Is "Brain Drain" a Waste or a Driving Force behind the Improvement of Human Capital? *

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Abstract

We survey the situation of emigration of medical professionals in African nations. For many countries, more than 20% of the medical professionals who were tertiary-educated at country's expense leave the country (the Brain Drain). We examine the reasons why so many medical professionals emigrate in African countries and its implications, from the viewpoint of modern economic theory. In addition, another question is whether the huge investments in education at the tertiary level are an efficient way to improve the welfare of a country or not. Taking into account remittances of brain drainers and the external effects of education, it seems that the large amount of investments in higher education could contribute to economic development in African countries.

Keywords：brain drain, migration, medical professionals, internal rate of education, external effect

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Introduction

The migration of health professionals in African countries has been noticed these days. According to Clemens and Pettersson (2008), approximately 37,000, which are about 28% of 96,000, sub-Saharan-born physicians and 53,000, which is about 11% of 415,000, sub-Saharan-born nurses, were working overseas in a developed country in the year 2000.[1)] These represent about three tenth of sub-Sahara-African-born physicians and about one tenth of sub-Sahara-African-born professional nurses were working abroad. The rates of brain drain for physicians and nurses in 2000 are more than 20% in about 80% and 32% countries of whole African countries respectively.

On the other hand, several developed countries are facing a shortage of medical professionals. In particular, the scarcity of medical workers in remote area as well as a specialty division has been becoming a serious problem. Percentage of foreign trained physicians in the USA, Australia, and Canada is 27%, 21.4%, and 20% respectively. In the USA, 30% of migrant physicians are from India and Pakistan, and the main sources of foreign-trained nurses are Nigeria, South Africa, Canada and the Philippines. In the United Kingdom, 31% of its doctors and 13% of its nurses are foreign-born and 20% of the migrant physicians are from Africa, and the figures are 23% and 47% in London respectively.[2)] In Canada, 10% of migrant physicians are from South Africa and one-third is from the United Kingdom.[3)]

While the demand for medical care has been increasing in the developed countries due to the aging population, the medical workers have not increased very much. In addition, since work of them, nurses in particular, is tough, the retention rate of nurses is low compared with other works. So, some developed countries have been recruiting the medical workers actively on an international basis to get hold of them.

Migration of those who have high technology and special knowledge level from the developing countries has been discussed as “brain drain”. Recently in particular, the migration of doctors and nurses from African countries has been increasing and reviewed thoroughly from the viewpoint of the country’s economic development. However due to the lack of exact data, academic research on the cause and effects of the phenomenon has not been developed very much. We try to examine about this problem theoretically as well as empirically from the perspective of modern economics. In Japan, the issue of whether to introduce medical workers from Philippines has become the important topics of policy. The analyses here could apply and are mentioned to the Japanese case. The structure is the followings. The first chapter explains the present situation in African countries. The second chapter analyzes such problems from the perspective of economic theory and simple regression analysis is executed. In the third chapter, the concluding remarks are described.

1) The receiving countries are France, United States, Australia, Belgium, Canada, Portugal, South Africa, Spain and United Kingdom.
2) Refer to “Brain drain and health professionals,” *BMJ*, volume 324, 2 March 2002, bmj.com.
3) Refer to Vujicic et al. (2004).

1. The medical market in African countries

(1) Cost of emigration

About 23,000 qualified professionals in Africa emigrate abroad annually in the early 2000s. A third to a half of its graduates of the medical schools migrates to the developed countries such as U.K., Canada and South Africa. In Zimbabwe, though density of doctors and nurses is below 1 per 10,000, more than 18,000 nurses work abroad.[4)]

Let's see the cost implication of emigration.[5)] The main cost is the tertiary education one. The United Nations Commission for Trade and Development estimated that each professional leaving Africa cost the continent US$184,000 with the current level of emigration of 20,000 graduates annually. In the case of South Africa, about 600 of its medical graduates are working in New Zealand and the financial cost to South Africa was estimated at $37m.[6)] In an example of brain drain for Kenya, only 600 doctors work in public hospitals out of more than 5,000 registered, and the rest have moved abroad or are working in the private sector.

Furthermore, these professionals are usually among the highest taxpayers in their countries, and their departures result in large fiscal losses. Finally, brain drain can lead to brain waste when expatriate specialists are employed in high-income countries for the jobs below their level of qualification.

The loss caused by the departure of the medical workers in the developing countries is partially compensated by remittances from the emigrants. Though it is indeed true that these substantial funds improve household income, it is not sure to what extent they could help contribute to the improvement of the health system in the source countries. There is a supporting argument that migrating abroad might help alleviate internal labor surpluses when unemployment rate in some developing countries such as Philippines is high. However considering the absolute shortage of medical workers in Africa, it doesn't seem that this argument could apply to the health sector in African countries. Furthermore, even in Philippine, from the point of view of long-term, the loss of brain drain might have possibility of outweighing the merit of temporary reduction in unemployment rate. In any case, we need to examine in detail.

There are many reasons for pushing medical workers from the developing countries. They are political instability, civil strife, insecurity, inadequate social service, poor housing and inadequate educational facilities for children, and economically low salaries and lack of continued education as well as professional development.

On the other hand, there is increasing demand for health workers due to the aging society in developed countries. Advance in medical practice and technology also increases the demand for health care. This in-

4) Refer to "Brain drain and health professionals," *BMJ*, volume 324, 2 March 2002, bmj.com. These are official ones and the actual figures are more as many migrate unofficially. In Philippines, More than 150,000 Filipino nurses work abroad.
5) Refer to the above.
6) These figures come from the article "Brain drain and health professionals," *BMJ*, volume 324, 2 March 2002, pp. 499-500

creasing demand for medical workers has not been met by the domestic health workers. In most of developed countries, applications for medical undergraduate and postgraduate education have been decreasing[7] unlike the demand side, which shows the reduced attraction of the medical profession.

In particular, the inflow to the nursing profession is more problematic. Increasing alternative career options for women and the reduced attraction of the job reduce inflow to the nursing profession. In addition, the rate of retention of nurses is low. The nature of the nursing job has also been changing. Higher patient turnover, staff shortage and productivity standards result in ever-greater workloads, health sector reforms and hospital restructuring in increasing bureaucracy. These may explain why many of newly employed nurses in the medical sector leave their position right after the employment. As a result of that, several developed countries try to recruit overseas medical workers as a policy of the countries.

By the way, the main reason for the international migration seems to be the wage difference between the source and destination countries. As table 1 shows for physicians as well as nurses, the wage premium in the USA is the largest and the smallest in France. The wage variation across destination countries is much larger for physicians than for nurses. The nurse wage in Australia and Canada is about 25 times the nurse wage in Zambia, about 14 times in Ghana and about twice in South Africa. The physician wage in the USA is about 25 times the physician wage in Zambia, about 22 times in Ghana and about 4 times in South Africa.

Table 1 Wages frp health care, USDPPP, monthly wages

Source country	nurse	doctor
Chad	$425	$1050
Ghana	$206	$473
Philippines	$380	n.a
South Africa	$1486	$2836
Sri Lanka	$407	$1329
Uganda	$38	$67
Zambia	$106	$425
USA	$3056	$10554
U.K.	$2576	$7676
France	$2133	$5120
Canada	$2812	$8472
Australia	$2832	$5438

Source: WHO:http://www.human-resources-health.com/content/2/1/3

Thus, migrants who wish to migrate to foreign countries don't always choose the country with the highest wage premium. They also consider migration cost, working as well as living conditions, continuing educa-

7) In the USA, applications to medical colleges dropped from 46,968 students in 1996 to 37,137 in 2000.

tion and probability of taking jobs. For example, let's see South Africa and Ghana. The ratio of health care professionals who intend to migrate is about 62% in Ghana and 58% in South Africa, which is almost same.[8] The average wage premium in Ghana is 12 times for nurses and 15 times for doctors, respectively, the average wage in the destination countries. If the wage premium is the only determinant, the ratio in Ghana would be far higher than South Africa. Talking of South Africa, she is not only a sending but also receiving country. She is receiving many health care professionals from African countries. From the point of view of the average wage premium, it seems that they should go to USA and U.K. However they prefer South Africa for some reasons. Migration cost as well as the same culture might be the reasons. In any way, it seems that the average wage premium would not be only choice factor of migration.

The growth of mobility for health professionals is ascribed to development of the commercial recruitment agencies as well as the Internet. However this doesn't imply that social network is not important. When deciding to leave home country, the existence of relatives as well as friends living in destination countries becomes a key factor. Therefore once migration pathways are established, this will promote further migration. For example, the developments of network of Filipino and South African nurses in the U.K. have led to a lot of migrants there.

When you ask a commercial recruitment agency to be able to work as a registered nurse in the destination country, you have to pay some money for it. In Ghana, about £2,500-3,500 is thought to be charged, which excludes accommodation, air fare and visa fees. In the USA, about $5,000-10,000 is charged. This is highly expensive, but this has not discouraged the migration. There are some reasons for that. Even if you stay in the source countries, you cannot development your skill as a professional nurse since they do not have educational system to execute it. If you go to the developed countries and acquire the high level of skill, you can expect to gain the high return from the overseas experience when you return to the home country.

(2) Internal return rate of education

There is an argument that spending on higher education in African countries is a waste of resources due to the high rate of brain drain. However if we take into account remittances of brain drainers, it might bring improvement of welfare in source country. We imagine the policy maker of a small country on how much to spend on tertiary education at the university. People in the country obtain utility from having educated people around them, and the valuation of educated people is equal to the wage rate they earn when they stay in the country. Let $\{W_t^s\}_{t=0}^{\infty}$ denote the expected wages of educated people in the country.

Those who leave the country are supposed to send the remittances. In addition, these remittances are used for the country as a whole not only for the relatives for the senders. Let $\{R_t\}_{t=0}^{\infty}$ denote the sequence of

8) Refer to Vujicic et al. (2004).

expected remittances of a brain drainer. When an individual stays within the country, R_t is equal to 0. Let $\delta=1/(1+r)$ denote a discount factor and r is the interest rate, and the discounted wages and remittances are $W^s=\sum_{t=0}^{\infty}\delta^t W_t$, $R=\sum_{t=0}^{\infty}\delta^t R_t$, respectively. And let C denote the cost of education at the tertiary level.

Policy makers try to maximize the expected discounted present value of the $W+R-C$. At the optimum, marginal cost of additional student at tertiary level is equal to the expected discounted benefit for him or her, and the marginal benefit is the return over and above the secondary educated. We neglect expected wages of those who graduate from the secondary school here for simplicity. We suppose that there are two types of the tertiary educated representative individual. Some will migrate with probability p and the others will stay in the country with probability $1-p$.[9] We refer to the former as NPV^d and the latter as NPV^s

$$NPV^s=W^s-C, \qquad NPV^d=R-C$$

The net present value of the country is the followings

$$NPV=(1-p)NPV^s+pNPV^d=(1-p)(W^s-C)+p(R-W^s) \qquad \text{(I)}$$

The first term is the case if there was no brain drain and the second term represents the expected discounted increment of the remittances over the wages in the source country. The first term is thought to be positive, but the internal rates of return for the education have been considered to be very low so far. However existence of the second term has possibility of enhancing the internal rate of return. To the extent that remittances exceed the wages in the source country, the second term will be positive. In fact, the level of remittances in African countries is very high. We can use data on remittances given by the UN International Fund for Agriculture Development (IFAD). According to it, large remittance recipients (US$ million) are Nigeria(5,397), Ghana(851), Sudan(769), Kenya(796), Senegal(667), South Africa(1,489), Uganda(642), and Ethiopia(591) in 2006. In addition, annual average remittances sent by an African emigrant household are $1,263 more than the average annual per capita income of sub-Saharan African countries.[10] In the case of Ghana, remittances per migrant are estimated to be about $5,200 to $3,600.

On the other hand, we can use data on the cost of tertiary education for the government from the UNESCO datasets. According to it, per unit annual costs of tertiary education is below 3 times GDP per capita in many countries of Africa. Furthermore, the costs have been decreasing over time in African countries. For example, in the case of Ghana, the costs have gone down from 14.8 in 1970 to 2.09 times one in 2005. As a result, simply speaking, we can say that the costs are financed by the remittances for three years. From the perspective of the individual, the internal return of tertiary education investment seems to be high. In the case of Philip-

9) We can think of two types of brain drainers, that is, some will never return to and some will return to the source country. But, because the difference is nothing but the period of remittances, we don't think about it here. Nyarako (2011) considers the possibility of return.

10) "Leveraging Migration for Africa," www.ifad.org/pub/remittances/africa_migration.pdf.

pine, fee of private university is around 400,000 yen for four years. If migrant from Philippine could work in Japan as a nurse and earn 3 million yen per year, the return of the educational investment would be very high. As a result, people in Philippine have strong incentive to migrate to foreign countries such as Japan and USA.

However we have to keep in mind that real benefit of tertiary education is return over the secondary education. As the wages of the secondary school graduates are not considered, the real return would actually get smaller than we think here. Instead of that, the return of migration seems to be high and robust.

According to Hagopian et al. (2004), sub-Saharan African medical schools have trained approximately 5,334 physicians currently practicing in the USA. In particular, Nigeria, South Africa and Ghana account for about 86% of them. The number of Nigerian physicians is 2,158, one of South African is 1,943 and one of Ghana is 478 respectively, and the ratio of total physicians educated in the respective country now practicing in USA or Canada are 9%, 14% and 30%. Furthermore, only ten medical schools in sub-Sahara-Africa have produced 79.4% of the sub-Saharan African countries' graduates who are practicing in the USA. African graduates usually join in a USA residency program. The structure of gender has changed. More than 90% of sub Saharan physicians who are practicing in USA were male in 1969 or earlier, but now only 66.3% of them in 1990 or later are male.

The average age of sub-Saharan African physicians in the USA is getting younger. 42% of sub-Saharan African physicians in the USA are under 40 years. In the case of Nigeria, 63% are under 40. The increasing ratio of them has been advancing in generalist areas, in which many of USA-trained physicians are not willing to advance. If it is possible, they would like to choose medical specialist rather than generalist. However it seems that they are reluctant to accept the job in order to stay in USA. In fact, 57.9% of those trained in the 1990s selected a generalist practice specialty compared to 28.3% of those trained in the 1970s.

In the United States, United Kingdom, Canada and Australia, the immigrants constitute 20 to 30% of the physician workforce. Furthermore, Canada and Australia are the largest receiving countries of physicians from the United Kingdom. And United States is the fifth receiving country of them from Canada. These four countries are sending as well as receiving countries. The net beneficiaries of this movement are the United States and Australia. According to Mullan (2005), net gains of their countries are 12,902 and 2,539 physicians respectively, whereas the net losers are the United Kingdom and Canada, with the net loss of 9,837 and 5,604 physicians respectively. Canada is the net beneficiary with regard to the United Kingdom and Australia, but is the big loser with regard to the United States, and results in the final net loser.

(3) Implications of international migration

The main benefits of the mobility of highly skilled labor are associated with the remittance of income, the knowledge and skills acquired by returnees, and spill-over effects when people try to invest in human capital in order to migrate. In fact, the educational level and the number of applicants have risen sharply in African

country such as Ghana. With regard to remittances, it is difficult to judge how much of remittances come from the health sector. Furthermore, remittances benefit the families of migrant health professionals rather than the health system. However, according to a research, the families with remittances invest in human capital more than the families without remittances, and it seems that there are big differences in economic behavior between the two families.[11)]

A number of factors should be considered in the movement of health professionals. At first, education and training of them are funded by the state. If they leave the state, she will lose the investment return and the tax revenue. A second issue relates to the situation of labor market for the source country. In African countries, poor labor planning has created mismatch in the labor market, and shortages of health professionals have been confronted in many cases. Thus, shortages and unemployment coexist. Due to poor working condition, vacancy rates in public hospitals as well as in rural areas are very high. This is not only limited to the developing countries but also is seen to the developed countries. This is one of reasons why movement of the health workers takes place between the countries. A third issue is related to the education in the source countries. Ironically the education's programs are designed to match for medical care in the developed countries not for domestic medical care from the point of short-run view. As a result, graduates who received the education there do not have the skills to cure the decease of people suffering from in the source countries. If they would like to make the most of their skill, they have no choice but to leave the country.

2. Migration theory

(1) Simple theory

Let's consider the simple theory as a useful guide of migration problem. Whether the individual (i) should decide to migrate or not depends on the wage differences and the moving cost. The simple formulation can be expressed as the followings.

$$M_i = W_{d,i} - W_{s,i} - C_i > 0 \qquad (1)$$

W_d and W_s represent the wage of the destination and source country respectively, and C_i represents the migration cost. It depends on an individual. For example, if he or she is a person who could adapt oneself to new environment easily, his cost of migration is low, and if he has relatives and friends in the destination country, it might be a great help for him to adapt himself to new environment, and then migration cost would get lower. When we suppose that this decision on whether to migrate or not is executed in terms of utility and utility is assumed to be logarithmic and the variables are expressed as natural log, the higher is the destination wage

11) "Leveraging Migration for Africa," The International Bank for Reconstruction and Development/ The World Bank, 2011, africa_migration.pdf.

and the lower are the source wage and the migration cost, the more individual (i) is likely to migrate. Furthermore, if these terms are interpreted as present discounted value, then the likelihood of migration will decline with the age of individual (i) as the remaining working life becomes shorter. In general, since the population of developing countries is likely to be skewed towards the young working classes, international migration can be seen from the developing countries to the developed countries. In fact, the average age of sub-Saharan African physicians in the USA is getting younger. 42% of sub-Saharan African physicians in the USA are under 40 years. In the case of Nigeria ones, 63% are under 40.

(2) Skill and wage

Next, let's introduce skill level into the model. Let individuals in the source country have skill levels designated as $s_{s,i}$, with mean $\mu_{s,i}$ and variance $\sigma^2_{s,i}$. If the individual with skill (s_i) works at the destination and the source, the wages are assumed to be represented respectively as:

$$W_{d,i}=\alpha_d+\beta_d s_i; \qquad W_{s,i}=\alpha_s+\beta_s s_i; \tag{2}$$ [12)]

with means and variances, respectively, μ_{wd}, μ_{ws}, σ^2_{wd}, σ^2_{ws}. Substituting into (1):

$$M=\alpha_d-\alpha_s+(\beta_d-\beta_s)s_i-c_i \tag{3}$$

If the return to skill in destination countries (β_d) is greater than that of the source contries (β_s), migration will increase with skill given the other conditions being constant. Following Borjas (1989), if s_i and c_i are normally distributed, which means $W_{d,i}$ and $W_{s,i}$ are also normally distributed, the migration rate from the source counties to the destination countries can be expressed as:

$$M^{'}=1-\Phi\left(\frac{-(\mu_{wd}-\mu_{ws}-\mu_c)}{\sigma_m}\right) \tag{4}$$

We assume that μ_c is the mean of c_i, σ_m is the standard deviation of M, and Φ is the cumulative distribution function of the standard normal function. Here σ_m is a function of the variance in $W_{d,i}$ and $W_{s,i}$. If we assume that the wage of the destination country is relatively high $(\mu_{wd}-\mu_{ws}-\mu_c>0)$, then the migration rate depends on the wage distribution of the two countries (σ_m). Since σ_m is maximized at the point where $\frac{\sigma_{ws}}{\sigma_{wd}}=1$ the migration rate will be an inverse "U" shaped function of σ_{ws}/σ_{wd}. In this case, when income dispersion at the destination country is big, even if the average wage is high there, people might choose not to migrate because they think the possibility of their wage being low. Therefore, the migration rate depends not only on average wage, but also on the wage's dispersion. In this theory, if the income's dispersion or income equality of both countries is the same, it doesn't matter for migration. For example, when we look at the actual data of Gini index of Phil-

12) This formulation is the same as Hanson (2010).

ippine and Japan, they are 0.461(2000) and 0.249(1993) respectively.[13] The large Gini index in Philippine implies that there are some people who cannot migrate though they really would like to because of inability to pay the migration costs. So, it seems that there is room for migrants to increase if policy for supporting the poor with high skill is implemented.

When the minimum cost (C') is needed in migration as a brokerage, poor people might not be able to migrate due to income constraint. The proportion of the population who couldn't migrate would be:

$$P=\Phi\left(\frac{-(\mu_{wd}-\mu_{ws}-\mu_c-C')}{\sigma_m}\right)$$

Thus, the smaller is the mean income difference and the higher are the cost of migration and the standard deviation of income, the higher the proportion of potential migrants who will be income constrained. However theses income constraints are relaxed through social network. For example, remittances from previous migrants could mitigate the credit constraints.

It seems that migrants who wish to migrate to foreign countries do not always choose the country with the highest wage premium. They also consider migration cost, working as well as living conditions, continuing education and probability of taking jobs. For example, let's see South Africa and Ghana.[14] The ratio of health care professionals who intend to migrate is about 62% in Ghana and 58% in South Africa, which is almost same. The average wage in Ghana is 12 times for nurses and 15 times for doctors, and in the case of South Africa, 3-4 times and 2-3 times respectively, the one in the destination countries. If the wage premium is the only determinant, the rate of brain drain in Ghana would be far higher than South Africa. Furthermore, from the point of view of the average wage premium in general, it seems that most of people in African countries should go to USA. However some people prefer South Africa and other various European countries as the first choice. Migration cost, working conditions and living conditions seem to be as important factors as the wage premium.

There are two ways of thinking in this case. The first argument is that supply of migrants is insensitive to the wage premium. Maybe, the presence of friends and people who come from the same country seems to have same impacts as the wage premiums. In this case, even if the wages of health worker go up in Ghana, supply of migration would not be expected to reduce significantly.

The second argument is that if the supply of migration is sensitive to price mechanism, working conditions and living conditions in Ghana have to be more superior to those in South Africa. However it is difficult to get such data. It seems that with regard to the living conditions, South Africa is better than Ghana considering the following indexes. GDP per capita in 2008 is $10,140 PPP in South Africa and $1,533 in Ghana. The

13) The source of this data is World Development Indicator 06.

14) Talking of South Africa, she is not only a sending but also receiving country. She is receiving many health care professional from the other African countries.

human development index in 2005 was 0.443 in Ghana and 0.597 in South Africa. The ratio of people living below $1.25 PPP per day is about 30% in Ghana and about 26.2% in South Africa. Adult literacy rate in 2008 is 67% in Ghana and 89.3% in South Africa. There is one disadvantage in South Africa. The volume of HIV/AIDS cases is much more in South Africa than in Ghana. The estimated number is 5,700,000 and 260,000 respectively, and the population is about 50,000,000 and 18,000,000. As a result of that, South Africa is more exposed to the dangers associated with HIV/AIDS in the workplace than in Ghana. However, protective measures against HIV are provided more properly in South Africa than in Ghana and it doesn't seem that this factor affects the extent of brain drain remarkably.

As regards to the destination countries, in particular among the four English speaking countries such as the USA, Canada, UK and Australia, there might be slight differences in working and living conditions other than the wage premium, but we could say that those conditions are almost the same among them.

We execute a regression analysis here. The dependent variable is the ratio of brain drain in African countries. The independent variable is the wage difference between the African countries and USA and cost of tertiary education.[15] The estimation equation is

$$Ln\,(Y)=\alpha+\beta Ln(X_1)+\gamma Ln(X_2),$$

$$Y=ratio\ of\ \ brain\ drain,\quad X_1=wage\ difference,\ \ X_2=cost\ of\ tertiary\ education,$$

However the result was not good. We can't reject the possibility of $\beta=\gamma=0$. So, we try the regression analysis with the only variable of wage difference in the case of physicians. In the case of the nurses, it turned out that we can't reject the possibility of $\beta=0$. Therefore, it seems that wage differences do not affect the great effect on the international migration of nurses. Even in the case of physicians, we can't reject the possibility of $\beta=0$ at the significant level of 5%. We could conclude that supply of migration is not responsive strongly to the wage premium within a certain range.

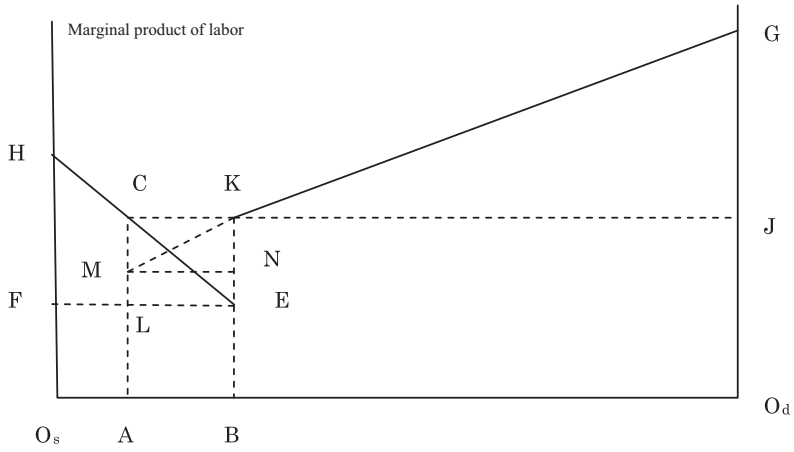
Table 2 The result of regression analysis; physicians

coefficient	Estimated	T value	Significance level
α	-14.391	-1.889	0.065
β	1.259	1.788	0.058

R2=0.07, adjusted value=0.05, N=53

15) In the regression analysis, the variables of wage differences that are converted into logarithm are used. GDP per capita is substituted for wage of every African country.

(2) Diagrammatic Analysis



We suppose two countries: a source (S) and a destination country (D), and think the allocation of people between the two countries. The line GKB is marginal product of labor in D and the line HEB is the marginal product of labor in S. Let's suppose that the demand for medical care is O_dB and the real wage is O_dJ in D, and O_sB and O_sF respectively in S. There is the wage difference of KE between D and S. If the demand for medical care increases by AB in D, the country has to introduce medical workers from source country to meet the demands. We assume here that the marginal product of the source country's labor in D is KM line. In this case, the equilibrium wage is AM in D, and the gain of the migrant is LMNE. However, the loss to the residents in S, so-called to those left behind is CLE. On the other hand, the gain of destination country is KMN. So, the migrants and people in D gain, and those left behind in S lose. Thus in principle, there is room to take transfer from the D to the S into consideration, which can make everyone better off.

Two points need to be kept in mind. In this model, the wage in D would decrease by accepting medical workers from the source country. This is the one of reasons why some groups such as Japanese nurse's association are against the plan of accepting medical workers from foreign countries. But from the viewpoint of the country as a whole, the reduction of the medical cost is needed to solve the fiscal deficits. In principle, the wage depends on productivity of the individuals and scale of the migrants. Therefore, it doesn't always go down automatically. It seems that the reduction of medical costs should be pursued by executing efficient allocation of human resources rather than by preventing the prevalence of foreign medical workers.

With regard to the gain to the destination country, the marginal product of migrants is an important factor. Conservative people criticize it is much inferior to the one of the destination country. In particular, it is often said in Japan that the wall of language is big. In this case, the marginal product line of the migrants starts from not K but far below K in the figure. Marginal product of them might be indeed inferior to the one of destination country during the initial period of work until they adapt themselves to new environment. However it

seems that they get used to it soon as long as they are well trained on the job.

Another problem is the loss to those left behind in source country, which is getting hot issue nowadays. However if externality takes place in production, welfare of those left behind might go up.[16] Since an individual worker will not consider his own level of human capital from the viewpoint of social optimum, the prevailing level of human capital will be less than social optimum level. If many people try to invest in more human capital in pursuit of migration, the level of human capital as a whole would increase compared with the case of no migration. As a result, the marginal product line of the source country would go up.

3. Conclusion

When we think about international migration of, in particular, African countries, we need to see not only economic factor but also living conditions. This means that the wage differences are not only driving forces. The existence of relatives and friends seems to promote international migration. With regard to brain drain, taking into account the remittances of brain drainers and external effects of education, high investments in tertiary education seem to hasten the level of human capital and heighten the economic development in the source countries. Therefore such a policy seems to be the efficient one rather than the waste.

References

Borjas, G. J. (1989), "Economic Theory and International Migration," *International Migration Review,* 23(3), 457-85.

Clemens, Michael A., and Gunilla Pettersson (2008), "New data on African health professional abroad," *Human Resources for Health*, 6(1).

Hagopian, Amy, Matthew J. Thompson, Meredith Fordyce, Karin E. Johnson, and L. Gary Hart (2004), "The Migration of Physicians from Sub-Saharan Africa to the United States of America: Measures of the African Brain Drain," *Human Resources for Health,* 2 (17).

Hanson, Gordon H. (2008), "The Economic Consequences of the International Migration of Labor," NBER Working Paper No.14490.

Hanson, Gordon H. (2010), "International Migration and human Rights," NBER Working Paper No.16472.

Mullan, Fitzhugh (2005), "The Metrics of the Physician Brain Drain," *The New England Journal of Medicine*, 353, Downloaded from nejm.org.

Nyarako, Yaw (2001), "The Return to the Brain Drain and Brain Circulation in Sub-Saharan Africa: Some Computations Using Data from Ghana," NBER Working Paper No.16813.

Stark, Oded (2003), "The Economics of the Brain Drain Turned on its Head," *Toward Pro-Poor Policies, Aid, Institutions, and Globalization, Annual World Bank Conference on Development Economics*, edited by Bertil Tungodden, Nicholas Stern, and Ivar Kolstad.

16) Refer to Stark (2003) with regard to externality.

Vujicic, Marko, Pascal Zurn, Khassoum Diallo, Orvill Adams, and Mario R. Dal Poz (2004), “The Role of Wages in the Migration of Health Care Professionals from Developing Countries,” *Human Resources for Health*, 2(3).