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# Can Health Foreign Assitance Break the Medical Brain Drain?

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**Abstract**

This paper analyses the impact of health foreign assistance on physicians' brain drain. We use the database from Bhargava and Docquier (2008) to explain physicians' brain drain and health foreign assitance from 1995 to 2003 using a bilateral gravity equation model. In the first time, we propose to investigate the direct and reverse impact of health assistance through Simultaneous Equation Model with Three-Stage Least Squares (3SLS) methodology and highlight a significant negative effect of health foreign assistance on the medical brain drain whereas emigration rate of doctor increases the amount of health aid received by recipient countries. In a second time, we analyzed the indirect effect of health aid via epidemics prevalence through the death rate per 1000 people. We find that health aid plays a key role in the improvement of vaccination, treatment and prevention which may reduce death rate and, finally, decreases the physicians emigration rates. These findings confirm the efficiency of health foreign aid to weaken the vicious circle of physicians drain.

Cet article analyse l'impact de l'aide santé sur la fuite des médecins. Nous utilisons la base de données de Bhargava et Docquier (2008) pour expliquer la fuite des médecins et l'aide santé de 1995  2003 en utilisant un modéle bilatral de gravité. Dans un premier temps, nous étudions l'impact direct et la causalité reverse de l'aide santé  travers un modéle d'équations simultanées avec la mthode des Triples Moindres Carrées et nous trouvons un effet significatif et négatif sur la fuite des cerveaux dans le secteur médical. Alors que le taux d'émigration de docteur lui augmente le montant de l'aide  la santé recu par le pays receveur. Dans un second temps, nous analysons l'impact indirect de l'aide santé via la prévalence d'épidémies capté par le taux de mortalité brut pour 1000 personnes. Nous trouvons qu'il joue un rôle important dans l'amélioration des taux de vaccination, des traitements et de la prévention qui réduit le taux de mortalité et, á son tour, décroît le taux d'émigration des médecins. Ces résultats confirment l'efficacité de l'aide santé dans le ralentissement de ce cercle vicieux de la fuite des médecins.

*Keywords:* International Migration, Physicians Emigration Rates, Foreign Aid, Health foreign assistance, Simultaneous Equation Model, Three Stage Least Squares, Gravity Equation model.

*JEL classification:* F22 - F35 - O15 - C23 - I1 - O11.

# 1 Introduction

Over the last twenty-five years, international migrations became an important figure of the globalisation. In 1965, the world counts 75 millions of migrants (2% of world population), and in 2000 the number of migrants is around 175 millions which corresponds to 3% of the world population (Nations (2001) ,Simon (2002)). This migration is equally balanced between "'North-North migration"', "'South- North migration"' and "'South-South migration"'. The last one is being an increasing phenomenon during the last year, but because of lack in data, few studies have been realised.

Over the last decades, there was a huge debate focused on the impact of brain drain in the developing countries. On one hand, the traditional view ( Miyagiwa (1991), Haque and S.J (1995), Bhagwati and Dellafar (1973)) shows a negative effect of labour migrations and specially of skilled migrations. It could be explained by the net loss of human capital with negative convergence on the development process of sending countries.

On the other hand, more recently, a more optimistic view has emerged.

First, theoretical (Mountford (1997)) and empirical approaches (Beine et al. (2001)) show a positive effect of migration's perspective on the expected change in education's level of non migrant population. In fact, in developing countries where the return to education is very low, the migration's perspective increases the incentive to invest in education which raises the level of human capital. Even though part of educated people will migrate finally, most people stay at home with a higher education level which create positive externalities for growth. This positive feedback takes the name of "'Brain Gain"'. In other words, in countries where the brain drain is important, the level of education appears higher.

Second, positive impact of skilled worker emigration on origin's countries can be transmitted through the amount of remittances from migrants to their relatives (Adams (2006)). It can have an impact on the family educational level (Mansuri (2006)), their health mac kinnon and finaly their welfare (Azam and Gubert (2002)).

Third, whereas the traditional view has seen the migration process has definitive, the recent one analyzed migration as "'pendulum"'. So return migration can contributes to the development process through knowledge and technology diffusion Dos Santos and Postel-Vinay (2005) and business entreprise enlargement (Dustmann and Kirchkamp (2002)).

Finally, diaspora externalities (Beine et al. (2008)) permits information exchange accross the world. This permit to increase the foreign direct investments (Kugler and Rapoport (2007)), trade (Head and Ries (1998)) and social norms diffusion (Beine et al. (2008)) as such fertility rates.
However, Docquier (2007) showed that, after a threshold of 15% of emigration, brain gain cannot compensate the brain drain.

As skilled migration, the emigration of physicians' from developing countries to developed countries has increased. For example, according to American Medical Association, in 2002, 23% of physicians in Canada were trained abroad (Astor et al. (2005)).

This phenomenon is acquiring a big importance for several reasons in OECD countries:
(i) Developed countries face an ageing population which is and will be big consumers of health and medical services in the future.
(ii) In OECD countries, a decline in the number of children per women consequently leads to a reduction of new students in medecine and finally to a possible reduction in new physicians and new health workers. Even if the number of health diploma, particularly in Europe, is fixed by the "'numerus closus"', the demography has a significant impact on the replacement of doctors (OECD (2008a)).

(iii) The educationnal medical system in developed countries itself is unable to create sufficiently medical workers compared to the shortage observed in the medical labour market. As said before, the "'numerous closus"' is fixed and not take into account the need of population in health care (OECD (2008a)).

This gap between health demand and health supply pushed developed countries to host medical workers and to compete with other developed countries for the recruitement of health workforce from all over the world. Because globalisation has caused interaction between countries, developing countries may face an emigration in health sector and it may cause, in turn, a shortage of medical workers in these countries.

The impact of such emigration for sending countries on the health outcomes is large, and particularly on the achievement of the Millenium Development Goals in the health sector. The fourth Goal is to reduce by two third in 2015 the under-five mortality rate, the fifth is to improve the maternal health and the sixth is to fight epidemics such as HIV-AIDS, malaria and others (Nations (2008)). In all these objectives, the need of professionals health care is so important to improve the health population and to attain this target in 2015.

When the International Community adopted the Millenium Development Goals in 2000, one of the tools which was preconised to attain these objectives was to increase the Official Development Assistance (ODA) toward developing countries. As a symbol, in 2005, ODA goes up to the threshold of $100 billion. Official Development Assistance, and particularly in the health sector, has the property to increase the infrastructure such as new hospitals, more medicines and drugs, vaccination and prevention programs, new equipement... However, because the number of health workers, and particularly doctors and nurses, are not sufficient (especially in rural and less wealthier areas (Dussault and Franceschini (2006)), the operating and access of these facilities remain limited. The increase in health infrastructure may be accompanied with an increase in health professional to improve the health quality in developing countries.

The management of health workforce around the world seems to be consider in developed and developing countries. Already in seventies, Bhagwati and Dellafar (1973) proposed to tax skilled emigration to compensate the expected shortfall. This preconisation was theorically efficient but it caused such operating and functioning problems that policymakers did not decide to implement this policy. Then, developed countries has become more selective in their immigration policies, on one hand, through the restriction of visas delivrance and, on the other hand, through the reinforcement of borders control to deter illegal immigrants. Finally, OECD organisation advocates coherence in migration, trade and aid policies between developed and developing countries for the attainment of development process (OCDE (2007)). Cogneau and Lambert (2006) investigate the relationship between foreign aid, trade and migration in a macroeconomic approach. They conclude that foreign aid responds to a compensation of other flows (trade, capital flows and migration). Nevertheless, policy implications about the control of these flows and the linkage between them is very complex and not easy to implement.

Our paper try to evaluate the effect of health foreign aid on the medical brain drain and his capacity to retain medical workers. The contribution of this paper is triple.

Firstly, even if theorical research exist on this topic (Gaytan-Fregoso and Lahiri (2000) and Schiff (1994)), few study (Berthélémy et al. (2008)) investigates empirically the effect of foreign aid on migration. However this study focuses on general migration whereas we analyses this correlation particularly in health sector.

Secondly, we use a new database on bilateral medical brain drain (Bhargava and Docquier (2007)) which allows panel analysis. It covers the bilateral physicians' emigration of 192 developing countries (even in Sub-Saharan Africa) to 16 OECD countries over 14 years (1991-2004).

Thirdly, policy implications are important on the impact of health foreign assistance on the

medical brain drain. As Kugler and Rapoport (2007) asked, are international labor and foreign aid in health sector complements or substitutes? Subsitutes means that aid is a great tool to reduce physicians emigration by improving medical working conditions whereas complements means that aid gives incentives to South physicians to migrate.

The paper will proceed as follows: Section 2 gives a general review of the literature on the medical brain drain. Then, Section 3 will present the analytical framework. Section 4 presents estimation strategies and data; Section 5 reports findings and Section 6 concludes.

# 2 Review of Literature

## 2.1 Determinants of medical emigration

Even if the physicians' emigration has take a large part in the debate of migration's consequence, few studies tried to investigate the determinants of these movements. Astor et al. (2005) has established a questionnaire which ask questions about the motivation of migration decision, the working conditions in health sector and policies which could be effective to improve physicians conditions. In this part, we report only statistics concerning the migration decision. Their analyse is foccused on 5 countries: India, Nigeria, Pakistan, Colombia and Philippines. 90,8% are attracted by the desire for a higher income. This result go in favor to Harris and Todaro (1970). They stipulate that migration is attracted by the differential between origin's wage and the expected destination's wage.

However another factors has an increasing importance in health sector is the working conditions. In Astor and al's survey, 74,1% of respondants want to have access to better techonology and equipment. In the same way, Vujicic et al. (2004) discussed about the role of wage in two African countries: Ghana and South Africa. They observed that the wage premium (ratio of destination wage on the source wage) is about 22 between Ghana and the USA, it is only 4 for South Africa. They expected that medical workers emigration is much lower in South Africa than in Ghana. Surprisingly, the percentage of health care professionals who intend to migrate is quite similar (62% in Ghana and 58% in South Africa). Vujicic et al. (2004) conclude that the correlation between supply of health worker and the wage ratio is quite small. So policies which consist in increasing the source wage will not reduce enough the huge wage differential to weaken health professionals emigration rate. Better policies are those which improve the working and living conditions in developing source countries. In this case, the higher HIV prevalence in South Africa explains the same emigration rate with Ghana. Their policies proposition goes in favour of the effectivness of health foreign aid in weakening medical emigration through the improvement of working conditions.

Awases et al. (2004) have made a survey on the migration of health professional in 6 African countries: Cameroon, Ghana, Senegal, South Africa, Uganda and Zimbabwe. They observe an increase in the number of migration of health workers which occured principally nurses. In 2002, the intention to migrate is quite high in these countries ranging from 26,1% in Uganda to 68% in Zimbabwe. The favorite destination countries are United Kingdom, the Unites States and France. Further reasons are given by these health workers to explain their decision to emigrate or their intention to migrate: Better remunerations (72% in Uganda), more perspective for training and experience (85% in Cameroon) and because of poor management of lack of resources in health services. Awases et al. (2004) show that countries where the HIV-AIDS prevalence are higher (in their cases: South Africa, Uganda and Zimbabwe), the situation becomes more stressful for health professionals.

In the same way, in countries where the health care system is basic and faces high epidemic prevalence (HIV-AIDS, Tuberculosis, Malaria...), the medical brain drain is disastrous.
Bhargava and Docquier (2008) demonstrated that physicians' emigration is explained by an increase in HIV prevalence especially in Sub-Saharan Africa. Their analysis is based on database of medical emigration collected on census data and association data from the 16 biggest OECD countries. In the first step, the medical emigration rate is explained by economic variables: GDP

per capita, percent of secondary school enrollment, ratio of wage in home on wage in USA and by health variables in particular HIV prevalence. Even if the wage ratio go in favour to migrants move to countries where the expected wage are higher,one of their main results reveal, that a double of HIV prevalence rate induces an increase of medical brain drain close to 80%.

## 2.2 Consequence of physicians' emigration on sending countries

The migration research debate between "'brain drain"' view and "'brain gain"' view has been transmitted to the health sector. In that way Winters et al. (2007) are even more pessimistic. They focussed their analysis on the health sector, especially on the overseas doctors in the United Kingdom. They specified two conditions for the brain drain to be beneficial:Firstly, as the "'brain gain"' theory claims, the incentive to migrate should have an impact on the education process, in their paper on the medical training. Their survey and their calculations go against this assumption. Secondly, migrants might not be strongly screened, because if the selection process is too hard, almost everyone believe that they have no chance to be admitted by the host countries and so only few people decide to invest in education. In developed countries, the admission process is very strict and restricting.
Winters et al. (2007) questionnaire showed that none of these conditions is fulfilled and conclude that the "'Brain Gain"' hypothesis is not applicable in the health sector.

Defoort (2008) demonstrated that the "'Brain Gain"' theory is verified in some countries. Her econometric study found that it exist a convergence process to their long term equilibrium in term of the number of health physicians. Secondly and the more important, the perspective to migrate is positively correlated to the growth of number of physicians only in middle income countries. Defoort (2008) explains this result by the liquidity constrain in low income countries which inhibit the investment in medical education. This incentive effect seems to well operate into 2 regions: Asia and Latin America. Finally the presence of pandemics such as Malaria deter the investment in medical education. This paper goes in favor to the new approach of "'Brain gain"' theory and find positive incentive associated to the medical emigration. However, Sub-Saharan Africa seems to have no incentive effect in acquiring medical education whereas it is this region where the situation is alarming.

On the other side, Awases et al. (2004) showed the risks associated of quality and quantity of medical education and training after large physicians emigration. This emigration cause problem into the replacement of teacher in medical schools and into the quality of medical course because the emigration of experienced medical teacher. Awases et al. (2004) cited the problem associated to the cost of training medical professional. Because large part of medical training is subsidied by governement, the emigration after their diploma obtention represent a large lost in term of taxation. They proposed that developed countries have to participate into the educational medical system in conterpart of the requirement of health professional from these developing countries.

Astor et al. (2005) asked also question about the characteristics of medical schooling and the potential impact of physician's migration on sending countries. 55,6% of interviewed professionals think that medical schools provide number of specialized student in medecine which are used more effective in other countries. Moreover, in Pakistan, Nigeria and Phillipines more than 50% are agree with the fact that physicians' emigration has led to insuficient physicians to meet the need of population healthcare and so has not help to build the health system. According to "'Brain gain' theory, close to half respondants think that migration permits to increase the medical level knowledge and education.

In the second step of their paper, Bhargava and Docquier (2008) use the medical brain drain to explain the number of death due to HIV and the life expectancy by using a simultaneity equation model. They found that a double increase of physicians' emigration causes an increase of 20% of death due to HIV a fortiori in countries where HIV prevalence is high (the threshold is about 3%). Bhargava and Docquier (2008) propose to solve this vicious circle by implementing pilot program

for the health sector and fighting HIV prevalence which pushes physicians to leave their country.

Chauvet et al. (2008) tried to compare the effect of remittances and health ODA in improving the child mortality. It seems that health aid is effective in improving child health only in countries under the threshold of $3225 income per capita. In upper countries, the health aid rises the child mortality. Whereas, remittance per capita elasticities remains significantly negative whatever the regression. Chauvet et al. (2008) go beyond the first specification, and try to evaluate the effect of medical brain drain on the child mortality. And, as we expected, the lack of health care professionals causes a big damage on the child health. In a descriptive statistics, aid to training and education in health sector seems to be positively correlated to emigration rate in medical sector. In other words, investing in health education creates incentives for medical students to go training and working abroad. Dayton Johnson and Katseli (2006) underlined the policy incoherence between the foreign aid policy, particularly in health sector, and the immigration policy in OECD countries.

# 3 Analytical Framework

relation.pdf

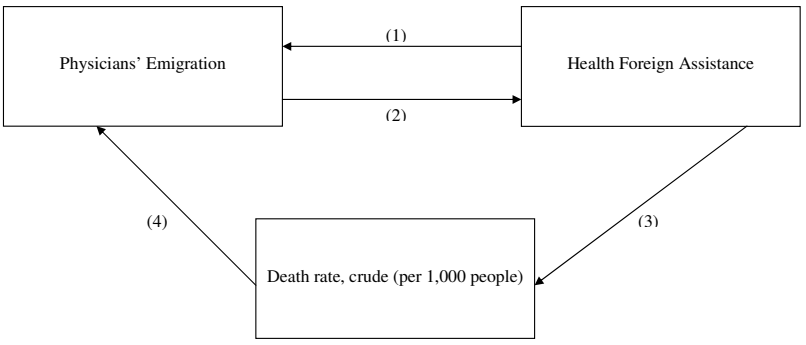



Figure 1: Relationship between Health aid, Migration and Death Rate

We assume the following relationship existing between Health aid, Physicians emigration and

working conditions (see Figure 1). (1) and (2) represent the direct impact between health aid and physicians emigration and the reverse causality. This effect can be analysed by Three Stage Least Squares method in our analysis. The (3) and (4) show the indirect impact of health foreign assistance on the physicians emigrations rate through the death rate.

### 3.1 Direct Impact of Health Foreign Aid

Health foreign assistance can adopt different types of activities such as building hospitals and clinics, assistance to specialised institutions such as those for tuberculosis, maternal and child care, other medical and dental services, disease and epidemic control, vaccination programmes, nursing, provision of drugs, health demonstration, public health administration and medical insurance programmes. It includes also training of physicians which corresponds to grants to students to realize part of their scholarship in an OECD country (Chauvet et al. (2008)). It improves the mobility of migrants and particularly physicians. This type of aid can change the expectation of physicians at the end of their training which creates incentives for them to stay in the destination country after their diploma and accelerates the emigration of health workers in the short term. Although the mobility grants have the aim of increasing the international migration, origin's countries expect their health workforce will come back after educational duration. If migrations become permanent, the mobility grants may have negative effects in the source countries. Many reasons can be cited: Firstly, if the cost of education is supported by public funds, permanent migration will reduce social return to education. Secondly, we expect that remittances or diaspora effects could compensate this loss. But the effect of remittances on health in home countries is ambiguous (Adams (2006)).

On the other side, foreign aid can delay the migration decision for physicians. In fact, health assistance create hope in labour conditions improvement. Obviously, if the situation is better than before, it means that health assistance is effective and migration decision can be delayed to another period or dropped. In health aid, part of it is devoted to drugs' provision and medical equipments. This kind of aid can permit to improve the working environment of medical doctors. Furthermore, part of official development assistance take the form of technical assistance such as an expertise on specific topic. These kind of aid in health sector can help physicians to work in better conditions and then avoid them to migrate *in fine*. All these improvements into working conditions through the financement of medical tools, equipement, or expertise for basic health is captured by health aid and this type may have a completely different implications compared to mobility grants.

We can think also, that if we help health sector, all the ressources presented in source countries included human capital will converge to the helped health sector rather than other health sector. Typically, the health aid devoted to public health sector can improve the working conditions and can compete with the private medical sector. Then, physicians in private sector can be attracted by a public career which in turn improve the labour environnement. This "'vertuous circle"' can be announced by the arrival of health foreign assistance.

The impact of health aid may be different amoung time. Typically, in short term (before five years), the direct impact of health assistance lies in activities with an immediate effect such as grants for medicine students and medical specilisation or the furniture of medical tools or drugs. But, in long term (more than five years), after the realisation of health infrastructures such as hospitals, the construction of clinics... the impact of health assistance can be different[1].

The relationship between physicians' emigration and health aid can be positive if the destination countries compensate the brain drain they generated by an increase of their level of health assistance to these countries. Morover Lahiri and Raimondos-Moller (2000) have shown that diaspora in destination countries may lobby to influence the allocation of aid. Berthélémy et al. (2008) show that the presence of specific diaspora in OECD countries could influence the allocation of aid.

[1] Unfortunetely, due to data time limitations, we cannot test this hypothesis in this study

### 3.2 Impact of Health Foreign Aid through improvement into epidemics prevalence

Foreign aid in medical sector should permit a substantial improvement in working conditions, finances vaccination campaign to fight epidemics and should improve the labour environment of doctors.Bhargava and Docquier (2008) show the importance of epidemics like HIV-AIDS in the decisions of physician's emigration. In fact, a high HIV prevalence rate deteriorates the safety of care and creates high transmission risk for medical staff. Then, medical workforce have an additional incentive to migrate. As Bhargava and Docquier (2008) said, the emigration rate creates in turn high death rate due to HIV because, in one hand, in developing countries the availability of anti-retroviral treatment are quite low and , on the other hand, if the equipment and drugs are available, the medical staff is not sufficently presented to nurse patients infected by the HIV-AIDS virus. So, health foreign assistance can have an indirect effect via the combat against diseases to retains health emigration. The problem is how can we measure it? The HIV prevalence rates as used by Bhargava and Docquier (2008), can be a good proxy for this. However, HIV data is not available annually from 1995 to 2003 and this statistic is not completely reported for countries where the prevalence rate is high. So we prefer to approximate epidemics prevalence rate as the death rate crude per 1000 people. This variable is quite well reported in our analysis accross time period and accross countries. In fact, where the death rate is high, we may suppose that epidemics is highly present. The advantage of this variable is that it embodies all diseases which developing countries faced. For example, in Sub-Saharan Africa, HIV-AIDS causes big damage. With high HIV-AIDS transmission, other types of diseases reappeared such as tuberculosis because sick persons suffer of a loss of immunization, consequently, they contract others diseases. Because this region is geographycally in a tropical area, the climate conditions is favourable to the proliferation of mosquitos, in particular Plasmodium falciparum species which increases the malaria transmission risks. Death rate includes death due to these big pandemics but also other death due to less fatal diseases such as measles, diphteria, tetanus and pertussis.[2]

Our econometric analysis can give the genuine effect of aid, especially in health sector, on the physicians' emigration rate, directly or indirectly, controlling for others factors.

## 4 Data and Empirical issues

### 4.1 Data and descriptive statistics

The medical brain drain dataset of Bhargava and Docquier (2007) covers 192 source countries to 16 OCDE countries during the period of 1991 to 2004. These 16 OCDE destinations countries are the most important doctor immigration countries (nearly 75%, see Bhargava and Docquier (2007)). These countries of destination are Australia, Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Italy, New Zealand, Norway, Portugal, Sweden, Switzerland, United Kingdom, and United States. Our analysis is focused only on the time period between 1995 and 2003 because our health aid database and all others variables are available only for this period. Medical brain drain is defined as the part of physicians educated in their countries but working abroad. We keep as dependant variable, the rate of medical brain drain which is denoted $M_{ij,t}$. $M_{ij,t}$ is defined as the stock of physicians from country i working abroad in country j and P$i,t$ is the number of physicians working at home $i$ at time $t$ and $\sum_{j=1}^{16}(M_{ij,t})$ is the sum of migration stocks between i and all destinations countries j.

[2]Notice that retaining medical staff in health sector can have positive impact on population welfare and specifically on the reduction of mortality (Bhargava and Docquier (2008) and Chauvet et al. (2008)). In fact, the presence of health staff should permit developing countries to faced diseases and finally reduced deaths and so improve the working conditions. Notice that the opposite is possible. If health aid cannot permit to improve the health working condition, then emigration rate continue and mortality will be higher which in turn deteriorate the labour conditions. In order to simplify the specification, we will not investigate these correlations. The allocation of health aid can be different for countries where the death rate is higher. Even if aid allocation is influenced by "'self-interest"' factors (see Berthélémy (2003)), a higher death rate could change the aid distribution As previous, and because instruments are difficult to be found, we will not focussed on this issue.

Medical brain drain rate is then defined by the following equation:

$$MBD_{ij,t} = M_{ij,t}/(P_{i,t} + \sum_{j=1}^{16}(M_{ij,t}))$$

We prefer the rate rather than stocks of physicians emigration for dependant variable because the absolute value is not taking into account the physicians population staying at home.

Table 1 gives descriptive statistics of the level of medical brain drain. Some interesting figures can be raised out:

Firstly, small countries or islands are most affected by medical brain drain. For example, in 2003, the average rate of medical brain drain in small countries is around 14%. In Carabean islands like Grenada and Dominica the rate of medical brain drain is above 90% in 2003 which explains the higher medical brain drain in this region. Notice that in Pacific island, the situation is equivalent.

Secondly, Low income countries face high emigration rate in health staff. This phenomenom is quite worrying because it is in this part of the world that the number of physicians per 1000 people is the lowest. For exmple, In Sub Saharan Africa, the number of physicians for 1000 people is 0,16 and but the emigration's rate of physicians is equal to 16.4% in 2003 which is the highest rate in the world. These huge outflows of health care professional cause shortage in sending developing countries which creates hard rise in mortality rate.

Official Development Assistance(ODA) database on health sector is extracted from the Country Reporting System (CRS) database which is provided from Development Assistance Committee(DAC) of the Organisation for Economic Co-operation and Development (OECD). Health sector includes assistance to hospitals and clinics, assistance to specialised institutions such as those for tuberculosis, maternal and child care, other medical and dental services, disease and epidemic control, vaccination programmes, nursing, provision of drugs, health demonstration, public health administration and medical insurance programmes.

In our analysis, we focused only on the health aid commitments expressed in constant dollars in 2006 rather than disbursement[3]. However CRS database begins from 1995 until recent period which constrains our study to begin in 1995. Moreover, large part of CRS database is composed of missing data in health sector. It can mean either that donors are not giving any health aid at the period considering or the donors are giving health aid but it was not reported. That's why these missing data are dropped from the analysis rather than considered as zero health aid. In dropping our missing data, our database is not really a panel data because some pairs of countries (we are in a bilateral analysis empirical issue) only appear in discontinuous way across the time. So our database permits us to realize pooled analysis (with different periods but with different country-pair across the time) rather than genuine panel data analysis with fixed or random fixed effect.

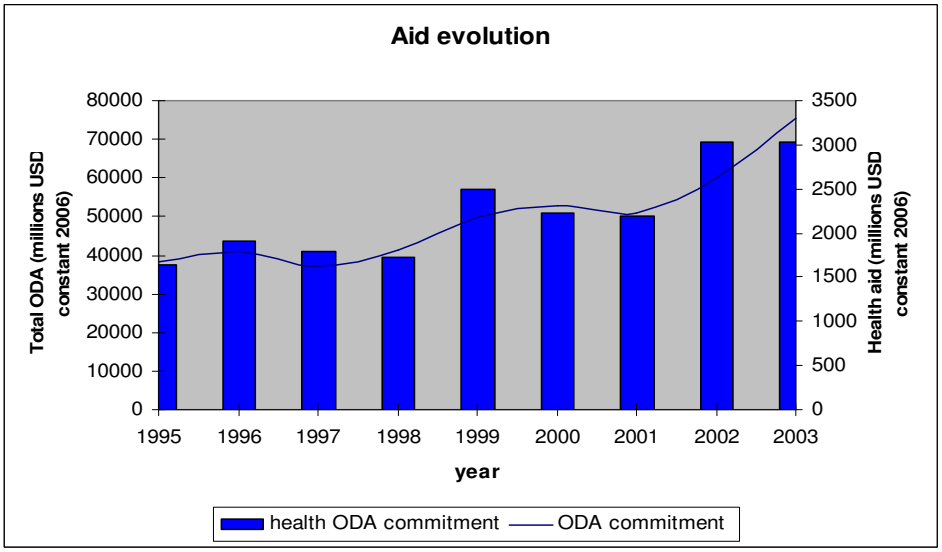
Figure 1 deals with the evolution of total Official Development Assistance (ODA) commitment and the specific ODA in the health sector. During 1995 and 1998, global ODA and health aid have not changed and keep, respectively, around 4 billions and 2 billions. However, after 1998, foreign aid increases gradually until 2003 to 70 billions US Dollars. Health assistance goes from 2 billions to 3 billions in 2003. These net increases go in paralell with the adoption of Development Millenium Goals in 2000 to eradicate poverty and fighting epidemics in health sector.

[3]Disbursement is underreported compared to commitments which provide not enough data for an econometric analysis

Table 1: Physicians Distribution accross country group

| 1995 | Physicians Emigration Rate | Nb Physicians per 1000 people |
|---|---|---|
| **Population Size** | | |
| small (pop<2.5m) | 12% | 0.88 |
| lower middle (2.5m<pop<10m) | 8% | 1.50 |
| upper middle (10m<pop<25m) | 6% | 1.52 |
| large (pop>25m) | 2% | 1.35 |
| **Income group (WB Classification)** | | |
| Low Income | 6.2% | 0.08 |
| lower middle income | 2.1% | 0.78 |
| upper middle income | 3.1% | 1.39 |
| high income | 3.8% | 1.82 |
| **Geography** | | |
| East Asia - Pacific | 1.1% | 0.65 |
| Europe - Central Asia | 0.7% | 2.95 |
| Latin America - Carribean | 2.4% | 1.18 |
| Middle East - North Africa | 5.5% | 1.25 |
| OECD | 3.9% | 2.64 |
| South Asia | 8.5% | 0.27 |
| Sub-Saharan Africa | 16.8% | 0.15 |
| 2003 | Physicians Emigration Rate | Nb Physicians per 1000 people |
| **Population Size** | | |
| small (pop<2.5m) | 14% | 0.99 |
| lower middle (2.5m<pop<10m) | 7% | 1.61 |
| upper middle (10m<pop<25m) | 5% | 1.64 |
| large (pop>25m) | 2% | 1.48 |
| **Income group (WB Classification)** | | |
| Low Income | 14.1% | 0.99 |
| lower middle income | 6.6% | 1.61 |
| upper middle income | 5.0% | 1.64 |
| high income | 2.4% | 1.48 |
| **Geography** | | |
| East Asia - Pacific | 1.0% | 0.72 |
| Europe - Central Asia | 1.1% | 2.90 |
| Latin America - Carribean | 2.3% | 1.37 |
| Middle East - North Africa | 5.7% | 1.52 |
| OECD | 3.6% | 2.94 |
| South Asia | 7.7% | 0.36 |
| Sub-Saharan Africa | 16.4% | 0.16 |

Notes: Author Computations from Bhargava and Docquier (2007) dataset.




Source OCDE-CAD-CRS

## 4.2 Empirical Models

### 4.2.1 Simultaneous Equation for Direct and Indirect Impact

We analyse the effect of foreign aid in health sector on the medical brain drain all over the world. We follow Mayda (2005), and specify a bilateral "'gravity equation model"'. Then, we add health foreign assistance. We expect that health foreign aid may affect the physicians' brain drain through a reverse causality. So, we use a system of simultaneous equations with Three-Stage Least Squares (3SLS) method.

This methodology has many advantages:
-Firstly, it decomposes the reverse causality because dependant variable in one equation appears in right-hand side (as explicative variables) in other equations.
- Secondly, in 3SLS, the endogeneity is taking into account through the introduction of exclusion variables which appear in one equation but not elsewhere. These exclusion variables are extremely important because there are used as intrumental variables for the endogeneous variables. Good instruments permit to control for endogeneity, that's why we reported in our analysis, test of validity of instruments for our exclusion variables.
-Thirdly, 3SLS, rather than 2SLS, takes into account the disturbance between residual in different equations.
-Finally, the simultaneous equations framework give the possibility to incorporate other equations as channels transmissions.

All variables in all specifications are expressed in logarithm except colony, common language

and contiguity dummies for interpretation as elasticities. The estimated system of equation is the following:

$$MBD_{ij,t} = \alpha_0 + \beta_1 Y_{i,t} + \beta_2 Healthaid_{ij,t} + \beta_3 X_{mbd,t} + u_{ij,t} \quad (1)$$

$$Healthaid_{ij,t} = \alpha_0 + \beta_1 Y_{i,t} + \beta_2 MBD_{ij,t} + \beta_3 X_{h,t} + u_{ij,t} \quad (2)$$

where:
$(_i)$ is the country of origin, $(_j)$ is country of destination, $(_{ij})$ represents pair of countries and $(_t)$ is the year.

Differents $\alpha_0$ in equations is defined as the constant. $MBD_{ij,t}$ is our dependant variable which is the physicians emigration rate occured in home country (i) to destination country (j) at time (t). $Healthaid_{ij,}t$ is our interested explanatory variable which is the foreign assistance devoted to health received by the country of origin (i) and given by donors (j) at time (t).

$Y_{i,t}$ correspond to common variables which appear into both equations. We incorporate variables which appears traditionnaly into "'gravity equation model"' such as:
Gdp is the gross domestic products per capita in PPP. [4] Pop is the population in total. All these variables are provided by the World Development Indicator 2006 from the World Bank.

Distance is the simple distance in kilometers between the source most populated cities and the destination most populated cities. Language is dummy variable for sharing common official primary language. Colony represents dummy variable for have ever been in colonial relationship. Finally, Contiguity is a dummy variable equal to 1 if contiguity occurs for country-pairs. These variables are extracted from Mayer and Zignago (2006).

Political is defined as the ICRG political index which varies from 0 to 100 points and consider different kind of political stability: Government Stability, Socioeconomic conditions, Investment profile, Internal Conflict, External Conflict, Corruption, Military in Politics, Religion in Politics, Law and Order, Ethnic Tensions, Democratic Accountability, Bureaucracy Quality (ICRG (2004)). Higher points mean that political risk are low and lower points mean that political risk are high. These data are coming from International Country Risk Guide (ICRG) database.

To decompose the global effect of health aid on migration, we identified simultaneous equation model where we included transmission channels in another equation. Because our first specification is on bilateral analysis, we cannot introduced the death rate in origin's countries itself as dependant variables. Then we aggregated physicians migration and health aid by each destination countries. Then, we obtained:

$$\sum_{j=1}^{16}(M_{ij,t}) = \alpha_0 + \beta_1 Y_{i,t} + \beta_2 Death - rate_{i,t} + u_{i,t} \quad (3)$$

$$Death - rate_{i,t} = \alpha_0 + \beta_1 {Y_{i,t}}^{5} + \beta_2 \sum_{j=1}^{16} Healthaid_{ij,t} + \beta_3 X_{z,t} + u_{i,t} \quad (4)$$

$$\sum_{j=1}^{16} Healthaid_{ij,t} = \alpha_0 + \beta_1 Y_{i,t} + \beta_2 X_{h,t} + u_{i,t} \quad (5)$$

Where $Death - rate_{i,t}$ is the death rate crude per 1000 people (expressed in logarithm). This channel can be influenced by health aid that's why, health aid variable appears in the right hand

[4] GDP is a proxy of wage which have an important role in migration decision (Harris and Todaro (1970))
[5] In death rate equation, $Y_{i,t}$ include only Gdp per capita in origin's countries

side into the channels equations.[6] These dataset are provided by the World Development Indicator 2006 from the World Bank. Because in developing countries, differents kind of diseases occured, it is very difficult to select one specific prevalence rate rather than another one. The advantage in taking the death rate as a proxy is that it cover all diseases which occured in developing countries. A high prevalence in one disease could lead to an increase into death rate *in fine*. However, because our transmission channel is not perfect, death rate will not captured situations where the prevalence rate is high for non-fatal diseases and so where working conditions are also hard (this effect will be capture by health aid variable itself).

$u_{ij,t}$ and $u_{i,t}$ are error terms.

#### 4.2.2 Exclusion Variables

In each equation, we have to introduced exclusion variables to well specified the system. These variables are like "'instruments"' in a Two-Stage-Least Square. Their characteristics is to be correlated to the dependant variable but not to the interested variables.

In our case, $X_{mbd,t}$ represents to exclusion variables related to destination health sector treated as instruments for medical brain drain. In $X_{mbd,t}$, we incorporate variables which are correlated with medical brain drain but not to health aid. Because we are in a bilateral analysis, we can use variables which are coming from the destination side (j) related to migration but not to foreign aid specifically in health sector. We have identified 3 instruments:

Physicians per 1000-d corresponds to the number of physicians per 1000 people in destination country (j). These variables are provided by Bhargava and Docquier (2007). Pop65-d is the percentage of population over 65 years old in destination country (j) and Health Expenditure-d , the total of health expenditure expressed in percentage of GDP in destination countries. OECD Health Database give us this information. These variables are well correlated to health system and give a good idea of the functionning, the need of care, and the environment in OECD countries. They explain quite well the health sector in the demand side but are no correlated to the amount of health aid giving by OECD countries. No substitutions or complementarities exist between the domestic health system status and the health international cooporation toward overseas countries.

$X_{h,t}$ represents exclusion variables related to recipient characteristics treated as instruments for health aid distribution.In $X_{h,t}$, we denoted exclusion variables in health aid distribution. Because we know that donors are very sensitive to the economic and financial situations of recipient countries, we identified 3 instruments:

Economic expresses the ICRG economic index. It is based on 50 points. And the interpretation is as political index: the higher is the index, the lower is the risk. It incorporates different aspects of the economic status of a country at a given time such as: GDP per head, Real GDP growth, annual inflation rate, budget balance and current account. Because in our analysis, the GDP per capita is added next to this index, so the economic index is taking more into account the 3 last indicators like inflation, budget balance and current account. Financial represents ICRG financial index. It is based also on 50 points. Financial index includes foreign debt, foreign debt service, current account, net international liquidity, and exchange rate stability. Budget corresponds The total budget of the donors.

Tavares (2003) showed that the budget of donors and its interaction with geographical and cultural proximity are good instruments to aid allocation. In the same order, we use donor budget and other variables which expressed purely financial and economic situations of the recipients countries. Statistical measures as economic and financial country risks have no direct impact on the decision to migrate for medical doctor but it can well explained the aid distribution accross countries.In Equation 5, health aid exclusions variables are the budget of 2 donors: France and United Kingdom.

[6] Notice that, we are trying to extract the HIV-AIDS prevalence or the proportion of people who receive antiretroviral treatment, but not enough data are available for my time-period econometric analysis.

As before, $X_{z,t}$ corresponds to exclusion variables related to death rate equation. It embodies the tuberculosis incidence per 100000 people and the ICRG financial risk in equation 4. Because our analysis is based on the time period from 1995-2003, no pandemics annually data were available except for tuberculosis. The second variable can be viewed as a proxy for social governement expenditures. Where the financial risk is high, debts are important and part of governement budget is devoted to reimbursement and few funds are invested into social infrastructures.

# 5 Empirical Results

Firstly, we propose a direct estimation of the health foreign aid on the physicians emigration rates in bilateral framework. It corresponds to the estimation of the system of equation (1) and (2). We thus decompose the impact between transmission channel which is the estimation of simultaneous equation (4), (5) and (6).

Table 2 and Table 3 present the direct impact into bilateral model and then Table 4 presents the indirect effect through the death rate.

## 5.1 OLS estimation of physicians emigration equation

Table 2 presents the OLS estimation between health aid and physicians emigration rates (column 1) and then we add the transmission channel (column 2). In column 3 and 4, we used Two Stage Least Squares to control for endogeneity, respectively health aid and physicians emigration rate by theirs instruments.

Firstly the Gdp per capita in the origin's countries has a significant and negative impact on the physicians emigration rate. So migration is important in poor regions, typically Sub-Saharan Africa, as we have seen in descriptive statistics. So when the Gdp per capita is low, the wage potential earned in home countries is low and the working conditions will be risky, so the incentive to migrate is high. In the poorest countries, few people have the ability to migrate, because the cost of migration is too high and due to liquidity constrain. However, physicians are upper socio-professional occupation in developing countries and the migration cost is easily supported by them.

The big host countries are those with the higher GDP per capita in OECD countries even if the GDP-d appear with negative sign only into the two first columns. Probably, in these countries, the level of wage is quite higher than in other OECD countries. The wage differential across countries are very large in particular for physicians. For example, in 1997, the monthly wage of physicians in Ivory Coast is $311 compared with $284 for Philippines which is in turn lower than the $5724 earnings in the United States. We know that GDP per capita captures various effects other than wage[7] Notice that the elasticities associated to this variable is relatively large. In column 3, if we increased the Gdp-d to 1% the physicians emigration rate increase to almost 3%. As Mayda (2005), the demand side is a big determinant of the migration in general and it remains significant specifically in health sector.

For the population, the higher is the population in receiving countries, the lower is the physicians emigration rate. This findings confirm our descriptive statistics that the emigration rate is high for islands where the population is quite small whereas larger countries send more doctors in stock in average but it represents low physicians rate.

Doctors seem to be attracted to countries where the population is high. The higher is the population in destination countries, the larger would be the need of care, the bigger will the health

[7]We try to carry out in our analyses the source-country wage for general physicians from Occupational Wage Around the World database(OWW) compiled by Freeman and Oostendorp (2000). The database provides monthly wage for 161 occupations and 137 countries between 1983 to 2003. These informations come from ILO October Inquiry data (Oostendorp (2005)). When we include the wage country-specific calibration for general physicians expressed in US $ for source and host country, the sample is not large enough for our econometric analysis.

system and finally the higher will be the probability for them to be employed.

Distance has a negative effect. Physicians' emigration, as general migration, would affect close countries because the distance is a proxy for migration cost even if the migration cost is lower for skilled migrants (like physicians). It is likely that a higher distance means a higher cost of transportation, information cost, psychological cost and a higher duration of unemployment in the received countries.

Migration is not only an economical phenomenon but it responds to a common culture or history between two countries. That's why historical and socio-cultural variables as to share a common language or have ever been in a colonial relationship increase medical brain drain. These variables are usually used to capture the cultural proximity between the source and the host countries. Sharing the same language is an important composent for medical occupations which is based essentially on the communication between patient and caregiver. Having ever been in a colonial relationship can mean that cooperation (in trade, financial capital, foreign direct investment, foreign assistance)between both countries is important.

The working conditions in receiving countries influence the migration process. This is taking into account by the number of physicians per 1000 people and the population over 65 years old into the destination's countries. The coefficient associated with density of physicians per 1000 people is strongly negative and significant into the Two and the Three Stage Least Squares. In other words, where the number of physicians per 1000 people is low in destination countries, the higher is the physicians' emigration rate toward these countries. So shortages in receiving countries in health sector are combined with immigration of physicians coming from developing countries (OECD (2008b)). And when the population over 65 years old is important, the lower will be the physicians immigration. This is quite alarming because health workforce is not distributed proportionnaly to the need of care. Countries where the population gets older do not attract more physicians migrants. The United States, Canada, and Australia are the largest receiving countries whereas their population over 65 years old is around 10%. In Denmark, Norway, Germany and Belgium the part of population over 65 years old are above 15% and these countries are not the "'top importers"' of health migrant.

Finally, the health foreign aid is introduced in column 1 and appears with significant positive sign. In other word, country which is receiving more health aid from donor, will see his emigration rate of doctor become more important toward this donor. This interpretation goes in favour to Chauvet et al. (2008) which explain the positive correlation between health aid and physicians emigration rate by significant part of grants attributed to physicians for specialisation into OECD countries. In column 2, we added the death rate and found a significantly positive correlation with migration. In presence of transmission channel, health assistance become unsignificant. Health aid may have effect on health care emigration rate, indirectly through the improvement of working conditions. However, the causality between health aid and physicians migration can be reverse and omitted variables can biaised the regression. That's why in column 3, we instrumented health assistance to control for the endogeneity problem. Because the correlation between physicians and health aid can occur in the opposite way, we instrumented health migration in the column 4.

## 5.2 Direct Impact Between Health aid and Migration in IV and 3SLS Methods

In column 3 of table 1, instrumental variables are used to implement the health aid. The ICRG economic index, the financial risk and the budget of donor are the instrumental variables. We check the relevance and validity of instruments by the Hansen test which is equal to 0.86 and the F-test associated to instruments is significantly equal to 10,36. The correlation between health aid and physicians emigration rate become significantly negative. So health aid has a negative direct impact on the physicians emigration rates. It would reduce emigration and not boost it. The elasticity associated to health aid is -1.16%. In other words, if health aid increase to 1%,

the physicians emigration rate decrease to 1,16%. It can be explained by the fact that mobility grants attributed to student's training is not important enough to impact positively the migration process. It seems that the physicians migration decisions is delayed or dropped when the health aid arrive due to the improvement in working conditions. In fact, health aid embodies such big infrastructures in health sector as hospital, clinics etc... but finance lots of drugs provisions and equipments. It finances prevention campaign which is prevent population against diseases. It can also take the form of technical assistance or expertise for one specific way. All these types of aid permit to build capacity into health sector and improve gradually the working conditions of health professionals.

In column 4, instrumental variables method is used to implement the physicians emigration rate. We used the exclusion variables such as the number of physicians per 1000 people and the proportion of 65 years old into the destination countries. The Hansen test does not reject the validity of instruments (0.86) and the F-Test is significantly equal to 68,31. In this case, physicians emigration rates have a positive impact on the amount of health aid received by the home countries. In other words, donors compensate origin countries of physicians for the losses of human capital which are attracted in OECD countries. The elasticities of physicians emigration rate is close to 0.5%. Notice that the higher is the Gdp of recipients, the lower is the amount of health aid. Aid is distributed in priority to poorest countries. The bigger is the population of origin and the higher is the health assistance. Surprisingly, health aid is negatively affected by common language whereas it is positively correlated to distance, colony and politics. According to Berthélémy (2003) and Burnside and Dollar (2000), aid allocation is very sensitive to the governance level and historical link.

In Table 3, we reported the simultaneous equation system with the method of Three-Stage Least Squares. In the column 1 and 2 we reported, respectively, the physicians emigration equation and the distribution of health aid. We observed exactly the same results as previously. Health aid has negative impact on the medical brain drain but high emigration in health sector causes an increase in amount of health assistance. More emigration in health sector can be viewed as countries where the need in health care is critical, that is why donors gives more health aid where the need of care is unsatisfied. In column 3 and 4, we checked if our result is robust to the introduction of health expenditure in destination countries in migration equation and contiguity dummy in migration and aid equation. The results do not change: health aid is negatively associated to physicians migration but the reverse causlity is positive. The improvement into working conditions seems to be the better explanation for the interpretation of health aid coefficient. Notice that when OECD governement spends more into their national health sector , it permits to improve the health system in OECD countries and attract physicians coming from "'South"' countries. This interpretation is confirmed by the positive sign attributed to health expenditure variable. The contiguity of a country is important for the physicians migration. This is particularly the case for the physicians emigration between Mexico and United States. The physicians emigration rates is around 8% whereas it is around 3% for the Honduras. It is also the case for the contiguity between Austria and Slovenia.

### 5.3 Indirect Impact Between Health aid and Migration in 3SLS Method

In Table 4, we introduced the death rate as explanatory variables to capture the direct effect of health aid and the possible indirect effect through epidemics channels. In the two first columns, death rate is explanatory variable only into migration equation. In the two second, death rate is viewed as common variable in both equations. As expected, death rate appears with a positive and significant coefficient for physicians migration but remains unsignificant for the allocation of health aid. It means that health aid have a direct negative impact on physicians migration other than through the improvement of death rate. So death rate well measures the epidemics' prevalence in source countries. Because the working conditions can be improve without real change into the death rate. For example, health aid can increase the hospital capacity or the technical knowledge of personnel. In that case, working conditions for medical workers is improved but it have not

automaticaly an impact on death rate. We hope that, but nothing is guaranteed. In table 4, the health aid elasticities is higher (-1.89) than before (-1.15) which is surprising because we extracted the indirect effect via death rate. One possible explanation is due to the different size of sample (in table 4, 1420 and in table 3, 2179). If we regress the specification in table 3 on the sample of 1420, we have a significant elacticity of -1.99 for health aid without death rate variable. So the main effect of health aid is a negative direct impact. This effect is reduced in presence of death rate. So we can think that health aid have an indirect impact on physicians migration through death rate.

In Table 5, we estimate the indirect impact by introducing the transmission channels into the specification. The column 1 explains the medical doctor migration by the death-rate. In the column 2, the death rate is explained by health aid. Finally, the third column explain the determinants of aid allocation.
In the first column, the death rate is significantly positive. In other words, where the death rate is high, the proportion of doctors emigrants will be higher. The elasticities associated to this coefficient is close to 0.8%, which means that an improvement into death rate and in the fight against big epidemics such as HIV-AIDS, Tuberculosis and Malaria can effectively reduce physicians emigration. According to Bhargava and Docquier (2008), countries, which face high epidemics rates, have higher risk transmission for population and further for medical staff. This phenomenom creates big incentives for them to emigrate.

In the second column, the death rate is explained by our interested variable: health aid. We added as exclusion variables, the tuberculosis prevalence rate and financial risk[8]. As expected, tuberculosis prevalence rate appears with a positive sign whereas financial risk appeared with negative sign. It goes in favor to big improvement of immunisation rate to retain physicians *in fine*. Health aid appears significantly negative in this regression which confirms the hypothesis that the indirect impact of health assistance is also negative. The elasticities of this variable is -0.041%. Part of health aid devoted to epidemics programs, prenvention, treatment and vaccination would lead to nurse population infected which reduced the death rate. Notice that the sample becomes smaller due to the aggregation of our database accross destination countries.

In the third column, the health foreign assistance is explained by common variables and specific exclusion variables as explanatory variables. Health aid is proportionnal to the amount of budget of two donors: France and United Kingdom. The political situation of countries is more important into the strategy of donor's bilateral allocation. Where these risks are low, donors have incentive to give more assistance because in these situation the governance is quiet good to used these financial flows in an appropriate way (Burnside and Dollar (2000)). However where we does not distinguish between destination countries, governance has much less importance into the allocation of foreign aid and it is more determined by the need of recipients countries typically where the poverty level is high and where population is higher (Berthélémy (2003)).

So if we compute the indirect elasticities of health aid on medical brain drain, we obtain -0.03276. So increasing health aid to 1% allows to reduce physicians emigration rate to 0.03% via the fighting against epidemics which is approximate by the death rate. According to the size of the coefficient, a big rise into health foreign aid is needed to get real impact. Because both effects (the direct (table 4 column 1) and the indirect effect (Table 5)) are coming from different database, it would be difficult to add them. But what we can say is that the global effect of health assistance is negatively associated to physicians migration. The global elasticities associated is -1.31% included the epidemics channels (and around -2% in specific cases). Finally, the global impact of aid is high enough. Notice that increasing the fighting against big diseases like HIV-AIDS, Malaria and Tuberculosis permits to retains part of medical staff in source countries.
This analysis confirms our first results:

[8]If we considered these two variables as instruments in a Two-Stage Least Square, validity test is accepted. The F-test and partial R-Squared show us that these exclusions variables is valid (respectively 46.70*** and 0.2702 for heath aid equation and 49.80*** and 0.0881 for physicians' emigration equation) and hence the Sargan test validate the quality of our instruments in our case (respectively 0.9219 for health aid equation and 0.5888 for physicians' emigration equation.

1) The health foreign assistance has a strongly negative impact on the physicians emigration rate. The direct impact of health aid remains significant and negative. So health foreign aid delays the migration decision and maybe give some medical equipment and drugs permit to work in better conditions but this is not capture by the death rate.

2) Health foreign assistance has an indirect impact through improvement in death rate which permit to reduce medical brain drain. The epidemics prevalence plays an important role to retain doctors and where the situations are alarming, the medical brain drain is amplified and destroying. The elasticity associated with global impact of health assistance is relatively high (-1,31%). So donors have to increase few foreign assistance devoted to health sector in order to expect a real decrease in medical brain drain.

3) Finally, countries which face huge emigration of doctor, would see the amount of health foreign assistance increase. In fact, donors are very sensitive to the health need care in "'South"' countries. Health emigration is a proxy of the health status in these countries. So the medical emigration create incentives for donors to increase the health assistance in order to compensate the lost of these medical human capital. Furthermore, we know that diaspora creates pression on OECD governements to allocate large proportion of aid (in health sector in our case) to their home countries. The presence of physicians is extremely important for the effectiveness of any treatment or in vaccination campaigns against diseases.

# 6 Conclusions

The importance of medical professional staff, in particular physicians, in achieving the Millenium Development Goals in health outcome is well established. Policymakers have argued that increasing the health development assistance could attained these objectives. However, health system needs both infrastructure in health and human ressources as doctors, nurses and others specialities. Health ODA increases, incontestably, the health capital and infrastructure but what about the health human capital? Our bilateral analysis seems to show that health foreign assistance is a good tool for retaining the doctor emigration through the improvement of working conditions. Notice that the magnitude of health elasticity is quite high. So we have to increase health ODA by a small amount to lead substancial retainment into medical health professionals.
Physicians emigration, in all our analysis, is detrimental to the improvement of epidemics prevalence rate through death rate. It is also important in the distribution of health aid given by the donors.

An important element to retain medical workers is to improve the working conditions in the hospitals and clinics. Great equipment and fight epidemics such as malaria, HIV-AIDS and tuberculosis are effective in the improvement of physicians environnement and health assistance can be beneficial to attain these objectives. Health aid can play a major role in these improvements if the amount is substancial and regular. Reducing health aid would be disastrous for the advancement accomplished during several years and for the achievement of Millenium Development Goals into health sector adopted in 2000. International community, through bilateral and multilateral agencies ,NGO and, of course, the governement of recipient countries itself should focussed attention on Sub-Saharan Africa where the supply of health care is largely unsufficient.

Another possible fruitful policy, reported in OECD (2008b), in reducing medical flows is to focus on the demand side. OECD countries should be careful to the origin of the medical health professional if final goal is to improve development process in developing countries. As in the United Kingdom, a new code of conduct, elaborated by UK's National Health Service and the Commonwealth, advise to limit the host of overseas doctor coming from the developing countries. In an ethical view, it is difficult to retain these people in their home countries whereas they want to move.

Even if OECD's countries face shortages in health staff, these countries would be careful to not "'export"' these shortages into developing countries (OECD (2008b)) even less, in regions where the number of physicians compared to population is low. Different mechanisms of monitoring and assessment have to be implement to have visibility about recruitment and can anticipate the potential risk associated to these management.

OECD countries would not consider the requirement of their health staff as a national policies (OECD (2008b)). Today, with the integration of labour market accross the world, requirement adopted in one country can affect other countries at the end. Depriving these regions to their health staff, where diseases infect large part of population, may be dangereous for developing population but also for developed countries in the case of pandemics infection and transmission on an international level.

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Table 2: OLS and IV Estimation - Direct Impact

| | (1) OLS physician-mig | (2) OLS physician-mig | (3) 2SLS physician-mig | (4) 2SLS health-aid |
|---|---|---|---|---|
| $gdp_o$ | -0.42024 | -0.24815 | -1.00917 | -0.30583 |
| | (0.05341)*** | (0.07464)*** | (0.15395)*** | (0.08065)*** |
| $gdp_d$ | -0.48422 | -0.48308 | 2.8195 | 1.45669 |
| | (0.27849)* | (0.34334) | (0.89208)*** | (0.43473)*** |
| $pop_o$ | -0.48999 | -0.50014 | -0.2325 | 0.44876 |
| | (0.02632)*** | (0.03040)*** | (0.07284)*** | (0.06460)*** |
| $pop_d$ | 0.64571 | 0.67897 | 1.17032 | -0.62479 |
| | (0.03011)*** | (0.03783)*** | (0.12580)*** | (0.18179)*** |
| dist | -0.38044 | -0.35417 | -0.3723 | 0.17938 |
| | (0.06379)*** | (0.07973)*** | (0.12845)*** | (0.09608)* |
| common language | 1.48927 | 1.45957 | 1.4983 | -0.57063 |
| | (0.10225)*** | (0.13740)*** | (0.18616)*** | (0.23536)** |
| colony | 1.32781 | 1.45478 | 3.40958 | 0.99299 |
| | (0.15156)*** | (0.20107)*** | (0.53071)*** | (0.23526)*** |
| politic | -0.51446 | -0.47295 | -0.2546 | 0.58362 |
| | (0.21415)** | (0.29048) | (0.41904) | (0.32287)* |
| $physicians1000_d$ | 0.32906 | 0.30344 | -0.68048 | |
| | (0.16764)** | (0.22628) | (0.36330)* | |
| $pop65_d$ | -4.44184 | -4.51388 | -4.47486 | |
| | (0.37354)*** | (0.47683)*** | (0.70369)*** | |
| economic | | | | -0.61382 |
| | | | | (0.29718)** |
| financial | | | | 0.45702 |
| | | | | (0.30837) |
| budget | | | | 1.00668 |
| | | | | (0.14982)*** |
| health-aid | 0.05107 | 0.02645 | -1.15972 | |
| | (0.01619)*** | (0.02052) | (0.25667)*** | |
| death-rate | | 0.49191 | | |
| | | (0.12349)*** | | |
| physician-mig | | | | 0.47777 |
| | | | | (0.11738)*** |
| Constant | 15.73766 | 12.67005 | -27.9888 | -18.44178 |
| | (3.60605)*** | (4.68127)*** | (11.90340)** | (5.37710)*** |
| Observations | 2179 | 1420 | 2179 | 2179 |
| R-squared | 0.56 | 0.58 | 0.81 | 0.25 |
| endogeneous variable | | | healthcst | physician-mig |
| instruments | | | economic | $physicians1000_d$ |
| | | | financial | $pop65_d$ |
| | | | budget | |
| F-Test | | | 10.33*** | 66.25*** |
| Hansen test | | | 0.9304 | 0.8748 |

Notes:(i.)Robust standard errors in parentheses.
(ii.)* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: 3SLS Estimation - Direct Impact

| | (1) 3SLS physician-mig | (2) 3SLS health-aid | (3) 3SLS physician-mig | (4) 3SLS health-aid |
|---|---|---|---|---|
| $gdp_o$ | -1.0038 | -0.31317 | -1.27031 | -0.33963 |
| | (0.14501)*** | (0.07856)*** | (0.17196)*** | (0.07649)*** |
| $gdp_d$ | 2.77765 | 1.44538 | 3.08218 | 1.62037 |
| | (0.79080)*** | (0.39727)*** | (0.88900)*** | (0.37992)*** |
| $pop_o$ | -0.23482 | 0.44411 | -0.12458 | 0.4062 |
| | (0.06725)*** | (0.06185)*** | (0.07892) | (0.05916)*** |
| $pop_d$ | 1.16466 | -0.62509 | 1.21248 | -0.51403 |
| | (0.11468)*** | (0.16780)*** | (0.12947)*** | (0.15689)*** |
| dist | -0.37113 | 0.18343 | -0.32913 | 0.16229 |
| | (0.12258)*** | (0.08893)** | (0.14282)** | (0.08662)* |
| contiguity | | | 4.756 | -0.28233 |
| | | | (1.60616)*** | (1.02346) |
| common language | 1.49638 | -0.57257 | 1.57596 | -0.41719 |
| | (0.19042)*** | (0.23915)** | (0.21978)*** | (0.22576)* |
| colony | 3.39864 | 0.99258 | 4.36577 | 1.10114 |
| | (0.48934)*** | (0.22987)*** | (0.58777)*** | (0.22155)*** |
| politic | -0.25573 | 0.54764 | -0.19552 | 0.50897 |
| | (0.41777) | (0.31814)* | (0.48533) | (0.30880)* |
| $physicians1000_d$ | -0.64214 | | -1.16721 | |
| | (0.30270)** | | (0.33740)*** | |
| $pop65_d$ | -4.52228 | | -3.8987 | |
| | (0.62786)*** | | (0.67965)*** | |
| $health\text{-}exp_d$ | | | 2.03727 | |
| | | | (0.48557)*** | |
| economic | | -0.58835 | | -0.48639 |
| | | (0.27005)** | | (0.23418)** |
| financial | | 0.54231 | | 0.42181 |
| | | (0.26103)** | | (0.22450)* |
| budget | | 1.00599 | | 0.93642 |
| | | (0.13730)*** | | (0.13140)*** |
| health-aid | -1.1483 | | -1.65668 | |
| | (0.23322)*** | | (0.27535)*** | |
| physician-mig | | 0.47817 | | 0.39279 |
| | | (0.11163)*** | | (0.10363)*** |
| Constant | -27.37493 | -18.44866 | -37.92488 | -20.93793 |
| | (10.30506)*** | (4.92912)*** | (11.35439)*** | (4.67195)*** |
| Observations | 2179 | 2179 | 2179 | 2179 |

Notes:(i.)Robust standard errors in parentheses.
(ii.)* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: 3SLS Estimation - Direct Impact

| | (1) physician-mig | (2) health-aid | (3) physician-mig | (4) health-aid |
|---|---|---|---|---|
| $gdp_o$ | -1.25881 | -0.41979 | -1.20675 | -0.39028 |
| | (0.24366)*** | (0.09667)*** | (0.25390)*** | (0.10388)*** |
| $gdp_d$ | 3.32497 | 1.59002 | 3.35716 | 1.62797 |
| | (1.17234)*** | (0.45374)*** | (1.16913)*** | (0.45449)*** |
| $pop_o$ | 0.01855 | 0.4626 | 0.02522 | 0.45673 |
| | (0.12486) | (0.07444)*** | (0.12462) | (0.07452)*** |
| $pop_d$ | 1.27832 | -0.46804 | 1.28156 | -0.43641 |
| | (0.17891)*** | (0.18797)** | (0.17858)*** | (0.19185)** |
| dist | -0.31782 | 0.12624 | -0.32531 | 0.11317 |
| | (0.18704)* | (0.10319) | (0.18732)* | (0.10418) |
| contiguity | 5.38376 | -0.11395 | 5.40253 | -0.01586 |
| | (1.78359)*** | (1.08096) | (1.78313)*** | (1.08423) |
| common language | 1.45155 | -0.42355 | 1.43305 | -0.40774 |
| | (0.31096)*** | (0.28010) | (0.31200)*** | (0.27964) |
| colony | 4.97588 | 1.15732 | 4.9655 | 1.19554 |
| | (0.83887)*** | (0.27941)*** | (0.83733)*** | (0.28281)*** |
| politic | 0.50816 | 0.90577 | 0.60199 | 0.95824 |
| | (0.72360) | (0.41217)** | (0.73341) | (0.41524)** |
| $physicians1000_d$ | -1.48986 | | -1.46265 | |
| | (0.47550)*** | | (0.46985)*** | |
| pop65 | -3.77627 | | -3.69044 | |
| | (0.87080)*** | | (0.86945)*** | |
| health-exp | 2.53815 | | 2.50644 | |
| | (0.64179)*** | | (0.63735)*** | |
| economic | | -0.67217 | | -0.65246 |
| | | (0.28855)** | | (0.28374)** |
| financial | | 0.26203 | | 0.26759 |
| | | (0.27955) | | (0.27293) |
| budget | | 0.88899 | | 0.8705 |
| | | (0.16104)*** | | (0.16224)*** |
| health-aid | -1.89134 | | -1.88454 | |
| | (0.38418)*** | | (0.38282)*** | |
| physician-mig | | 0.36312 | | 0.34029 |
| | | (0.12024)*** | | (0.12350)*** |
| death-rate | 0.85703 | | 1.0118 | 0.13017 |
| | (0.24622)*** | | (0.32064)*** | (0.17402) |
| Constant | -50.4464 | -21.77136 | -52.20164 | -23.32601 |
| | (16.08727)*** | (5.64135)*** | (16.14340)*** | (5.98828)*** |
| Observations | 1420 | 1420 | 1420 | 1420 |

Notes:(i.)Robust standard errors in parentheses.
(ii.)* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: 3SLS Estimation - Indirect Impact

| | (1) physicians-mig-tot | (2) death-rate | (3) health-aid-tot |
|---|---|---|---|
| gdp | 0.15228 | -0.25169 | -0.6908 |
| | (0.19716) | (0.03097)*** | (0.12243)*** |
| pop | -0.04403 | | 0.28061 |
| | (0.05665) | | (0.07017)*** |
| politic | -0.91345 | -0.13389 | 0.64258 |
| | (0.58604) | (0.11041) | (0.54417) |
| death-rate | 0.78117 | | |
| | (0.42730)* | | |
| health-aid-tot | | -0.04164 | |
| | | (0.01579)*** | |
| tuberculosis | | 0.22049 | |
| | | (0.01946)*** | |
| financial | | -0.3168 | |
| | | (0.10836)*** | |
| budget-gbr | | | 0.30224 |
| | | | (0.04213)*** |
| budget-fra | | | 0.21935 |
| | | | (0.05002)*** |
| Constant | -1.78727 | 4.87912 | -1.03778 |
| | (4.12390) | (0.45072)*** | (2.30844) |
| Observations | 357 | 357 | 357 |

Notes:(i.)Robust standard errors in parentheses.
(ii.)* significant at 10%; ** significant at 5%; *** significant at 1%.