

Should Host Countries Regulate or Deregulate the Labour Immigration Policy when Accepting Study Migrants?

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Abstract: This study investigates how host countries should manipulate the labour immigration policy when they accept study migrants and employ non-natives 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. Many countries introduced the labour immigration policy and accepted skilled workers to *import* quality human capital while accepting study migrants to *generate* it domestically. In conducting these policies, they tend to deregulate the labour immigration policy and open unskilled as well as skilled jobs to non-natives. However, such a policy may lower the study migrants' incentive to build quality human capital. This study finds that if unskilled jobs are less available to non-natives and the migration costs are high, it is likely that employed skilled migrants' human capital is larger under the deregulated labour immigration policy. However, if unskilled jobs are much available to non-natives 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. These results suggest that the relaxed labour immigration policy is not necessarily compatible with the study migrants' acceptance policy that attempts to generate skilled workers and that additional policies will be necessary to accomplish these objectives at once.

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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 in order 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 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 emigration.

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 did not necessarily limit its objective to accumulate high-quality human capital.

If the government regulated labour immigration and only the skilled job was open to non-natives, study migrants would study seriously, i.e. put self-effort when receiving education, seeking 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. We infer that study migrants might not study seriously and might not build high-quality human capital. This inference can happen because they can be employed as an unskilled labour migrant in host countries, even if they did not put self-effort 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 conducting the study migrants' acceptance policy.

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 decision on migration and human

capital formation 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 while accepting study migrants.

This study finds that if unskilled jobs are less available to non-natives and the migration costs are large, 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 accumulate larger skilled human capital and fill the vacancy of the unskilled job simultaneously. 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 when they accept study migrants and encourage their human capital formation. There happen cases in which they secure unskilled jobs by non-natives, but total skilled human capital is smaller.

Our results suggest that host countries cannot always increase high-quality human capital and fill the shortage of unskilled workers with unskilled migrants by conducting the deregulated labour immigration policy and the study migrants' acceptance policy. Another policy will be necessary to attain these two objectives at once.

This study's contribution is to show the situations in which host countries can adjust the labour immigration policy to the study migration policy to accumulate high-quality human capital and secure unskilled labour and those in which they cannot do so. Existence of these situations suggests

us to implement other policies in addition to migration policies if we are to solve the skilled and unskilled labour shortages' problems simultaneously.

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 born 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 (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 larger under migration or its possibilities. Mountford (1997) and Stark et al. (1997) are those who first 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 situation 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 skilled 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 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. Organisation for Economic Co-operation and Development, 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 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 a 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 on academic activities. 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 dealt with the cultural problem successfully 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

This section models an economy. The economy is comprised of two countries, developing and developed countries. Individuals 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 human capital is available. Individuals native to 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. Study migrants receive education and build human capital at a young age. Some study migrants remain in the developed country at an old age and turn into labour migrants. They may contribute to increasing skilled workers' human capital and in addition, they may fill the unskilled workers' vacancy.

Whether they take the skilled job or the unskilled job 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 migrants who received education in the developed country can work as migrant workers at an old age.

All natives remain in the developed country to work at an old age.

Human capital is primarily 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 from \underline{a} to \bar{a} ($>\underline{a}$). Also, human capital formation is enhanced by a self-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. If he only attends the class, his human capital is not large 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

$$U_i^* = 2w_{us}^* \quad (1)$$

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* put a self-effort (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 utility $U_{1,i}$ is

$$U_{1,i} = \theta_{us} \left(\frac{a_i}{\bar{a}} \right)^{1/2} a_i^{1/2} w_{us} + w_{us}^* - RMC - SEC + \bar{L} - 1 \quad (2)$$

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 costs 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 \bar{L} is a constant and represents the time available at a young age.

The time available for non-academic activities $\bar{L}-1$ yields utility. 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 whether or not study migrants put a self-effort when receiving an education.

Suppose an individual with an innate ability a_i migrated to the developed country and received education in school, and put a self-effort. In that case (this can happen when immigration is deregulated or when it is regulated), he would build human capital by $(ea_i)^{1/2}$. 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, in addition to 1 hour at school. Wages per efficiency for the skilled job is w_s ($> w_{us}$). 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 $\theta_s\{(ea_i)^{1/2}/(e\bar{a})^{1/2}\} = \theta_s(a_i/\bar{a})^{1/2}$, where $0 < \theta_s < 1$ is a constant and measures the overall ease of employment for the skilled job. This depends on the availability and 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 $\theta_{us}(a_i/\bar{a})^{1/2}a_i^{1/2}w_{us}$. If he is not employed in the developed country, he returns to the developing country and does the unskilled job there. His lifetime utility $U_{e,i}$ is

$$U_{e,i} = \theta_s \left(\frac{a_i}{a} \right)^{1/2} (ea_i)^{1/2} w_s + \theta_{us} \left(\frac{a_i}{a} \right)^{1/2} a_i^{1/2} w_{us} + w_{us}^* - RMC - SEC + \bar{L} - e \quad (3)$$

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

$$U_{e,i} |_{\theta_{us} = 0} = \theta_s \left(\frac{a_i}{a} \right)^{1/2} (ea_i)^{1/2} w_s + w_{us}^* - RMC - SEC + \bar{L} - e \quad (4)$$

Individuals born in the developing country firstly 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, study migrants determine whether to put a self-effort or not when receiving education in the developed country. They certainly put a self-effort 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 put a self-effort 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 non-academic activities, and he could derive higher utility from it. 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 putting a self-effort. However, the time available for non-academic activities would be short.

4. Study Migration and Learning

This section considers the decisions on 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 put a self-effort 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 put a self-effort after migration.

Individuals who put self-effort decide migration if $U_{e,i}|_{\theta_{us}=0} \geq U_i^*$. In other words, those whose innate ability is equal to or higher than

$$\frac{w_{us}^* + RMC + SEC - (\bar{L} - e)}{\theta_s(e/\bar{a})^{1/2}w_s} \quad (\equiv a_s) \quad (5)$$

migrate, where a_s is such that $U_{e,i}|_{\theta_{us}=0} = U_i^*$. All of them put a self-effort when receiving education. 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 larger. 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, not only those who intend to put a self-effort but also those who intend not to do

so consider migration.

Even if an individual does not put a self-effort after migration, he can attain higher utility by study migration, i.e. $U_{1,i} \geq U_i^*$ if his innate ability is equal to or higher than

$$\frac{w_{us}^* + RMC + SEC - (\bar{L} - 1)}{\theta_{us} (1/\bar{a})^{1/2} w_{us}} (\equiv \hat{a}_{us}) \quad (6)$$

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

If an individual puts a self-effort after migration, he can attain higher utility by migration, i.e. $U_{e,i} \geq U_i^*$ if his innate ability is equal to or higher than

$$\frac{w_{us}^* + RMC + SEC - (\bar{L} - e)}{\theta_s (e/\bar{a})^{1/2} w_s + \theta_{us} (1/\bar{a})^{1/2} w_{us}} (\equiv \hat{a}_s) \quad (7)$$

where \hat{a}_s is a_i that satisfies $U_{e,i} = U_i^*$. 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

$$\min[\hat{a}_{us}, \hat{a}_s]$$

migrate since they can attain higher utility by migration either by putting a self-effort or by not putting it. It cannot be determined a priori which of \hat{a}_{us} and \hat{a}_s is larger.

Unlike the case in which only the skilled job is open to non-natives, when both skilled and unskilled jobs are open, individuals who decided to migrate determine whether they seek a skilled job or an unskilled job by comparing utility in each case, i.e. $U_{e,i}$ and $U_{1,i}$. Since

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

whether to seek a skilled job by putting a self-effort or an unskilled job by not putting it depends on the innate ability. Utility derived by putting self-effort is

equal to or higher than that by not putting it if an individual has innate ability equal to or higher than

$$(e-1) \left[\theta_s \left(\frac{e}{\bar{a}} \right)^{1/2} w_s \right]^{-1} (\equiv a|_{U_{e,i} = U_{1,i}}) \quad (8)$$

where $\theta_s(e/\bar{a})^{1/2} w_s \underline{a} - (e-1) < 0$ and $\theta_s(e/\bar{a})^{1/2} w_s \bar{a} - (e-1) > 0$ are assumed. According to Equation (8), if utility derived from non-academic activities when not putting a self-effort is much larger than that when putting it, 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, $a|_{U_{e,i} = U_{1,i}}$ increases with $e - 1$. If wages for the skilled job are higher, it is profitable for study migrants to put a self-effort even if the innate ability is lower. Accordingly, $a|_{U_{e,i} = U_{1,i}}$ decreases with w_s .

Equation (8) suggests that when labour immigration is deregulated and skilled and unskilled jobs are open to non-natives, individuals who decided migration put a self-effort if the innate ability is equal to or higher than $a|_{U_{e,i} = U_{1,i}}$. Such individuals build *skilled workers' human capital*. Individuals who decided migration do not put a self-effort if the innate ability is lower than $a|_{U_{e,i} = U_{1,i}}$. Those individuals 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. Based upon this, it 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 (migrant workers who did not receive education in that country), employed skilled migrants' human capital is equal to human capital of study migrants who put a self-effort at a young age and are 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_s migrate to the developed country and put a self-effort when receiving education (see Equation 5). Accordingly, the sum of employed skilled migrants' human capital is

$$\int_{a_s}^{\bar{a}} \theta_s (a_i/\bar{a})^{1/2} (ea_i)^{1/2} da_i = (\theta_s/2)(e/\bar{a})^{1/2}(\bar{a}^2 - a_s^2) (\equiv MHC_s) \quad (9)$$

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 $\min[\hat{a}_{us}, \hat{a}_s]$ can attain higher utility by migrating to the developed country. We also found that putting a self-effort does not necessarily provide higher utility. Only those individuals with innate ability equal to or higher than $a|_{U_{e,i} = U_{1,i}}$ attain higher utility by putting a self-effort after migration (see Equation 8). Therefore, under the deregulated immigration policy, those whose innate ability is equal to or higher than

$$\max[\min[\hat{a}_{us}, \hat{a}_s], a|_{U_{e,i} = U_{1,i}}]$$

migrate to the developed country and put a self-effort when receiving education.

We cannot determine the ranking of \hat{a}_{us} , \hat{a}_s and $a|_{U_{e,i} = U_{1,i}}$ a priori. However, since

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

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

$$\text{if } A < B, \text{ then } \hat{a}_{us} - \hat{a}_s > 0, \hat{a}_{us} - a|_{U_{e,i} = U_{1,i}} > 0, \hat{a}_s - a|_{U_{e,i} = U_{1,i}} > 0$$

i.e.

$$\text{if } A < B, \text{ then } a|_{U_{e,i} = U_{1,i}} < \hat{a}_s < \hat{a}_{us}$$

whereas

$$\text{if } A > B, \text{ then } \hat{a}_{us} - \hat{a}_s < 0, \hat{a}_{us} - a|_{U_{e,i} = U_{1,i}} < 0, \hat{a}_s - a|_{U_{e,i} = U_{1,i}} < 0$$

i.e.

$$\text{if } A > B, \text{ then } \hat{a}_{us} < \hat{a}_s < a|_{U_{e,i} = U_{1,i}}$$

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 put a self-effort. The sum of employed skilled migrants' human capital in this case is

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

An individual with innate ability $\hat{a}_{us} \leq a_i \leq \bar{a}$ attains higher utility by migrating to the developed country and putting self-effort 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. $\hat{a}_s \leq a_i < \hat{a}_{us}$ and a self-effort. In addition, an individual who has $\hat{a}_s \leq a_i < \hat{a}_{us}$ and puts a self-effort 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 $a|_{U_{e,i} = U_{1,i}}$ build skilled workers' human capital. In this case, only part of study migrants put a self-effort. The sum of employed skilled migrants' human capital in this case is

$$\int_a^{\bar{a}} \theta_s(a_i/\bar{a})^{1/2} (ea_i)^{1/2} da_i = (\theta_s/2)(e/\bar{a})^{1/2} \{\bar{a}^2 - (a \mid_{U_{e,j} = U_{1,j}})^2\} (\equiv MHC_{s,MS,A>B}) \quad (11)$$

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 now consider how the developed country should manipulate the labour immigration policy to coordinate to the study migrants' acceptance policy in order to increase employed skilled migrants' human capital.

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

$$MHC_s < MHC_{s,MS,A<B}$$

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. By deregulating the labour immigration policy, they can also secure unskilled labour. Accordingly, 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

$$a|_{U_{e,j}=U_{1,j}} - a_s = \frac{\bar{L} - 1 - (w^* + RMC + SMC)}{\theta_s (e/\bar{a})^{1/2} w_s}$$

$$= \frac{A - B - (e - 1) \theta_{HS} (1/\bar{a})^{1/2} w_{HS}}{|\theta_s (e/\bar{a})^{1/2} w_s|^2} \gtrless 0$$

$a|_{U_{e,j}=U_{1,j}} - a_s$ 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 $a|_{U_{e,j}=U_{1,j}} - a_s$ can be positive, suggesting that $MHC_s > MHC_{s,HS,A>B}$, 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 $a|_{U_{e,j}=U_{1,j}} - a_s$ can be negative, suggesting that $MHC_s < MHC_{s,HS,A>B}$, 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 $a|_{U_{e,j}=U_{1,j}}$ 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, in this case, the developed country cannot always conduct the deregulated labour immigration policy and the study migrants' acceptance policy compatibly. If the labour immigration policy is deregulated when $MHC_s > MHC_{s,HS,A>B}$ happens, employed skilled migrants' human capital is not be maximised and the objective of the study migrants' acceptance policy cannot be fully attained.

Therefore, 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 will be required 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 address these issues. However, they tended to implement these two policies independently, i.e. without considering the possible interdependence 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 the labour immigration policy and the study migrants' acceptance policy cannot be conducted independently. Of course, there are cases in which host countries can increase employed skilled migrants' human capital by admitting the unskilled job to non-natives while accepting study migrants. However, other cases also exist in which they cannot increase it under the deregulated labour immigration policy. Therefore, host countries cannot always increase high-quality human capital and fill the unskilled job's vacancy by non-natives simultaneously via the deregulated labour immigration policy and the study migrants' acceptance policy. This result suggests that other policies will be necessary to attain these objectives at once, in addition to migration policies.

We can extend our analysis 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. 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. Chances for labour migration will affect the decision on study migration.

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