This study investigates how host countries should manipulate the labour immigration policy when they accept study migrants and labour migrants simultaneously. In particular, this study clarifies whether host countries should regulate or deregulate the labour immigration policy, i.e., whether to open only the skilled job to non-natives or open skilled and unskilled jobs to increase domestic human capital while accepting study migrants. Many countries introduced the labour immigration policy and attempted to accept skilled workers to increase quality human capital. They also implemented the study migrants’ acceptance policy and tried to generate it domestically. However, at the same time, they tended to deregulate the labour immigration policy to fill the vacancy of unskilled jobs. They often open the unskilled job as well as the skilled job to non-natives. This may negatively affect study migrants’ human capital formation. Even if study migrants did not study seriously, they could have chances for an unskilled job. Thus, study migrants would lower the incentive to build quality human capital. Accordingly, it appears that accepting skilled and unskilled labour migrants by relaxing the labour immigration policy is not necessarily compatible with the study migrants’ acceptance policy designed to generate skilled workers. Therefore, we may need to adjust the labour immigration policy to the study migrants’ acceptance policy, i.e., we regulate or deregulate the labour immigration policy, depending on the situation. This study considers these issues. This study looks into them analytically by building a two-period one-generation model. It assumes a developing country that sends study migrants and a developed country that accepts study migrants and provides them with education and job opportunities. This study finds that if unskilled jobs are less available to non-natives in the developed country and the migration costs are high, it is likely that employed skilled migrants’ human capital is larger under the deregulated labour immigration policy. Accordingly, in such a situation, the labour immigration policy can be deregulated. However, if unskilled jobs are much available to non-natives in the developed country and the migration costs are small, we cannot determine a priori whether the employed skilled migrants’ human capital is larger under the deregulated immigration policy or the regulated one. In other words, there are cases in which host countries can deregulate the labour immigration policy, and there are also cases in which they should regulate it. These results suggest that the relaxed labour immigration policy is not necessarily consistent with the study migrants’ acceptance policy that attempts to generate skilled workers. Additional policies may be necessary to accomplish these objectives at once. This study’s contribution is to show the situation in which the deregulated labour immigration policy is compatible with the study migrants’ acceptance policy to accumulate quality human capital and secure unskilled labour at once. This will help solve the skilled and unskilled labour shortages’ problem via migration policies and other policies.

**Keywords**: Study migration, Human capital, Skilled job, Unskilled job, Labour immigration, Regulation, Deregulation

**JEL classification numbers**: F22, I25, J24, O15

*Faculty of Economics, Nagasaki University. Email: shimada@nagasaki-u.ac.jp*
1. Introduction
This study deals with the problem of the human capital accumulation of host countries under the mobility of labour and students. This study draws attention to the coordination of the labour immigration policy to the study migrants’ acceptance policy. This study considers how host countries should adjust the labour immigration policy to the study migrants’ acceptance policy to increase domestic human capital. In particular, this study investigates whether host countries should regulate or deregulate the labour immigration policy when accepting study migrants and encouraging them to build high-quality human capital.

Students and workers have become mobile today. They cross borders to receive a good education and to get suitable jobs. In addition, study migration and labour migration are increasing with each other. Students who received education in foreign countries tend to work out of their home countries after education, and increased opportunities for working overseas promote study migration.

The increased mobility has made many countries suffer from the outflow of human capital, and many of them experienced the brain drain. A country’s total human capital has decreased due to migration and become smaller under migration than under non-migration.

Given this situation, countries introduced the labour immigration policy that primarily aimed for accepting skilled workers. They attempted to import high-quality human capital by receiving skilled workers from abroad. To complement this policy, they also implemented the study migrants’ acceptance policy. They tried to produce it domestically by accepting students from abroad and providing them with education.

Countries indeed sought high-quality human capital from abroad, but they also turned to foreign workers to fill the vacancy of unskilled job. For this purpose, they often opened unskilled job as well as skilled one to non-natives. Accordingly, unlike the study migrants’ acceptance
policy, the labour immigration policy does not necessarily limit its objective to accumulate high-quality human capital.

If the labour immigration policy were regulated and only the skilled job was open to non-natives, study migrants would study seriously for employment in the skilled job. They would surely build high-quality human capital. However, suppose it is deregulated, and both skilled and unskilled jobs are open to non-natives. In that case, we infer that study migrants may not study seriously and may not build high-quality human capital. This inference may happen because they can be employed as an unskilled labour migrant in host countries, even if they did not study seriously and did not accumulate high-quality human capital enough to be skilled workers.

This may be suggesting that the labour immigration policy and the study migrants’ acceptance policy cannot be necessarily compatible and that the labour immigration policy may harm the effectiveness of the study migrants’ acceptance policy. Accordingly, it appears that if we are to accumulate high-quality human capital by accepting workers and students from abroad, the labour immigration policy needs to be manipulated, i.e. it needs to be regulated or deregulated, depending on the situation. This study examines how we should implement the labour immigration policy when we carry out the study migrants’ acceptance policy simultaneously.

For this purpose, this study builds a two-period one-generation model. It assumes a developing country that sends study migrants and a developed country that accepts study migrants and provides them with education and job opportunities. We derive the optimal behaviour of study migrants and calculate employed skilled migrants’ human capital in the developed country. Based upon the solutions, we consider how a host country should manipulate the labour immigration policy to make employed skilled migrants’ human capital larger when accepting study migrants.
This study finds that if unskilled jobs are less available to non-natives and the migration costs are large, it is likely that employed skilled migrants’ human capital is larger under the deregulated labour immigration policy than under the regulated one. Accordingly, the labour immigration policy can be deregulated, and host countries can admit non-natives skilled and unskilled jobs in this case. They can also fill the vacancy of the unskilled job. However, suppose unskilled jobs are much available to non-natives and the migration costs are small. In that case, we cannot determine a priori whether the employed skilled migrants’ human capital is larger under the deregulated immigration policy or the regulated one. In some cases, it is larger under deregulation, and in other cases, it is larger under regulation. Therefore, host countries cannot always implement the deregulated labour immigration policy that admits non-natives unskilled and skilled jobs when they accept study migrants and encourage their human capital formation.

Our results suggest that host countries cannot always increase high-quality human capital and compensate the shortage of unskilled workers with unskilled migrants by conducting the deregulated labour immigration policy and the study migrants’ acceptance policy simultaneously. Another policy instrument may be necessary to attain these two objectives.

This study's contribution is to show the situations in which host countries can adjust the labour immigration policy to the study migration policy that enables host countries to accumulate high-quality human capital and secure unskilled labour and in which they cannot do so. This will help solve the skilled and unskilled labour shortages’ problem via migration policies and other policies.

The remaining of this study is organised as follows. Section 2 provides the related literature review. Section 3 models the two-country economy comprised of developing and developed countries. Section 4 derives the decisions on study migration and learning of potential migrants in
the developing country. Section 5 calculates the human capital of employed skilled migrants and considers how the host country should manipulate the labour immigration policy when accepting study migrants. Section 6 gives the concluding remarks.

2. Literature Review

This section reviews related literature on labour migration and the brain drain/the brain gain, the labour immigration policy, the study migrants’ acceptance policy, combined analyses on labour and study migration and study migrants’ time allocation. The literature reviewed in this section is, of course, not exhaustive.

2.1 Literature on Labour migration and the Brain Drain/the Brain Gain

According to International Labour Organization, ILO (2018), the stock of international migrant workers was 164 million in 2017. It was a 9 per cent increase since 2013 when it was 150 million (International Labour Organization, ILO, 2015). International migrant workers constituted 4.4 per cent of all workers in 2013. It increased to 4.7 per cent in 2017, suggesting that the increasing number of workers is crossing borders.

Labour-sending countries reduce domestic human capital when their workers emigrate. This was initially highlighted by Bhagwati and Hamada (1974) and Hamada and Bhagwati (1975). At the same time, it is possible for labour-sending countries to increase domestic human capital when workers are mobile. Higher wages in foreign countries give an incentive to receive education and build human capital enthusiastically. As a result, human capital can become more significant under migration or its possibilities. Mountford (1997) and Stark et al. (1997) firstly pointed out this positive effect. If the former negative effect dominates (is dominated by) the latter positive effect,
the total human capital is smaller (larger) under migration or its possibilities than otherwise. We refer to such a case as the brain drain (the brain gain).

Many studies examined whether economies are actually experiencing the brain drain or the brain gain under migration or its possibilities. Results are mixed. Beine et al. (2008) found that migration prospects positively affect human capital formation in countries with small human capital and low migration rates of skilled workers. Beine et al. (2011) derived similar results. Skilled migration promotes human capital formation in low-income countries. Moreover, Batista et al. (2012), analysing the case of Cape Verde, revealed that massive emigration from that country encouraged the accumulation of human capital in that country.

However, according to Docquier (2014), in developing countries, the number of countries that experience the brain drain is larger than the number of those that experience the brain gain. Zhang and Lucey (2019) also found that less developed countries tend to lose highly educated workers. Moreover, Kasnauskiene and Palubinskaite (2020) found the negative long-term effect on EU8 countries (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia) of high-skilled migration to the UK.

2.2 Literature on the Labour Immigration Policy

Given the above-varied situation, many countries attempted to increase their domestic human capital. They tried to increase acceptance of skilled workers and implemented the labour immigration policy for that purpose actively.

However, such a policy was not easily accomplished since the competition was fierce among countries (Docquier and Machado, 2016). Even if they successfully accepted skilled workers from abroad, labour migrants’ human capital cannot be fully transferable to host countries, and
domestic human capital does not necessarily increase substantially. As found by Chiswick and Miller (1992, 2009), Docquier and Rapoport (2012), Basilio et al. (2017) and Boyd and Tian (2018), human capital transferability is generally low.

Limited transferability brings about non-beneficial effects on labour migrants themselves. Manuel and Plesca (2020) found that limited transferability of skill lowers the earnings of migrants who received education in their home countries. Also, their education and labour market experience acquired in other than host countries tend to be significantly less valued than those in host countries (Friedberg, 2000; Bauder, 2003).

In addition, selecting immigrant workers by referring to their education level involves the problem (Bertoli and Stillman, 2019). The education level is not necessarily effective in finding workers with sufficient human capital.

2.3 Literature on the Study Migrants' Acceptance Policy

Host countries complemented the labour immigration policy by conducting the study migrants’ acceptance policy and tried to increase domestic human capital. By receiving able students from abroad and providing them with education, host countries aimed for producing human capital domestically. If study migrants remain in host countries as workers after education, host countries increase domestic human capital. Study migration is also beneficial to study migrants themselves. As Rosensweig (2006) showed, study migrants move to high-wage countries and receive education to exploit employment opportunities there. Rao (1979), Huang (1988), Hazen and Alberts (2006), and Musumba et al. (2011) conducted researches on the non-return of study migrants after education in host countries. Also, Oosterbeek and Webbink (2006), Di Pietro (2012, 2015), Burmann and Delius (2017) and d’Hombres and Schnepf (2021) found that studying
abroad tends to raise the employment probability, while the evidence against this was presented by Liwiński (2019), utilising Polish students’ data. Factors that cause study migration are not limited to economic ones. Non-economic factors include quality of higher education (Kahanec and Králiková, 2011), geographical distance and the presence of a common language (Abbott and Silles, 2016) and foreign assistance (Lanati and Thiele, 2020).

Since study migration is beneficial both to host countries and to study migrants, study migration has increased significantly. OECD (2020) estimated that the number of mobile students enrolled in tertiary education programmes worldwide was 5.6 million in 2018. It was 4.4 million in 2014. It has increased on average by 4.8 per cent between 1998 and 2018. In total, across OECD countries, the share of incoming international students was 6 per cent of total enrolment in tertiary education programmes in 2018.

2.4 Literature on Combined Analyses on Labour and Study Migration

Even with the close connection between them, study migration and labour migration have been mostly analysed separately. Bergerhoff et al. (2013) is one of a few exceptions. They combined study migration with labour migration in a dynamic context and examined the effects of a study migrants’ acceptance policy on the host country’s human capital accumulation. Another exception is Brezis (2019). She examined the decisions about where to get an education and about where to work in an identical setting with two steps and showed that the brain drain can be an optimal solution. Shimada (2019) also assumed study migration and labour migration in an identical two-period model and looked into how labour-sending countries can prevent the brain drain by paying education subsidies.
2.5 Literature on Study Migrants’ Time Allocation

Study migrants often suffer from an economic problem in host countries. For example, many study migrants in Japan, including those from China, spare much of their time for part-time job (Tsuda and Cornelius, 2004, pp. 456-457; Liu-Farrer, 2011, pp. 64-70). They have to work to finance education and to make ends meet. This situation suggests that study migrants cannot necessarily spend all of their time building human capital. In addition, when receiving education in host countries, study migrants often face cultural difference. Reyes and Wenbo (2020) found that Chinese study migrants in Australia have successfully dealt with the cultural problem and have made progress academically after migration. However, study migrants relieve the stress of studying abroad and improve academic performance by participating in leisure activities (Lee et al., 2018; Zhou et al., 2018). This also suggests that study migrants spend part of their time on non-academic activities. Accordingly, it is not necessarily appropriate to assume that study migrants spend all of their time studying or that they do not drive utility from non-academic activities.

3. The Economy

The economy is comprised of two countries, developing and developed countries. Individuals born in those countries live for two periods, young and old ages. There is only one generation. The economy begins in the first period in which individuals are young and ends in the second period in which they are old.

In the developing country, there are no educational institution and no skilled jobs. Only the unskilled job that does not need education and human capital is available. Individuals born in this country are heterogeneous in their innate ability. They may migrate to the developed country at a
young age to receive education, aiming for employment in that country. If they do not migrate, they work in an unskilled job in the developing country at young and old ages.

On the other hand, the developed country has an educational institution, and skilled and unskilled jobs exist. Human capital is necessary to do either type of jobs. The unskilled job in the developed country is distinct from that in the developing country. The developed country accepts study migrants from the developing country. They contribute to increasing skilled workers’ human capital and may fill the unskilled workers’ vacancy, depending on the type of the labour immigration policy. Individuals born in the developed country and migrated to the developed country receive education and build human capital at a young age. All natives remain in the developed country to work at an old age. Some study migrants also remain in the developed country at an old age and turn into labour migrants. Whether they can take the skilled job or not depends on whether they studied seriously or not at a young age. It also depends on the labour immigration policy. We consider two cases. In one case, labour immigration is regulated, and only skilled labour is open to non-natives. In another case, labour immigration is deregulated, and skilled and unskilled jobs are open. For simplicity, we assume that the developed country does not accept workers from abroad. Only study migrants can become labour migrants.

Human capital is fundamentally built by school education, i.e. attending the class. Given the same amount of school education, an individual builds the larger human capital as he is more innately able. The innate ability of individuals born in the developing country $a_i$ is distributed uniformly distributed from $a_i$ to $\bar{a}(>a_i)$. Also, human capital formation is enhanced by an effort exerted by individuals after school. In particular, human capital increases if an individual spends certain hours learning by himself outside school. This does not require an extra pecuniary cost. It is just that study migrants reduce the time available for non-academic activities. To be employed in a
skilled job, an individual has to build human capital by attending class and putting a self-effort, i.e. studying for hours by himself. If he only attends the class, his human capital is not enough to do the skilled job. In such a case, he can be employed only in an unskilled job.

If an individual born in the developing country remains there for life, his lifetime utility $U_i^*$ is

$$U_i^* = 2w_{us}^*$$

(1)

where $w_{us}^*$ is wages for the unskilled job in the developing country. He earns same wages at young and old ages. The employment probability in the developing country is 1. To simplify the analysis, we disregard the time discount factor.

On the other hand, if an individual with an innate ability $a_i$ migrated to the developing country and received education in school but did not study by himself, that is to say, if he did not study seriously (this can happen when immigration is deregulated and skilled and unskilled jobs are open to non-natives), he would build human capital by $(1a_i)^{1/2} = a_i^{1/2}$, where hours spent to attend the class are assumed to be 1. This is the unskilled workers’ human capital, human capital that is enough for doing the unskilled job in the developed country but not enough for doing the skilled job in that country. Human capital is measured in efficiency units of labour and wages per efficiency for the unskilled job in the developed country is $w_{us}$. He is more likely employed for the unskilled job in the developed country if his human capital is relatively larger to the largest one $(1\bar{a})^{1/2} = \bar{a}^{1/2}$. His employment probability is $\theta_{us} (a_i^{1/2})/(\bar{a})^{1/2} = \theta_{us} (a_i/\bar{a})^{1/2}$, where $0 \leq \theta_{us} < 1$ is a constant and measures the overall ease of employment for the unskilled job in the developed country, which partly depends on the availability and the openness of such a job to non-natives. If he is not employed in the developed country, he returns to the developing country and surely earns wages by $w_{us}^*$ in the old age. His lifetime income $U_{i,j}$ is
where the first term represents expected wages of the unskilled job in the developed country.

**RMC** is a constant and represents the return migration cost, i.e. the costs that incur to study migrants when returning to the developing country to work there at an old age, **SEC** is a constant and represents the school education cost, i.e. the cost necessary to receive education in the developed country, which includes the moving cost from the developing country to the developed country and the school fee and **L** is a constant and represents the time available at a young age.

Unlike other studies that deal with education and human capital formation, this study assumes that spending time for studying reduces leisure at a young age and decreases utility. Even students who came to study from abroad derive utility from leisure, i.e. spending time not for academic activities in a host country. Utility derived from non-academic activities affects how seriously study migrants receive an education.

Suppose an individual with an innate ability **a** migrated to the developed country and received education in school, and spent certain hours for studying by himself after school. In that case, that is to say, if he studied *seriously* (this can happen when immigration is deregulated or when it is regulated), he would build human capital by \((ea)^{1/2}\). This is the *skilled workers’ human capital*, human capital that is necessary to do the skilled job. He spends \(e - 1(>0)\) hours for studying by himself, where \(e\) is a constant. Wages per efficiency for the skilled job is \(w_s(>w_u)\).

He is more likely employed in the skilled job if his human capital is relatively larger to the largest one \((e\bar{a})^{1/2}\). His employment probability is \(\theta_s\{(ea)^{1/2}/(e\bar{a})^{1/2}\} = \theta_s(a_s/\bar{a})^{1/2}\), where \(0 < \theta_s < 1\) is a constant and measures the overall ease of employment for the skilled job. This partly depends on the openness of the skilled job to non-natives. He can also be employed for unskilled job in the
developed country, and expected earnings from that job are \( \theta_{si} \left( \frac{a_i}{\bar{a}} \right)^{1/2} a^{1/2} w_{si} \). If he is not employed in the developed country, he returns to the developing country and does the unskilled job there. His lifetime utility \( U_{ei} \) is

\[
U_{ei} = \theta_i \left( \frac{a_i}{\bar{a}} \right)^{1/2} (ea_i)^{1/2} w_s + \theta_{si} \left( \frac{a_i}{\bar{a}} \right)^{1/2} a^{1/2} w_{si} - RMC - SEC + \bar{L} - e
\]  

(3)

If labour immigration is regulated and only the skilled job is open to non-natives, an individual who migrates certainly attends the class and studies by himself after school (since if he did not so, he could not be employed in the developed country). He derives utility by

\[
U_{ei} \bigg|_{a_{si}=0} = \theta_i \left( \frac{a_i}{\bar{a}} \right)^{1/2} (ea_i)^{1/2} w_s + w_{si}^* - RMC - SEC + \bar{L} - e
\]  

(4)

Individuals born in the developing country decide whether to migrate to the developed country or remain in the developing country by comparing utility. When labour immigration is regulated, they compare utility derived from non-migration (Equation 1) and migration (Equation 4). When labour immigration is deregulated, they compare utility derived from non-migration (Equation 1) and migration (Equations 2 and 3).

Once they decided to migrate, migrants determine whether to study seriously or not in the developed country. They certainly study seriously when labour immigration is regulated and only the skilled job is open to non-natives. However, when labour immigration is deregulated and skilled and unskilled jobs are open to non-natives, it cannot be determined a priori whether they study seriously or not. In this case, study migrants are faced with a trade-off. If they spent only an hour for studying, i.e. just attending the class, long hours would be available for leisure, and he could derive higher utility from non-academic activity. However, the human capital he accumulates would not be enough to get a skilled job. On the other hand, they could get a skilled
job and earn high wages by giving up part of leisure at a young age and studying seriously.

However, the time available for non-academic activities would be short.

4. Study Migration and Learning

This section considers the decisions of study migration and learning by individuals native to the developing country. In particular, this section examines who (individuals with what innate ability) decide to migrate to the developed country when labour immigration is regulated and who decides to migrate when deregulated. This section also examines whether study migrants study seriously or not after migration when labour immigration is deregulated.

We first take up the case in which labour immigration is regulated and only the skilled job is open to non-natives. In this case, as mentioned, study migrants never fail to study seriously after migration.

Individuals who intend to study seriously decide migration if \( U_{i|a} \mid \theta_{i} = \theta^{*} \). In other words, those whose innate ability is equal to or higher than

\[
\frac{w_{a} + RMC + SEC - (\bar{L} - e)}{\theta_{i}(a)^{\frac{1}{2}}w_{i}} (\equiv a_{s})
\]

migrate, where \( a_{s} \) is such that \( U_{i|a} \mid \theta_{i} = \theta^{*} \). All of them study seriously. Regarding the denominator of Equation (5), if wages per efficiency for the skilled job are higher, the return of education is higher so that it is better to migrate even if the innate ability is lower. As a result, \( a_{s} \) is smaller. Regarding the first three terms of the numerator of Equation (5), if wages earned at a young age in the developing country are higher or if the costs for return migration and study migration are higher, it is not profitable to migrate to the developed country unless the innate ability is high. As a result, \( a_{s} \) is higher. As for the fourth term, if higher utility is derived from
non-academic activities at a young age in the developed country, migration is more profitable even if the innate ability is lower. As a result, \(a_s\) is smaller.

We next deal with the case in which labour immigration is deregulated and both skilled and unskilled jobs are open to non-natives. In this case, those who intend to study not seriously and those who intend to study seriously consider migration.

Even if an individual does not study seriously after migration, he can attain higher utility by study migration, i.e. \(U_{1,i} \geq U_i^\ast\) if his innate ability is equal to or higher than

\[
\frac{w_{us}^* + RMC + SEC - (L - 1)}{\theta_{us}(1/a)^{1/2}w_{us}} \quad (\equiv \hat{a}_{us})
\]  

where \(\hat{a}_{us}\) is \(a_i\) that satisfies \(U_{1,i} = U_i^\ast\). Equation (6) can be interpreted similarly to Equation (5).

If an individual studies seriously after migration, he can attain higher utility by migration, i.e. \(U_{e,i} \geq U_i^\ast\) if his innate ability is equal to or higher than

\[
\frac{w_{us}^* + RMC + SEC - (L - e)}{\theta_{e}(e/a)^{1/2}w_{us} + \theta_{us}(1/a)^{1/2}w_{us}} \quad (\equiv \hat{a}_e)
\]  

where \(\hat{a}_e\) is \(a_i\) that satisfies \(U_{e,i} = U_i^\ast\). Equation (7) can be also interpreted similarly to Equation (5).

Accordingly, when labour immigration is not regulated and skilled and unskilled jobs are open to non-natives, individuals with an innate ability equal to or higher than

\[
\min[\hat{a}_{us}, \hat{a}_e]
\]

migrate since they can attain higher utility by migration either by studying not seriously or by studying seriously. It cannot be determined a priori which of \(\hat{a}_{us}\) and \(\hat{a}_e\) is larger.
Unlike the case in which only the skilled job is open to non-natives, individuals who decided to migrate determine whether they seek a skilled job or an unskilled job by comparing utility in each case, i.e. $U_{e,j}$ and $U_{1,j}$. Since

$$U_{e,j} - U_{1,j} = \theta_s \left( \frac{e}{\overline{a}} \right)^{1/2} w_s a_i - (e - 1)$$

whether to seek a skilled job by studying seriously or an unskilled job by studying not seriously depends on the innate ability. Utility derived by studying seriously is equal to or higher than that by studying not seriously if an individual has innate ability equal to or higher than

$$\left( e - 1 \right) \left[ \theta_s \left( \frac{e}{\overline{a}} \right)^{1/2} w_s \right]^{-1} = a_{1,e,j=U_{1,j}}$$

(8)

where $\theta_s (e/\overline{a})^{1/2} w_s \alpha - (e - 1) < 0$ and $\theta_s (e/\overline{a})^{1/2} w_s \alpha - (e - 1) > 0$ are assumed. According to Equation (8), if utility derived from non-academic activities when studying not seriously is much larger than that when studying seriously, i.e. $\bar{L} - 1 - (\bar{L} - e) = e - 1$ is larger, only individuals whose innate ability is higher prefer to study seriously after study migration since doing so is more profitable only to such individuals. Accordingly, $a_{1,e,j=U_{1,j}}$ increases with $e - 1$. If wages for the skilled job are higher, it is profitable for study migrants to study seriously even if the innate ability is lower. Accordingly, $a_{1,e,j=U_{1,j}}$ decreases with $w_s$.

Equation (8) suggests that when labour immigration is not regulated and skilled and unskilled jobs are open to non-natives, individuals who decided migration study seriously if the innate ability is equal to or higher than $a_{1,e,j=U_{1,j}}$. They build skilled workers' human capital. Individuals who decided migration do not study seriously if the innate ability is lower than $a_{1,e,j=U_{1,j}}$. They build unskilled workers' human capital.
5. Study Migrants’ Human Capital and the Labour Immigration Policy

This section first measures the amounts of employed skilled migrants’ human capital under regulated and deregulated labour immigration policies. This section then considers whether a host country should regulate or deregulate the labour immigration policy to increase employed skilled migrants’ human capital when accepting study migrants.

Since, as assumed, the developed country does not accept labour migrants, employed skilled migrants’ human capital is equal to human capital of study migrants who studied seriously at a young age and were employed in the skilled job at an old age.

When labour immigration is regulated and only the skilled job is open to non-natives in the developed country, individuals in the developing country with innate ability equal to or higher than $a$ migrate to the developed country and study seriously there (see Equation 5). Accordingly, the sum of employed skilled migrants’ human capital is

$$
\int_0^\pi \theta_i (a/\bar{a})^{1/2} (ea_i)^{1/2} = (\theta_i/2)(e/\bar{a})^{1/2} (\bar{a}^2 - a_i^2) = MHC_i
$$

When labour immigration is deregulated and skilled and unskilled jobs are open to non-natives in the developed country, we have already found that individuals in the developing country whose innate ability is equal to or higher than $\hat{\min}[\hat{\alpha}_u, \hat{\alpha}_s]$ can attain higher utility by migrating to the developed country and either by studying seriously or by studying not seriously there. We also found that studying seriously does not necessarily provide higher utility than studying not seriously after migration. Only those individuals with innate ability equal to or higher than $a$ attain higher utility by studying seriously after migration (see Equation 8). Therefore, under the deregulated immigration policy, those whose innate ability is equal to or higher than

$$
\max[\min[\hat{\alpha}_u, \hat{\alpha}_s], a]_{\{i_s, s_i\}}
$$

migrate to the developed country and study seriously there.
We cannot determine the ranking of $\hat{a}_{us}$, $\hat{a}_s$ and $a|_{U_{ij}=U_{ij}}$ a priori. However, since

$$\hat{a}_{us} - \hat{a}_s = \frac{1}{\{\theta_s(e/\bar{a})^{1/2}w_s + \theta_{us}(1/\bar{a})^{1/2}w_{us}\}{\theta_{us}(1/\bar{a})^{1/2}w_{us}}}(A - B)$$

$$\hat{a}_{us} - a|_{U_{ij}=U_{ij}} = \frac{1}{\{\theta_s(e/\bar{a})^{1/2}w_s + \theta_{us}(1/\bar{a})^{1/2}w_{us}\}{\theta_{us}(1/\bar{a})^{1/2}w_{us}}}(A - B)$$

$$\hat{a}_s - a|_{U_{ij}=U_{ij}} = \frac{1}{\{\theta_s(e/\bar{a})^{1/2}w_s + \theta_{us}(1/\bar{a})^{1/2}w_{us}\}{\theta_{us}(1/\bar{a})^{1/2}w_{us}}}(A - B)$$

where

$$A \equiv (e - 1)\theta_{us}(1/\bar{a})^{1/2}w_{us} + (\bar{L} - 1)\theta_s(e/\bar{a})^{1/2}w_s (> 0)$$

$$B \equiv \{w^* + RMC + SMC\} \theta_s(e/\bar{a})^{1/2}w_s (> 0)$$

we find that

if $A < B$, then $\hat{a}_{us} - \hat{a}_s > 0$, $\hat{a}_{us} - a|_{U_{ij}=U_{ij}} > 0$, $\hat{a}_s - a|_{U_{ij}=U_{ij}} > 0$

i.e.

if $A < B$, then $a|_{U_{ij}=U_{ij}} < \hat{a}_s < \hat{a}_{us}$

whereas

if $A > B$, then $\hat{a}_{us} - \hat{a}_s < 0$, $\hat{a}_{us} - a|_{U_{ij}=U_{ij}} < 0$, $\hat{a}_s - a|_{U_{ij}=U_{ij}} < 0$

i.e.

if $A > B$, then $\hat{a}_{us} < \hat{a}_s < a|_{U_{ij}=U_{ij}}$

Therefore, if $A < B$, then individuals born in the developing country with innate ability equal to or higher than $\hat{a}_s$ build skilled workers’ human capital in the developed country. In this case, all study migrants study seriously. The sum of employed skilled migrants’ human capital is

$$\int_{\bar{L}} \theta_s(a_i/\bar{a})^{1/2}(ea_i)^{1/2} = \theta_s/2(e/\bar{a})^{1/2}(\bar{a}^2 - \hat{a}_s)^2 (\equiv MHC_{us,A<B}) \quad (10)$$

An individual with innate ability $\hat{a}_{us} \leq a_i \leq \bar{a}$ attains higher utility by migrating to the developed country and studying seriously than by remaining in the developing country. This is because his utility is higher than that of an individual with a lower innate ability, i.e. $\hat{a}_i \leq a_i < \hat{a}_{us}$ and studies
seriously. In addition, an individual who has \( \hat{a}_i \leq a_i < a_{u_i} \) and studies seriously attains higher utility by migration than by non-migration.

On the other hand, if \( A > B \), then individuals born in the developing country whose innate ability is equal to or higher than \( a_{|u_{i,s} = U_{i,i}} \) build skilled workers’ human capital. In this case, only part of study migrants study seriously. The sum of employed skilled migrants’ human capital in this case is

\[
\int_{A_{i,s}^*, \tau_{i,s}} \theta_i (a_i / \bar{a})^{1/2} (e_a / \bar{a})^{1/2} = (\theta_i / 2)(e/\bar{a})^{1/2} \{ \bar{a}^2 - (a_{|u_{i,s} = U_{i,i}})^2 \} \equiv MHC_{i,sut, A>B} \tag{11}
\]

We cannot say definitely which of \( A < B \) and \( A > B \) happens under the deregulated immigration policy. However, \( A < B \) more likely happens when unskilled jobs are less available to non-natives and study and return migration costs are high. In contrast, \( A > B \) more likely happens when unskilled jobs are much available to non-natives and study and return migration costs are low.

We can now consider how the developed country should manipulate the labour immigration policy to coordinate to the study migrants’ acceptance policy, i.e. to increase employed skilled migrants’ human capital.

By comparing Equations (7) and (5), it is clear that \( \hat{a}_i < a_i \). Therefore, when \( A < B \), from Equations (9) and (10)

\[
MHC_s < MHC_{s,sut, A<B}
\]

In other words, the sum of employed skilled workers’ human capital is larger under the deregulated immigration policy than under the regulated one. This suggests that as long as unskilled jobs are less available to non-natives, i.e. the limited number of unskilled jobs is open to them and the migration cost is high, the deregulated labour immigration policy seems to be better.
than the regulated one in terms of skilled migrants’ human capital accumulation. In this case, the labour immigration policy that aims for accepting both skilled and unskilled labour migrants can be compatible with the study migrants’ acceptance policy.

We next compare Equations (9) and (11). Since

\[ a_{y_{1},x_{1}} - a_{S} = \frac{\bar{L} - 1 - (w^* + RMC + SMC)}{\theta_s(e/\bar{a})^{2/3}w_s} \]

\[ = \frac{A - B - (e - 1)\theta_{sa}(1/\bar{a})^{1/2}w_{sa}}{\left\{ \theta_s(e/\bar{a})^{2/3}w_s \right\}^2} \geq 0 \]

\( a_{y_{1},x_{1}} - a_{S} \) can be positive, 0 or negative when \( A > B \). Therefore, it cannot be determined a priori whether employed skilled migrants’ human capital is larger when labour immigration is regulated or when it is deregulated. In particular, if the migration cost is sufficiently low, then \( a_{y_{1},x_{1}} - a_{S} \) can be positive, suggesting that \( MHC_s > MHC_{s,sa,sa,B} \), i.e. employed skilled migrants’ human capital is larger when the labour immigration policy is regulated. However, if the migration cost is low, but not sufficiently low, then \( a_{y_{1},x_{1}} - a_{S} \) can be negative, suggesting that \( MHC_s < MHC_{s,sa,sa,B} \), i.e. employed skilled migrants’ human capital is larger when the labour immigration policy is deregulated. Since it cannot be determined a priori which of \( a_{y_{1},x_{1}} - a_{S} \) and \( a_{S} \) is larger, employed skilled migrants’ human capital is larger under the regulated immigration policy in some cases and it is larger under the deregulated one in other cases.

Therefore, we cannot always conduct the labour immigration policy that allows skilled and unskilled jobs to labour migrants and the study migrants’ acceptance policy that aims for accumulating high-quality human capital simultaneously in a consistent manner.

According to the results, it is not always possible for host countries to increase high-quality human capital and fill the unskilled job’s vacancy by non-natives simultaneously by conducting
the deregulated labour immigration policy and the study migrants’ acceptance policy. Another policy may be necessary to attain these objectives at once.

6. Concluding Remarks

With increases in the mobility of workers and students, many countries experienced the outflow of human capital. They also faced a shortage of skilled and unskilled labour due to the ageing of native workers. In response, they introduced the labour immigration policy and the study migrants’ acceptance policy to cope with these problems. However, they implemented these two migration policies independently, i.e. without considering the compatibility of the two. This study looked into whether host countries could coordinate these policies to increase high-quality human capital and fill unskilled job vacancies by non-natives at once. In particular, this study examined whether host countries should regulate or deregulate the labour immigration policy when accepting study migrants.

This study found that there are cases in which host countries can increase employed skilled workers’ human capital by admitting the unskilled job to non-natives while accepting study migrants. However, other cases exist in which they cannot increase it under the deregulated labour immigration policy. Host countries cannot always increase high-quality human capital and fill the unskilled job’s vacancy by non-natives simultaneously via the labour immigration policy and the study migrants’ acceptance policy.

We can extend our model to a dynamic one in which inter-generational externality operates. Also, there is room to assume that education is financed partly by taxes paid by natives at an old age and non-natives who remain in the developed country to work. We more likely observe such a situation in real economies. Under this assumption, we can also see the effects of migration costs.
on human capital formation. Moreover, this study did not assume acceptance of labour migrants from abroad. Only non-natives who received education have chances of becoming labour migrants in the developed country. This assumption simplified the analysis, but it has made the labour market less competitive for non-natives than in real economies. The analysis will become more general if the developed country receives study and labour migrants from the developing country.
References


Economic Literature, vol. 50, no. 3, pp. 681-730.


Rosenzweig, M. R. 2006. “Global Wage Differences and International Student Flows.” In Collins,


