to work. Such a policy is beneficial both to the host country and to study migrants and has been implemented in many countries, including Korea and Japan.[1]

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[1] Of course, the educational investment is not always the most effective way to accumulate domestic human capital. According to Chun *et al*. (2012), for the Korean economy, the subsidy to the R&D investment is more effective to improve productivity than to the educational investment.

However, the effectiveness of the study migrants' acceptance policy has not been examined empirically until now, partly because it has been difficult to collect the relevant data.

As for the problems with theoretical analyses on this issue, we tended to imagine the situations in which migrants are not allowed to take unskilled jobs as regular workers even if such jobs exist, or in which migrants who received an education in the host country do not opt for unskilled jobs after education even if they can be formally employed as regular unskilled workers. This is because many countries have been focusing on filling *skilled* jobs that cannot be filled by native workers and also because many of study migrants are assumed to be aiming to build human capital by studying abroad to take skilled jobs.

In the actual economy, however, it is often the case that migrants cannot avoid taking unskilled jobs. Natives usually do not want to take unskilled jobs, and such jobs tend to be relegated to migrants. By redefining or widening the definition of the skilled job, migrants can do the regular job that does not require the skill even though they are formally categorized as regular 'skilled' workers (Oishi, 2020). They are actually regular unskilled workers. If migrants are not allowed to become regular unskilled workers, unskilled jobs are done by non-regular migrants' workers.[2] Additionally, it is not easy for migrants to find a skilled job even if they have built sufficient human capital. They are faced with language and other barriers when trying to participate in the host country's skilled labor market.

It can be easily inferred that such undesirable situations likely affect their demand for education and human capital formation although previous

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[2] Like many other developed countries, Japan has been suffering from unskilled labor shortages. However, it has been restrictive in accepting unskilled labor migrants. Given this government policy, many study migrants supplied unskilled labor. This was realized because, as Tsuda and Cornelius (2004, pp. 456-457) and Liu-Farrer (2011, pp. 64-70) delineated, many foreign students, especially those from China had to do the unskilled part-time job to live and to receive education in Japan. Japan's immigration policy shifted to expanding the acceptance of unskilled migrants in 2018 (Song, 2020). Nonetheless, the situation surrounding study migrants has not changed yet significantly for now.

analyses did not pay sufficient attention. If we are to find the study migrants' acceptance policy that works effectively, we must take such situations into account explicitly.

Based on this reasoning, this study investigates how the host country can effectively implement the study migrants' acceptance policy to increase domestic human capital, assuming two cases in which the migrants' employment opportunities are limited to regular skilled jobs and in which migrants can apply not only for regular skilled jobs but also for regular unskilled jobs.

For this purpose, this study builds a small open economic model with overlapping generations that accepts study migrants from abroad.

This study finds that by implementing the study migrants' acceptance policy, the small open economy can make the average human capital larger than otherwise under a certain condition. Also, the economy can raise the effectiveness of the study migrants' acceptance policy by controlling the quality of study migrants.

This study further finds that the average human capital in the host country can be smaller when migrants can be employed as regular unskilled workers as well as regular skilled ones than when their regular employment opportunities are limited to the skilled job. This result stems from the change in utility derived from the time not spent for education due to the availability of the regular unskilled job. However, this happens not only by such a change in utility but also by the changes in the skilled jobs' employment probability for migrants caused by the change in utility.

This study makes two contributions to the literature on migration and human capital. One contribution is that this study combines study migration and labor migration in an identical dynamic model. Both types of migration are related, but they have been often analyzed separately. Another contribution is that it identifies both the limited effects of the study migrants' acceptance policy and the necessity of implementing additional policies.

This study has the following structure: Section 2 reviews related literature

on study migration and labor migration.   Section 3 presents the model.
Section 4 solves the model and derives the dynamics of human capital
formation.   Section 5 examines the effectiveness of study migrants'
acceptance policy when regular unskilled jobs are not available to migrants
and discusses how the government should accept study migrants.   Section 6
considers what will happen to the host country's human capital when regular
unskilled jobs are also available to the migrants and what should be done in
such a situation.   Section 7 provides concluding remarks.

2. LITERATURE REVIEW

Globalization has raised the mobility of students, especially those in
tertiary education.   Organization for Economic Co-operation and
Development (OECD) (2019) estimated that the worldwide total of foreign
students in tertiary education programs was 5.3 million in 2017.   It was 2
million in 1998, suggesting that it has grown an average of about 5.8%
annually.

One of the reasons for such a huge increase is that studying abroad enables
students to derive a better economic outcome in the labor market (see
Burmann and Delius, 2017).   Di Pietro (2015) found that in Italy, graduates
are more likely employed by about 23 percentage points after graduation if
they studied abroad, compared with those that didn't receive the overseas
education.

Of course, globalization has also raised the number of labor migrants (see
Docquier and Rapport, 2012).   They cross borders seeking better
employment opportunities. International Labour Organization (ILO) (2018)
estimated that there were 164 million international migrant workers in 2017.
This was about a 9% increase from 150 million in 2013.

The increase in labor migration has brought about the problem of the
decrease in the human capital of the labor-sending country.   Bhagwati and
Hamada (1974) and others argued that the labor-sending countries likely

experience the outflow of human capital.   On the other hand, more recent studies have focused on the positive effect of migration.   According to Mountford (1997) and others, emigration or the possibility to emigrate to a labor-receiving country with higher wages encourages workers to seek higher education at home.   Because some of those who accumulated human capital end up with non-migration and remain in the labor-sending country, they contribute to the accumulation of the labor-sending country's human capital. Accordingly, emigration or its possibilities may increase the human capital of the labor-sending country.   However, it has not been determined whether the latter positive effect actually outweighs the former negative effect.   Beine *et al*. (2011) showed that the positive effect may dominate and the brain gain may occur in the low-income country, whereas the negative effect may dominate and the brain drain may occur in the middle- and high-income countries.   Also, whether the brain gain or the brain drain will occur also depends on the kind of education provided to build human capital.   Shimada (2019a) found that education's globalization does not necessarily contribute to the human capital formation of the labor-sending country.

   Given this complicated situation, many countries have attempted to receive skilled workers from abroad to increase domestic human capital.   However, competition is fierce among countries, and it is not easy to attract such workers (see United Nations Department of Economic and Social Affairs (UN DESA), 2013).   Moreover, even if a country was successful in attracting highly-skilled workers, their human capital would not be fully transferable to the labor-receiving country, and they would not necessarily contribute to a host country's human capital accumulation (see Docquier and Rapoport, 2012).   Tzanakou and Behle (2017), Boyd and Tian (2018) and others offered evidence of the low transferability of human capital.   For these reasons, the skilled labor migrants' acceptance policy has not been very successful.[3]

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[3] Shimada (2019c) investigated analytically whether the *labor-sending* country's domestic human capital increases or decreases due to emigration of native workers in steady state and the short run.   He found that the labor-sending country's human capital accumulation

To complement this policy, some countries introduced the study migrants' acceptance policy.   Such a policy was conducted by taking advantage of the recent phenomenon in which study migration likely accompanies labor migration.   As previously mentioned, this is because study migration benefits students if they remain in the host country to work after education. It also benefits the host country.   Since study migrants' human capital tends to be transferable to the host country, those who remain to work after education will contribute to the host country's human capital accumulation (see Gribble, 2008; Organization for Economic Co-operation and Development (OECD), 2019).   Some countries have actually relaxed their immigration policies by devising visa schemes to allow study migrants to easily work in the country after education (see Grimm, 2019).

Many studies were conducted on study migration, but most of them focused on the exploration of the causes of study migration (see Rachaniotis *et al*., 2013; Beine *et al*., 2014; Abbott and Silles, 2016).

Given the close relationship between study migration and labor migration, both must be assumed simultaneously in an identical setup if we are to examine the effects of the study migrants' acceptance policy on human capital accumulation more accurately.   However, such an attempt has been rare.   Bergerhoff *et al*. (2013) is one of them.   They combined study migration with labor migration in a dynamic economic model.   Although it was not dynamic, Shimada (2019b) assumed an economy in which individuals can move to the foreign country to receive education and/or to work.   He found that the developed country, faced with the small wage disparity with the destination, can get rid of the brain drain if the government pays education subsidies to students appropriately.

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is related to the transferability of emigrants' human capital to the labor-receiving country.

3. MODEL

This study assumes a small open economy, connected to the rest of the world via migration. It is implicitly assumed that this small open economy suffers from the skilled labor shortage. Migrants come to this economy to receive an education when they are young. It is implicitly assumed that they migrate from the developing countries. They begin as study migrants. They do a part-time job while receiving an education. They prefer to and may actually remain to work in this economy after education when they are old. This means they may also become labor migrants. Some migrants may be employed in a skilled job — a job that needs human capital to do it— as regular workers. If it is formally permitted to employ migrants in an unskilled job—a job that does not require human capital — as well, they can also become regular unskilled workers. The model assumes that natives do not take the unskilled job although such a job always exists, and it must be done. This economy turns to migrants for the provision of unskilled labor. In a case where migrants who finished education are not allowed to become regular unskilled workers, the unskilled work is done by study migrants as their part-time job. They do such a job because, as mentioned above, they are from the developing countries and they need to work to earn a living and to finance education. Furthermore, if migrants are not employed in the small open economy, they have no other way than to return to their home countries to work. All jobs are assumed to be unskilled ones in their home countries. This is partly a simplification. However, as assumed above, they are from the developing countries and even if the prestigious jobs that need high skill exist in their home countries, such jobs are very few and employment possibilities are very low.

Natives and migrants are homogenous, respectively. Both live for two periods. The ratio of natives in the young generation is $0 < 1-\theta \leq 1$ and that for migrants is θ. It is assumed that the government can accept study migrants as many as they want. In general, the decision-making of the educated migrants, i.e., whether to attempt to work in this economy or not

after education, affects the number of foreign students who wish to study in the small open economy.   However, given higher wages in this economy, there always exist a sufficient number of foreign students and the government admits them by $\{\theta/(1-\theta)\}\times$ the number of natives in the young age.

In the first period of life — the young age — both natives and migrants receive education in the small open economy.   In the second period — the old age — both natives and migrants work.   Migrants work either in the small open economy or in their home countries.   They first seek employment opportunities in the small open economy since only unskilled jobs are available in their home countries, and wages and employment opportunities there are smaller than in the small open economy.   The model also assumes that natives work only in the small open economy, that is, they do not emigrate to work.

All natives in the old age are employed in a skilled job as regular workers, but they are not enough to fill the vacancy.   Firms in the small open economy have no other way than to turn to migrants who finished education in this economy (since labor migrants are not accepted).   However, they do not employ migrants as regular skilled workers unconditionally. They prefer to employ migrants with larger human capital relative to natives' since such migrants more likely contribute to firms' profits.   This study assumes implicitly that as a result of firms' profit maximization, migrants with larger human capital relative to natives' are more likely employed by firms.   In other words, denoting the migrants' employment probability for the skilled job as a regular worker in the small open economy in period $t+1$ by $0 < p_{S,t+1} < 1$, this probability increases with individual migrants' human capital in period $t+1$ relative to the individual natives' human capital in period $t+1$. Wages per efficiency of the skilled job are 1 for both natives and migrants.

The migrants' employment probability for the unskilled job as a regular worker in the small open economy in period $t+1$ is denoted by $0 \le p_{U,t+1} < 1$. This is given exogenously and does not change with the

level of individuals' human capital since human capital is not necessary for this job. In a case where migrants are not formally admitted to becoming regular unskilled workers, the quota for the unskilled job and the employment probability are both 0. In another case where they can be employed as regular unskilled workers, a certain positive amount of the quota is set by the government, and the employment probability is the ratio of the quota for unskilled jobs to the number of migrants who finished their education. Wages per efficiency for the unskilled job in the small open economy when it is done by regular migrant workers are $0 < \tilde{w} < 1$.

Accordingly, the migrants' probability of returning to their home countries is $1 - p_{S,t+1} - p_{U,t+1}$. The model assumes that even if migrants can be employed in the unskilled job as regular workers in the small open economy, the quota is sufficiently small so that $1 - p_{S,t+1} - p_{U,t+1} > 0$ and migrants cannot be employed with certainty after education in the small open economy. The employment probability in their home countries is $0 < p_{U,t+1}^* < 1$, which is smaller than $p_{U,t+1}$ when $p_{U,t+1}$ is positive. Wages per efficiency in their home countries are $0 < w^* < \tilde{w}$. The employment probability and wages per efficiency in their home countries are given exogenously.

Natives and migrants have different innate abilities. The innate ability of a native is equal to 1, and that of a migrant is $a > 0$.[4] It is implicitly assumed that the government of the small open economy can accept study migrants whose innate ability is *equal to* or *higher than* a certain level set by them. This suggests that the government cannot observe the innate ability of study migrants perfectly.

A native in the young age receives an education by $e_{n,t}$ in period t to build human capital. The intergenerational externality is operative in forming human capital. In particular, average human capital existent in

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[4] It is possible to introduce into the present analysis the mechanism that promotes the human capital investment by study migrants with high innate ability without changing the main results. Refer to the footnote of equation (3) for such a mechanism.

period t helps a young native in that period build the human capital.   In the old age, i.e., in period $t+1$, the native provides one unit of labor for the skilled job, utilising human capital built in the young age.

$$h_{n,t+1} = e_{n,t}^{\alpha} h_t^{\beta}, \ 0 < \alpha, \beta, \alpha + \beta < 1, \tag{1}$$

where h_t is the average human capital of the small open economy in period t, defined as $h_t \equiv (1-\theta)h_{n,t} + p_{S,t}\theta h_{m,t}$, $h_{n,t}$ is the average human capital of natives in period t who received their educations in period $t-1$ and work in period t, and $h_{m,t}$ is the average human capital of migrants in period t who received education in period $t-1$ and remain to provide skilled labor in the small open economy in period t.

Natives finance their education privately.   This assumption reflects the growing trend surrounding education and the fact that the government's incentive for public funding of internationally applicable education is smaller when students are mobile (see Justman and Thisse, 1997; Poutvaara, 2004; 2008) although this study does not specify the type of education.   The pecuniary cost to receive education for a unit of time is 1.   Under this assumption, net income in the old age of a native is $e_{n,t}^{\alpha} h_t^{\beta} - e_{n,t}$, where the time discount factor is not included for simplicity.

A native derives utility from net income in the old age.   Utility is also derived non-pecuniarily in the young age.   In particular, leisure in the young age — time spent not for the study, i.e., $\bar{L} - e_{t,n}$ — provides natives with utility, where $\bar{L}$ denotes total leisure available in the young age.   Education increases utility by generating human capital and income but deprives students of leisure.   Education indeed provides pleasure and satisfaction, but it also reduces the time available for non-educational activities.   The negative effect arising from the reduced leisure at the young age due to education cannot be disregarded.

Accordingly, lifetime utility of an individual native can be represented as

$$u_{n,t,t+1} = e_{n,t}^{\alpha} h_t^{\beta} - e_{n,t} + \bar{b}_n (\bar{L} - e_{n,t}), \tag{2}$$

where $\bar{b}_n > 0$ is a coefficient that measures the native's relative weight of utility derived from leisure to that from net income. The coefficient $\bar{b}_n$ does not change throughout the analysis. The time discount factor is disregarded for simplicity.

An individual native demands education to maximize utility. The maximization problem for a native is summarized as

$$\max_{e_{n,t}} u_{n,t,t+1}.$$

A migrant receives education by $e_{m,t}$ in period t in the small open economy. Intergenerational externality operates in the same manner as it does for natives' human capital formation.

$$h_{m,t+1} = ae_{m,t}^{\alpha}h^{\beta}. \tag{3)[5]}$$

Migrant's expected earnings for a skilled job are $p_{S,t+1}ae_{m,t}^{\alpha}h_t^{\beta}$. Migrants face the same education cost per unit of time as natives. They finance it by themselves. The migrant's expected earnings for an unskilled job in the small open economy are $p_{U,t+1}\tilde{w}$. Additionally, the migrant's expected earnings for the unskilled job in his or her home country are $(1 - p_{S,t+1} - p_{U,t+1})p_{U,t+1}^{*}w^{*}$. Under these circumstances, a migrant's expected

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[5] To promote human capital investment by study migrants with high innate ability, the government can pay wage subsidies to the firm that employs migrants as regular skilled workers if they have high innate ability. Denoting the innate ability of study migrants under this policy as $a' > 0$, the government pays wage subsidies if $a' \geq \bar{a}'$ and does not pay if $a' < \bar{a}'$, where $\bar{a}'$ is a positive constant. If wages subsidies measured in efficiency units are $w_{sub} \geq 0$, migrants' wages for the skilled job are $(1+w_{sub})a'e_{m,t}^{\alpha}h_t^{\beta}$. By redefining $(1+w_{sub})a'$ as a, the lifetime utility and human capital are represented by equations (4) and (6), respectively (the definition of a here is different from the one in the text). Migrants with innate ability higher than $\bar{a}'$ have an incentive to reveal their innate ability since they can be paid more than their innate ability if they reveal it and they will build larger human capital.

net income from the regular job is

$$p_{S,t+1}ae_{m,t}^{\alpha}h_t^{\beta} + p_{U,t+1}\tilde{w} + (1 - p_{S,t+1} - p_{U,t+1})p_{U,t+1}^{*}w^{*} - e_{m,t},$$

where the time discount factor is disregarded for simplicity. This represents migrant's utility derived from expected net income from the regular job.

A migrant does a part-time unskilled job while receiving an education in the young age.[6] He (She) has to do it to finance living and education. From the standpoint of the firm, they have to turn to migrants to secure unskilled labor. A study migrant spends the time by $\rho(\bar{L} - e_{m,t})$, $0 < \rho < 1$ for this purpose. They need to work as much as the law permits. By doing so, he (she) earns the money by $\rho(\bar{L} - e_{m,t})w_{PT}$, where w_{PT} are wages per efficiency for the part-time unskilled job, which are sufficiently small. Earnings by the part-time job generate utility.

The time spent not for education and the part-time unskilled job in the young age is $(1 - \rho)(\bar{L} - e_{m,t})$, and this generates utility by $\bar{b}_m(1 - \rho)(\bar{L} - e_{m,t})$, where $\bar{b}_m > 0$ is a coefficient that measures the migrant's relative weight of utility derived from leisure to that derived from expected net income from the regular job. This coefficient is a constant and does not change throughout the analysis. The time discount factor is disregarded for simplicity.

The sum of utility derived from the part-time job and leisure is represented as

$$\rho(\bar{L} - e_{m,t})w_{PT} + \bar{b}_m(1 - \rho)(\bar{L} - e_{m,t}) = \{\bar{b}_m + \rho(w_{PT} - \bar{b}_m)\}(\bar{L} - e_{m,t})$$
$$= b_m(\bar{L} - e_{m,t}),$$

where $b_m \equiv \bar{b}_m + \rho(w_{PT} - \bar{b}_m)$ and b_m is a positive constant. It should be noticed that b_m takes the different values when migrants are not allowed to

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[6] This assumption partly reflects the situation of the unskilled labor market of Japan.

become regular unskilled workers and when they are allowed.   This is because in the former case all unskilled jobs are relegated to study migrants, whereas in the latter case much of the unskilled jobs are done by regular unskilled migrant workers and study migrants do the rest of it.   Accordingly, the ratio of time spent on a part-time unskilled job in the former case ρ_1 is larger than the ratio in the latter case ρ_2.

$$b_{m,1}(\equiv b_m\big|_{p_{U,t+1}=0}=\bar{b}_m+\rho_1(w_{PT}-\bar{b}_m))$$

$$< b_{m,2}(\equiv b_m\big|_{1>p_{U,t+1}>0}=\bar{b}_m+\rho_2(w_{PT}-\bar{b}_m)).$$

Since w_{PT} is sufficiently small, $w_{PT}-\bar{b}_m<0.$ This suggests that if migrants can be employed in unskilled jobs as well as in skilled jobs as regular workers, migrants derive higher utility from the time other than education.

The lifetime utility of an individual migrant can be represented as

$$u_{m,t,t+1} = p_{S,t+1}ae_{m,t}^\alpha h_t^\beta + p_{U,t+1}\tilde{w}+(1-p_{S,t+1}-p_{U,t+1})p_{U,t+1}^*w^*$$

$$-e_{m,t}+b_m(\bar{L}-e_{m,t})-\bar{C}, \tag{4}$$

where $\bar{C}>0$ is a constant that measures the cost of study migration in terms of migrant's utility.

An individual migrant demands education to maximize utility.   The maximization problem for a migrant is summarized as

$$\max_{e_{m,t}} u_{m,t,t+1}.$$

4. HUMAN CAPITAL

This section solves the maximization problems of a native and a migrant

and derives the dynamics of the average human capital of the small open economy.

By solving the natives' problem, their individual demand for education is

$$e_{n,t} = \alpha^{\frac{1}{1-\alpha}} \left(\frac{1}{1+\bar{b}_n} \right)^{\frac{1}{1-\alpha}} h_t^{\frac{\beta}{1-\alpha}}.$$

Substituting this into equation (1), natives' average human capital in period $t+1$ is

$$h_{n,t+1} = \alpha^{\frac{\alpha}{1-\alpha}} \left(\frac{1}{1+\bar{b}_n} \right)^{\frac{\alpha}{1-\alpha}} h_t^{\frac{\beta}{1-\alpha}}. \tag{5}$$

Similarly, by solving the migrants' problem, their individual demand for education is

$$e_{m,t} = \alpha^{\frac{1}{1-\alpha}} p_{S,t+1}^{\frac{1}{1-\alpha}} a^{\frac{1}{1-\alpha}} \left(\frac{1}{1+b_m} \right)^{\frac{1}{1-\alpha}} h_t^{\frac{\beta}{1-\alpha}}.$$

A migrant demands more education either when he or she is innately more able, i.e., a is larger or when the employment probability for the skilled job is higher, i.e., $p_{S,t+1}$ is higher. This is because innate ability and the employment probability for the skilled job change the return on education. Substituting this into equation (3), migrants' average human capital in period $t+1$ is

$$h_{m,t+1} = \alpha^{\frac{\alpha}{1-\alpha}} p_{S,t+1}^{\frac{\alpha}{1-\alpha}} a^{\frac{1}{1-\alpha}} \left(\frac{1}{1+b_m} \right)^{\frac{\alpha}{1-\alpha}} h_t^{\frac{\beta}{1-\alpha}}. \tag{6}$$

Utilizing equations (5) and (6), the ratio of the average human capital of migrants to natives in period $t+1$ is

$$\frac{h_{m,t+1}}{h_{n,t+1}} = a^{\frac{1}{1-\alpha}} p_{S,t+1}^{\frac{\alpha}{1-\alpha}} \left(\frac{1}{1+b_m}\right)^{\frac{\alpha}{1-\alpha}} \left(\frac{1}{1+\bar{b}_n}\right)^{\frac{-\alpha}{1-\alpha}}.$$

Given $\bar{b}_n$ and b_m, migrants' average human capital relative to that of a native in period $t+1$ increases with the innate ability of migrants and their employment probability for the skilled job.

To be in line with the assumption made in the previous section, $p_{S,t+1}$ must increase with $h_{m,t+1}/h_{n,t+1}$. This can be stated formally as

$$p_{S,t+1} = p_S\left(\ln\frac{h_{m,t+1}}{h_{n,t+1}}\right), \quad p' > 0, \ 0 < p < 1.$$

The natural logarithm is taken to relative human capital only to simplify the calculation. Since $\ln(h_{m,t+1}/h_{n,t+1})$ is time-independent, the probability for migrants to be employed for the skilled job does not vary with time. Thereby the time subscript can be deleted.

$$p_{S,t+1} = p_S = p_S\left(\frac{\alpha}{1-\alpha}\ln p_S + \frac{1}{1-\alpha}\ln a + \frac{\alpha}{1-\alpha}\ln(1+\bar{b}_n) - \frac{\alpha}{1-\alpha}\ln(1+b_m)\right). \ (7)$$

By totally differentiating equation (7), we find that p_S does not necessarily increase with a since $dp_S/da = p_S'\alpha(1-\alpha)^{-1}\{1 - p_S'\alpha(1-\alpha)^{-1}p_S^{-1}\}^{-1}$ and $1 \gtreqless p_S'\alpha(1-\alpha)^{-1}p_S^{-1}$. The meaning and implication of the last inequality ('the direct effect' $\gtreqless$ 'the indirect effect') is going to be discussed in section 6.

Substituting equations (5) and (6) into the definition of the average human capital of the small open economy, i.e., $h_{t+1} \equiv (1-\theta)h_{n,t+1} + p_{S,t+1}\theta h_{m,t+1}$,

average human capital in period $t+1$ is expressed as a function of average human capital in period t,

$$h_{t+1} = \left[(1-\theta)\left(\frac{1}{1+\bar{b}_n}\right)^{\frac{\alpha}{1-\alpha}} + \theta p_S^{\frac{1}{1-\alpha}} a^{\frac{1}{1-\alpha}} \left(\frac{1}{1+b_m}\right)^{\frac{\alpha}{1-\alpha}} \right] \alpha^{\frac{\alpha}{1-\alpha}} h_t^{\frac{\beta}{1-\alpha}}, \quad (8)$$

where p_S is a solution of equation (7). This represents the evolution of the average human capital of the small open economy.

Human capital in steady state h^* is

$$h^* = \left[(1-\theta)\left(\frac{1}{1+\bar{b}_n}\right)^{\frac{\alpha}{1-\alpha}} + \theta p_S^{\frac{1}{1-\alpha}} a^{\frac{1}{1-\alpha}} \left(\frac{1}{1+b_m}\right)^{\frac{\alpha}{1-\alpha}} \right]^{\frac{1-\alpha}{1-\alpha-\beta}} \alpha^{\frac{\alpha}{1-\alpha-\beta}}, \quad (9)$$

where p_S is a solution of equation (7).

5. INCREASING HUMAN CAPITAL WHEN REGULAR UN-SKILLED JOBS ARE NOT AVAILABLE TO MIGRANTS

This section considers how the small open economy can increase their human capital by accepting study migrants when regular unskilled jobs are not available to them and that $\bar{b}_n = b_m (\equiv \bar{b})$.

Under this assumption, equation (8) can be rewritten as

$$h_{t+1} = \{(1-\theta) + \theta p_S^{\frac{1}{1-\alpha}} a^{\frac{1}{1-\alpha}}\}\left(\frac{1}{1+\bar{b}}\right)^{\frac{\alpha}{1-\alpha}} \alpha^{\frac{\alpha}{1-\alpha}} h_t^{\frac{\beta}{1-\alpha}}.$$

If $p_S a > 1$, then $h_{t+1}|_{\theta>0}$ can be larger than $h_{t+1}|_{\theta=0}$, given h_t. In other words, human capital is larger when accepting study migrants, i.e., when $\theta > 0$ than when not accepting them, i.e., when $\theta = 0$. Thus, the study migrants' acceptance policy is effective in the short run. The same argument applies to the human capital in steady state. That is, since

$$h^* = \{(1-\theta) + \theta p_S^{\frac{1}{1-\alpha}} a^{\frac{1}{1-\alpha}}\}^{\frac{1-\alpha}{1-\alpha-\beta}} \left(\frac{1}{1+\bar{b}}\right)^{\frac{\alpha}{1-\alpha-\beta}} \alpha^{\frac{\alpha}{1-\alpha-\beta}},$$

if $p_S a > 1$, then $h^*|_{\theta>1}$ can be larger than $h^*|_{\theta=0}$.

When p_S increases with a, the condition that $p_S a$ exceeds 1 is satisfied if a is sufficiently large. Even when p_S decreases with a, this condition holds if p_S does not decrease significantly until a takes the large value.

To increase the effectiveness of the study migrants' acceptance policy, i.e., to increase average human capital under the study migrants' acceptance policy, the government of the small open economy has to focus on the quality of study migrants. In particular, when the employment probability of study migrants increases with their innate ability, the government should admit study migrants with higher innate ability. On the other hand, when the employment probability decreases with the innate ability, the government should manipulate the innate ability so as to maximize the product of the employment probability and the innate ability, $p_S a$. The government must accept study migrants with higher innate ability when the negative effects of the innate ability on the employment probability are relatively small, i.e., $|dp_S/da| < 1$ and $d(p_S a)/da > 0$, whereas the government must accept study migrants with lower innate ability when the negative effect is relatively large, i.e., $|dp_S/da| > 1$ and $d(p_S a)/da < 0$. In summary, the effectiveness of the study migrants' acceptance policy can be raised by manipulating the quality of study migrants appropriately.

6. INCREASING HUMAN CAPITAL WHEN REGULAR UNSKILLED JOBS ARE AVAILABLE TO MIGRANTS

This section considers how the small open economy can increase their human capital by accepting study migrants when migrants can be also employed for unskilled jobs as regular workers. For convenience, this section assumes that the innate ability of migrants is a given constant.

It was noticed in section 3 that when migrants can be employed in unskilled jobs as well as in the skilled jobs as regular workers, the time spent not for education gives higher utility to migrants since $b_m\big|_{1>p_{U,t+1}>0}$, i.e., $b_{m,2}$ is larger than $b_m\big|_{p_{U,t+1}=0}$, i.e., $b_{m,1}$.

The evolution of average human capital in the small open economy differs depending on whether unskilled regular jobs are available to migrants or not.

$$h_{t+1} = \left[(1-\theta)\left(\frac{1}{1+\bar{b}_n}\right)^{\frac{\alpha}{1-\alpha}} + \theta p_{S,b_{m,1}}^{\frac{1}{1-\alpha}} a^{\frac{1}{1-\alpha}}\left(\frac{1}{1+b_{m,1}}\right)^{\frac{\alpha}{1-\alpha}}\right] \alpha^{\frac{\alpha}{1-\alpha}} h_t^{\frac{\beta}{1-\alpha}} \quad \text{if } p_{U,t+1}=0,$$

(10a)

$$h_{t+1} = \left[(1-\theta)\left(\frac{1}{1+\bar{b}_n}\right)^{\frac{\alpha}{1-\alpha}} + \theta p_{S,b_{m,2}}^{\frac{1}{1-\alpha}} a^{\frac{1}{1-\alpha}}\left(\frac{1}{1+b_{m,2}}\right)^{\frac{\alpha}{1-\alpha}}\right] \alpha^{\frac{\alpha}{1-\alpha}} h_t^{\frac{\beta}{1-\alpha}} \quad \text{if } 1 > p_{U,t+1}>0,$$

(10b)

where $p_{S,b_{m,i}}$ is a solution of equation (7) when $b_m = b_{m,i}$, $i=1,2$. Steady state human capital also differs between the two cases.

$$h^* = \left[(1-\theta)\left(\frac{1}{1+\bar{b}_n}\right)^{\frac{\alpha}{1-\alpha}} + \theta p_{S,b_{m,1}}^{\frac{1}{1-\alpha}} a^{\frac{1}{1-\alpha}}\left(\frac{1}{1+b_{m,1}}\right)^{\frac{\alpha}{1-\alpha}}\right]^{\frac{1-\alpha}{1-\alpha-\beta}} \alpha^{\frac{\alpha}{1-\alpha-\beta}} \quad \text{if } p_{U,t+1}=0,$$

(11a)

$$h^* = \left[(1-\theta)\left(\frac{1}{1+\bar{b}_n}\right)^{\frac{\alpha}{1-\alpha}} + \theta p_{S,b_{m,2}}^{\frac{1}{1-\alpha}} a^{\frac{1}{1-\alpha}} \left(\frac{1}{1+b_{m,2}}\right)^{\frac{\alpha}{1-\alpha}} \right]^{\frac{1-\alpha}{1-\alpha-\beta}} \alpha^{\frac{\alpha}{1-\alpha-\beta}} \text{ if } 1 > p_{U,t+1} > 0 .$$

$$(11b)$$

Equations (10a, 10b) and equations (11a, 11b) suggest that it cannot be determined *a priori* how average human capital will be affected by the availability of unskilled regular jobs to migrants.

Utilizing equation (7), p_S can be solved as a function of b_m, where a is assumed to be fixed. It cannot be determined whether b_m increases or decreases p_S, i.e.,

$$\frac{dp_S}{db_m} = -\frac{p_S'\alpha(1-\alpha)^{-1}(1+b_m)^{-1}}{1 - p_S'\alpha(1-\alpha)^{-1}p_S^{-1}} \gtreqless 0 .$$

This is because according to equation (7), p_S on the left-hand side depends on b_m. It (p_S on the left-hand side) also depends on p_S on the right-hand side.

$$dp_S = -p_S'\alpha(1-\alpha)^{-1}(1+b_m)^{-1}db_m + p_S'\alpha(1-\alpha)^{-1}p_S^{-1}dp_S .$$

For this reason, the employment probability for the skilled job is affected by b_m both directly and indirectly. In particular, b_m directly decreases p_S via changes in relative human capital. This, in turn, indirectly decreases p_S via decreases in relative human capital, and this process continues.

Suppose that p_S decreases by 1 due to an increase in b_m. This further decreases p_S by $p_S'\alpha(1-\alpha)^{-1}p_S^{-1}$. If $1 > p_S'\alpha(1-\alpha)^{-1}p_S^{-1}$, the direct effect is stronger than the indirect effect. On the other hand, if $1 < p_S'\alpha(1-\alpha)^{-1}p_S^{-1}$, the direct effect is weaker than the indirect effect. These are the possibilities mentioned in section 4.

Because $\{1 - p_S{}'\alpha(1-\alpha)^{-1}p_S{}^{-1}\}dp = -p_S{}'\alpha(1-\alpha)^{-1}(1+b_m)^{-1}db_m$, if the indirect effect dominates the direct effect, i.e., $1 < p_S{}'\alpha(1-\alpha)^{-1}p_S{}^{-1}$, then $dp_S/db_m > 0$. On the other hand, if the direct effect dominates the indirect effect, i.e., $1 > p_S{}'\alpha(1-\alpha)^{-1}p_S{}^{-1}$, then $dp_S/db_m < 0$.

If $dp_S/db_m > 0$, the employment probability is higher when the unskilled regular job is available to migrants than when it is not. The average human capital is larger when the unskilled regular job is available because a larger fraction of migrants remains in the smaller open economy as skilled workers and because migrants' demand for education is larger due to the higher return on education. However, for a given employment probability, migrants' demand for education and therefore their human capital is smaller by the larger value of b_m due to higher utility for not receiving education. Accordingly, if $dp_S/db_m > 0$, it cannot be determined a priori whether average human capital is larger or not when the unskilled regular job is available than when it is not.

However, when unskilled regular jobs are available to migrants, most of the unskilled jobs can be filled by regular unskilled migrant workers. This means that ρ_2 is much smaller than ρ_1 and thereby $b_{m,2}$ is much larger than $b_{m,1}$. Thus, the latter negative effect can be significant and the availability of the unskilled regular job will make human capital smaller even when the indirect effect is dominant and $dp_S/db_m > 0$.

If $dp_S/db_m < 0$, the employment probability is lower when the unskilled regular job is available to migrants than when it is not. The lower employment probability makes migrants' human capital smaller because the return on education is smaller. Migrants' human capital is also smaller for a given employment probability due to increases in b_m and thereby increases in utility for not receiving an education. Moreover, the smaller fraction of migrants remains in the small open economy as skilled workers. All these negative effects surely make the average human capital of the small open economy smaller when migrants can be employed for unskilled regular jobs than when they cannot. This is the case in which the direct effect is dominant.

The effects of the availability of unskilled regular jobs to migrants can be summarized as follows: Although it cannot be determined *a priori*, it is likely that average human capital is smaller in the short run and steady state when migrants can take unskilled regular jobs as well as skilled jobs than when they can take only skilled jobs. In other words, the availability of unskilled regular jobs to study migrants after education likely has the negative effect on the host country's human capital formation. This happens not only by the higher utility for not receiving an education but also by the changes in the employment probability for skilled jobs caused by the higher utility for not receiving it.

The government of the host country needs to take measures that alleviate the negative effects arising from the availability of unskilled regular jobs. One is to encourage study migrants to receive education, for example, by making them quit school or leave the host country when they get poor grades or giving scholarship or other grants when they get good grades. Another will be to provide the firm with more information on migrants' ability. For example, if the firm gives the test to migrants to decide whether to employ or not, the firm will know beforehand how much they are able. By doing so, the firm will employ able migrants more accurately and if employed, such migrants will receive wages that match their ability. This will also raise study migrants' incentive to receive an education.

7. CONCLUDING REMARKS

Countries can increase human capital by importing it from abroad in the form of skilled workers. However, skilled workers' acceptance policy was not very successful in many countries. To address this problem, some countries implemented the study migrants' acceptance policy to produce human capital domestically.

This study investigated how we can raise the effectiveness of the study migrants' acceptance policy. The study found that the host country's

average human capital can be increased by controlling the quality of study migrants. The study also found that in the general situation in which migrants can become skilled and unskilled regular workers, human capital tends to be smaller, compared with the one in the situation where only skilled regular jobs are available. In such a case, the effectiveness of the study migrants' acceptance policy will be raised by encouraging them to receive education further and providing the firm with information on migrants' ability.

The present framework can be extended in the following directions: It can be assumed explicitly that firms cannot observe workers' human capital perfectly when employing workers. Under such an assumption, the employment probability of study migrants will be determined by the relative human capital in the past periods. In this case, the employment probability is not a constant but evolves over time. Also, it will be more general to assume that the unskilled regular job needs some human capital even if it does not affect the chance of employment significantly. Without the skill of the local language, it will be impossible to get even an unskilled job.

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