Vladimir Iontsev
Department of Population
Head, Professor
Lomonosov Moscow State University
Faculty of Economics
Leninskie Gory
119992 Moscow, Russia
Phone +7(495) 939 2993
Fax +7(495) 939 0877
iontsev@econ.msu.ru

Anastasia Mogilat
Student of the Program of Bachelors, Faculty of Economics
Lomonosov Moscow State University
Sosnovaya St.
143000 Odintsovo, Moscow Region, Russia
Phone +7(985) 767 4071
forpost2@mail.ru
anastasia@mail.ru

Session 8. The international migration of highly skilled workers

Contemporary 'brain drain': mutually beneficial exchange of highly skilled workers or the process, increasing inequality between the countries?•

'In the context of the new global development, which is emerging in the 1990s, the resources of major importance are human knowledge, creativity, imagination and good will. It is more and more clear that with the lack of these resources a steady progress towards peace, human rights and freedoms' respect is impossible. Education is to play a key role in development of these resource.' (The UNESCO Report on Education, 1993)

The world community will soon be celebrating some sort of a jubilee – it turns 50 years since the international scientific and political debate on non-return migration of high skilled professionals has begun. It was in the beginning of the 1960s when the United Kingdom concerned by the outflow of its scientists and engineers to the USA entitled this process as 'brain drain'. This issue is not a new one; already in the 18th century the Russian Tsar Peter the Great began to conduct a State policy of attracting qualified specialists to work in Russia. However, its importance for a contemporary society of any state has become much bigger, both in positive and negative meanings. The understanding of this process remains quite different and controversial and the compromise on many methodological aspects has not been reached yet.

We understand the 'brain drain' as 'non-return migration of highly skilled professionals including potential professionals (students, postgraduates, and trainees) at whom a purposeful policy is applied to attract them' (Iontsev 1996; Iontsev, Ivakhniouk 2002).

• This report is prepared within the frames of the Research Project of the Russian Foundation for Humanities (RFH) No: 08-02-0084a (2008-2010) entitled 'Determinants of International Migration of Population and Improvement of the Russian State Migration Policy'. The head of the Project – Vladimir A. Iontsev.

Several important methodological elucidations are to be made when explaining such definition. First of all we should make clear the term 'brain' (highly skilled professionals). Very often only those who have higher education, hold an academic degree and work in R&D and educational fields are referred as 'brains'. Undoubtedly, these are very important professionals, especially when taking into consideration that the world community is entering a technologically new level of development.

Firstly, for more than 30 years there has been a tendency of the number of mediocre specialists growing in higher education. This has been becoming especially obvious in Russia for the past 15 years: the number of graduated people has greatly increased (especially in the fields of economy and law) while the number of high quality specialists (mostly in technological area) has decreased. Secondly, middle level high quality specialists are of a great value in the development today. For example, in medicine for many developed countries hiring good nurses is of a greater significance than hiring doctors. This remark is very important nowadays because in accordance with the World Bank estimate, for instance, in Latin America and Caribbean, the emigration rate for specialists with secondary level is high enough, despite of the total prevail of tertiary-skilled specialists in migration flows (Burns, Mohapatra 2008).

Clarification of the 'highly skilled migrants' definition becomes even more important when classifying the factors that determine the scale of brain drain. According to R. Appleyard it is possible to differ between 5 areas of 'highly skilled migrants': senior managers and executives; engineers and technicians; scientists; entrepreneurs, and students (Appleyard 2002; 10). We would add the arts people (writers, artists, and painters), i.e. those people who can influence population's state of mind and inspire the youth, to this list. If we take into consideration all these groups of professionals and intellectuals, their quantity will be counted by hundreds of thousands (and not by thousands like it is usually done today). In the contemporary structure of international migrants that can be classified into 5 groups: (1) classic type (i.e. non-return) immigrants – 200 millions; (2) migrant workers (including family members) – 150 millions; (3) illegal immigrants – 40 millions; (4) circular migrants (including students and postgraduates as well as two thirds of 840 millions of tourists) – 750 millions; (5) forced migrants (excluding 'classical' refugees) – 30 millions, the 'brain drain' migrants are presented mainly in the (1) and (4) groups.

The most important characteristic of brain drain is non-return type of migration. Surely, differentiation between non-return and temporary migration is often relative, but it is very important when comparing 'brain drain' and 'migration of intellects'. The latter is of temporary nature, being an absolutely positive phenomenon; its development may make the scale of the 'brain drain' decrease.

And finally, the third important indication of 'brain drain' is the purposeful migration policy aimed at attraction (enticement) of high-level professionals (since the 1960s such a policy became a governmental one in many countries).

If every criteria of our definition is examined, it is impossible to deny the existence of several alternative concepts with slightly different meanings of 'brain drain'. For instance, including so called 'inter-sector mobility' or 'internal brain drain' which means transferring specialists from R&D area to business (Malakha 1998) is different from our interpretation of

brain drain as *interstate non-return migration of highly skilled personnel*. According to that point of view 'brain drain' happens during the process of dramatic transformations of internal labor market when mass outflow of personnel from scientific and research organizations to commerce, state institutions and other sectors may occur (Ushkalov, Malakha 1999). According to some estimates, in early 1990s in Russia up to 30% (in certain provinces up to 50%) of research personnel made their choice in favour of employment in commercial structures (Valyukov 1994). However, the mass transferring of research workers to the business sector and giving up research activities is to be distinguished from international migration of intellectual workers. The first is related mainly to structural shifts in national economy and imbalances in national labour market while the latter is a 'natural' process of the search for better opportunities of human capital development and realization of research ideas and projects (Iontsev 1998). Besides, in the case of 'internal brain drain' the damage is mainly of non-material character (loss of scientific potential, decrease of the prestige of research work in the society, breach of continuity of scientific schools and generations, etc.) while direct losses related to the GNP underproduction are balanced by application of labour in other sectors.

The term 'internal brain drain' (that distorts the true sense of 'brain drain') is correlated with the term 'brain waste'. 'Brain waste' is understood as under-use or misuse of labour force inside a state (Taran 2009). In our opinion the analysis of 'brain drain', both quantitative and qualitative, is to be focused on data on *interstate non-return* migration of top and mid-level specialists' (as well as data on students, postgraduates etc.).

Availability of cross-state data on migration by educational level (primary, secondary and tertiary levels, though the duration of every level often differs from one country to another) makes it possible to estimate the scale of migration of each educational group separately.

There are many ways to calculate the scale of brain drain. Different methods are used both to compile and produce the result (for example the financial loss because of emigration of professionals). But they have one thing in common – since the 1980s when highly skilled emigrants from the former socialist block appeared on the international labor market international migration became global and the problem of the brain drain became the burning issue, particularly for developing source countries including those in the post-Soviet territory.

According to the World Bank data the rate of brain drain was the highest in the developing countries from the 1990s onwards. Samoa, Tonga and Guiana are in the top of the list: over 90% of the national highly skilled workers left these countries to the OECD states. From the Chart 1 it is clear that from the top 10 countries where the rate of brain drain was the highest, in 7 countries the intensity of labour migration increased as compared to figures of the previous decade. In Hong Kong, it was calculated that the number of graduates that have left between 1987 and 1989 represented totally 74,400 years of studying in universities. Jamaica lost 70% of qualified doctors and 95% of nurses (Stalker 1995) (for details, see table 1 in the Annex).

The situation is also a burning issue for Russia. Already in 1995 the share of non-return emigrants with higher and professional education was 47% among the totality of emigrants (Iontsev 1996). Between 1975 and 1988 the share of scientists working in the United States increased from 23% to 34% while the share of scientists working in the Soviet Union decreased from 24% to 19%. After the collapse of the USSR in 1991-1992 only, 508 of top scientists from the institutions of the Russian Academy of Sciences (RAS) left Russia for the USA (Ushkalov,

Malakha 1999). According to the Russian media in 2008 the size of the Russian academic diaspora abroad exceeds 30,000 researchers; this number equals the totality of the RAS academic staff (*Returning*… 2008).

Many changes, also concerning the field of international migration and in particular brain drain, have taken place in the world during the years passed. However, in our opinion, negative consequences of brain drain for developing countries have not changed, in particular, for Russia and other post-Soviet states, which have become principal 'suppliers' of more developed countries with their intellects. The Chart 2 represents the intensity of this process. For example, according to the UN estimation only financial losses of developing countries from 'brain drain' exceeded 60 billion USD for the last 30 years. There are the estimates of Russian and foreign experts concluding annual losses of Russia resulting from 'brain drain' in the 1990s as 50 billion USD (including potential losses) (Ushkalov, Malakha 1999).

During these years the developed countries repeatedly attempted to present brain drain as a mutually beneficial process. As a result such definitions as 'reverse transfer of technologies', 'brain gain' (Segal 2007), 'intellectual migration', 'diasporas model' (Bhagwati 2004), and others appeared. It is also not by chance, that the most significant feature of the 'brain drain', namely its non-return character, is being misrepresented. For example, Khadria (2001) is trying to prove that 'the difference between return and non-return migration has reduced its importance'. If so, then the 'brain drain' is nothing more than just migration of professionals, or 'intellectual migration', as it is called. In our opinion, this is absolutely uncertain.

All the above concepts differ mainly by evaluation of the consequences and the scale of brain drain. The similar terms 'brain exchange' (Stalker 1995) and 'brain circulation' that mean a sort of two-vector movement of professionals can be set off against the term 'brain gain' (Segal 2007). It is hardly disputable that the loss of professionals by source countries means gain of the same professionals by receiving countries. However, focusing on positive aspects of the process should not overlook its negative sides for the donor states.

Another approach to studying the cross-border flows of highly skilled personnel compares this process with a movement of 'human capital' in search for a higher output from knowledge and skills (Stalker 1995). Some authors argue that outflow of highly skilled workers to other countries stimulates investments into human capital in the source countries because the new incentives for the overseas employment appear. In its turn, development of the human capital encourages the growth of the economy (Mountford 1997; Haque and Kim 1995; Wong and Yip 1999). Positive effects of migration are also related to return flows of money, i.e. migrant remittances (Cinar and Docquier 2004), returning home with new knowledge and added experience (Stark and Helmenstein 1997; Domingues Dos Santos and Postel-Vinay 2003), and extended business contacts (Dustmannn and Kirchkamp 2002; Mesnard and Ravallion 2002).

The above mentioned terms 'reverse transfer of technology', 'reverse brain drain' can be interpreted in two ways: (1) emigration of professionals is a mutually beneficial process thanks to 'feedback channels' that provide a source country with new technologies and remittances. There is an opinion that highly skilled migrants invest their intellectual capital in the receiving countries in order to support their poorer relatives (Ozden and Schiff 2006); (2) 'reverse brain drain' is an analogue of cross-border transfer of production capacities. The USA is a good example: the major 'consumer' of foreign intellects the USA faced the growing number of American citizens who prefer to live in other countries where they see more opportunities for

themselves (Weber 2004). Accepting these arguments we would note that they are true mainly for *temporary* migration while non-return emigration sooner or later breaks the contact of emigrant with the motherland.

The above mentioned concepts of the brain drain issue are summarized in the scheme in the Appendix. In our opinion, the most important feature of brain drain is its non-return nature because irrevocable loss of intellectual potential has fundamentally different effects for the donor countries than temporary employment of intellectual workers abroad.

The globalization plays its own role in the brain drain process. It adds specific features to the debate, in particular, by modifying the ratio of certain types of migration as well as the factors it is conditioned by.

In this context, it is interesting to analyze the contemporary 'brain drain' issue on the basis of econometrical methods. We have worked out the econometrical model by using national statistics data and the 2007 figures of the World Bank (Docquier et al. 2007). According to data for the years 1990 and 2000, among the countries most affected by brain drain, developing countries prevail. The highest indicators are related to Samoa, Tonga and Guyana in 2000, where more than 90% of highly skilled specialists, who belong to the intellectual elite of the corresponding nations, prefer to leave their birth country for one of the OECD countries. Moreover, as it becomes clear from diagram 1, the highest indicators in 2000 significantly exceed the same in 1990. This fact also confirms that propensity for emigration among skilled specialists in these countries is growing.

Unfortunately, the statistics and the rate of migration flows are hard to calculate in many cases. And there are many reasons for that (lack of universal norms of migrants' registration in sending and receiving countries, differences in methodologies of immigrant status definition, etc.). That is why we should describe the methodology of collecting the statistical data that forms the basis of the forthcoming estimations and conclusions.

The number of people of foreign origin that live and work in the OECD countries and are medium or high skilled is used as a final variable. This data is available on the World Bank internet site (http://econ.worldbank.org/). Information gathering is based upon three fundamental sources: *population censuses, registers of population* and *sample surveys*. When taking into consideration the above mentioned obstacles related to data collecting a special attention is to be drawn at calculation errors and assumptions.

First, *all the information dealt with is dated by 1990 and 2000*. This can be explained by how the information was being collected (the main source of information on origin countries and educational level are population censuses in receiving countries that are usually conducted with a decade time span). The time gap between data collection and the present modeling is certainly a disadvantage. On the other hand, this gives an opportunity to evaluate factors that influence brain drain irrespective of certain period with regression analysis.

Second, *only the OECD countries were considered as the receiving countries*. However, as to the World Bank estimates of brain drain calculations presented in the report on '*Measuring the International Mobility of Skilled Workers (1990-2000)*', 53% of migration flows of highly skilled professionals in 1990 and 60% in 2000 originated from developed countries. For the case of

migrants with university degree only the share is 85% (United Nations 2002; Docquier and Marfouk 2004).

Third, *the data reveals the information on migrants of over 25 year old*. Thus the information about the students and young specialists is not taken into consideration. The estimated number of students studying abroad will exceed 3 million by the year 2010. At the same time, students, postgraduate students and trainees who are potential intellectuals, play an important role in migration flows of highly skilled specialists. Their outflow seriously threatens the national intellectual resource. According to the experts from the Russian Academy of Sciences, up to 75% of young researchers involved in bio-technologies research leave Russia for other countries (Extreme mobility... 2009; Returning... 2008). Because of the lack of support from the State the Russian science is going through hard times. It faces the threat of breach of continuity of generations. Moreover, the policy having a special purpose to encourage skilled personnel from other countries to immigrate is widely used by more developed countries. Though it concerns not only young potential specialists, but also those of the strongest demand, for example, high-skilled IT-professionals or medical staff (Iontsev, Aleshkovski 2007). The examples are: the United States *preferences* policy in the 1990s, the *Green Card fur IT-Fachkrafte* Program in Germany (2000-2004), the *2005 Immigration Law Zuwanderungsgesetz* in Germany that facilitated the residence permit procedure for entrepreneurs and highly skilled foreign specialists (Aleshkovski 2005). The European Union states have agreed on introducing the *blue card* for skilled immigrants of demanded qualifications after 2011. A sort of privileged residence permit, the *blue card* allows its holder to continue his/her work in any EU country after termination of the first contract (Extreme mobility... 2009).

And finally, the calculations are performed using *the total number of emigrants from different countries* without taking into consideration their ratio to the total amount of manpower in sending countries. This assumption makes data compensation by including specific 'correcting' parameters – the number of population or labor force – for every country absolutely necessary[1].

The simulation was conducted with the help of the ordinary least squares method on the basis of spatial selection. According to the UN statistics (http://data.un.org; http://unstats.un.org/unsd/databases.htm – *United Nations Statistics Division;* http://www.un.org/popin/ – *United Nations Population Information Network; United Nations Population Division – Department of Economic and Social Affairs*) in the capacity of explainable variables the estimates were chosen which we think influence the brain drain the most in different countries in the world. Taking into consideration both the determinative motives which lie in the foundation of migration on the whole and the peculiarity of 'brain drain', the rates which describe different aspects of the process of intellectual migration were considered.

To make the analysis easier they are divided into groups proceeding from the subject and the field which they are called to characterize (the detailed information is in the tables 2 and 3 of the Appendix.)[2] In addition, while choosing the estimates the expected influence they might have

[1] The size of labour force is used in the models due to its closer correlation to the resulting indicator.

[2] In Table 2 the full list of used variables with indication of the statistics this information presents and also the source publishing appropriate estimate. In Table 3 all the variables are divided according to the direct goal of introduction into the model.

on the resulting variable was considered; according to this influence the *positive correlation* was intended for *'stimulating' rates* and the *negative one* – for *'restraining' rates*. At the same time some indicators of economic life depending on the regional specifics can be both stimulating the professionals' migration and preventing it. For example, we can not explicitly claim whether the GDP growth promotes the emigration because it depends on a lot on the initial economic conditions in the country of departure, so the dependence in non-linear.[1]

The structure of the simulation consists of *two stages*. At first the variables based on the substantial thinking were chosen and grouped. These variables play the role of the factors of migration of professionals. The correlation analysis was made on the basis of which the directions of further simulation were outlined: the scheme of the simulation considering the specifics of the variables and excluding the appearance of multicollinearity. The second stage consisted per se of the simulation on the basis of spatial selection out of 194 countries within the period of two years: 1990 and 2000 (overall 388 observations). With its help they identified the number of factors, which mostly affect the 'brain drain' worldwide.

Let us comment on some of the general principles and results. The whole econometrical analysis includes *three components***:** the selection of the optimizing number of the variables for the description of the regularity of 'brain drain', the choice of the conformity form between variables that meets the economic sense and the check of the qualitative characteristics of the model itself with the elimination of its drawbacks.

All the chosen variables are systematized proceeding from the field, for the description of which they are used and combined in table 2 for convenience. It is necessary to take into consideration that some of them are measured in their absolute expression, others constitute fractions, growth rates, etc., i.e. take into account the fact of collation per se. This comment is especially important for eliciting the most correct specification of the models considered. In addition in appendix there is the table of coefficients of correlation between the regresses themselves in order to avoid the problem of multicollinearity. And finally, as it is seen from the given classification, some of the variables are used for the description of different aspects of the reality, which is especially relevant, because it gives the opportunity, allowing of no multicollenearity, not to give up these or those extra parameters, which full the model with the needed information.

The final tables of the results are in the Appendix (tables 4, 6). At first the models with the participation of each variable separately were assessed, with the resulting variable being considered linear and under the logarithm. The conclusions that incur from table 3 are based on the assumption that each of the considered estimates influences the 'brain drain' on its own, ignoring the attending conditions. In the group of linear and half-linear models (the explaining variable – under the logarithm) all the estimates significantly affect the 'brain drain, at the level of 1% and less, except the specific subsidy on the patent and the logarithm of the special coefficient of birthrate that are relevant at the level of 10%, and also the subsidies on the patents, shares of the expenditure on education in GNP and the logarithm of the growth rate of the GDP,

[1] This item does not contradict D. Massey's derivation of the theory of the world systems according to which the biggest outflow of the population happens in the developing countries while intensification of their development gradually reduces emigration (Massey 2002).

which turned out to be insignificant. High in their absolute meanings coefficients with the corresponding rates (agedep, logagedep, logfert) allow us to make a conclusion about the significant influence of the demographic situation in the country (the structure of its population and the demographic processes) on the 'brain drain' process. In addition, the figures of the coefficients do not refute the hypotheses that migration is not the sign of the absence of the development but vice versa is the result of the development itself. Thus, the highest rate of the demographic load is typical for the least developed African states where the rates of the 'brain drain' are not very high (diagrams 2 and 3 in Appendix). On the whole it can be asserted that the figures of the coefficients with the variables meet the expectations about the direction of the impact of the rates on the resulting variable. Similar conclusions are legitimate for the models from the half-logarithmical and double-logarithmical group.

However, as it was already mentioned, it is not always right to consider the direct impact of this or that rate on the resulting variable, it is frequently necessary to consider the attending conditions. As an example there is a model in table 4, which takes into account the impact on the 'brain drain' of the share of spending on education in GNP and the share of urban population, because one of the initial factors of the 'brain drain' is the urbanization in the country. Allowing for the part of the urban population in the model as a controlling estimate led to the fact that in the half-logarithmical model the educational expenses remained relevant at the level not exceeding 5%, whereas in the double-logarithmic model the logarithm of the educational expenses became significant at a 1% level.

The mission of further analysis became the combining of the indicators and their consecutive inclusion into the model. It is followed from the matrix of the correlation coefficients, the fragment of which is presented in table 5 of the Appendix, that the closest positive connection can be observed among the estimates from the group 'demographical' and also between the quantity of the labour force of the country of departure and the inclusion of the population with primary, secondary and higher education in the country (0.88; 0.985 and 0.95 accordingly). The existence of a high positive correlation seems logical also between the rates of the quantity of those studying at all the three levels.

Table 6 of the Appendix contains the best models from the 'technical' and theoretical points of view, describing the 'brain drain' as the process that is defined by a number of reasons and factors. The level of significance, determination coefficient and the coverage of different aspects of the 'brain drain' have been chosen as the quality criteria of the model. Because of the incompleteness of the data available the number of observations varies considerably from model to model (from 100 to 261). On the whole it should be mentioned that most models used indicators of the labour market, which points to the importance of a well thought-out policy in this field with the help of which it would become possible to control the scale of 'brain drain'. Considerable role is also played by the system of education. One can judge the problem not only by the importance of the indicators of the education level in a country, but also by high coefficients of variables responsible for the level of population embrace by primary, secondary, high, and higher education (models 3, 4, 5). Besides, the level of economic development and the living conditions inside a country are conducive to the fact that some estimates act in one case as stimulating the outflow of well educated emigrants while in another case they are restraining factors which characterize the overall low level of the living condition. It refers, for example, to the 'illiteracy rate' which has a positive coefficient in model 9 and a negative one in models 11,

12, 13. Diverse influence on the resulting variable of such indicators as population growth and annual GDP growth once again confirms the importance of theoretical perception of the problem of 'centrifugal' and 'centripetal' factors, the scheme of their influence on migration flows, as well as the priority of the influence on migration rates.

For lack of statistical time-series data on the dynamics of the 'brain drain' the attempt was made to divide structural characteristics of this process for the years 1990 and 2000 by introducing a fictitious variable 'fictyear' which equals to 1 in the 1990 and 0 in the 2000 (model 11). According to the conclusions in model 11, where this variable is included as an actor of another indicator – patent grants – time gap, as well as other external objective factors, influence considerably the 'brain drain' process. Thus, if in 2000 the increase in a state support for scientific research restrained emigration of qualified specialists, in 1990, on the contrary, the same indicator stimulated it. This sitiation seems possible and not inconsistent. Thus, in Russia, for example, because of unstable economical situation in the 1990's lots of professionals tended to go abroad in search of a better job and creative opportunities, and the spectrum of the 'centrifugal' factors was of course wider than in the year 2000 when the situation relatively stabilized and the preference of potential immigrants changed. At the same time the subsidizing of research as well as the increase of the share of expenditure on education in the structure of the GNP (model 7) is an important factor, restricting the emigration of the professionals with high level of education and qualifications. Thus, not only the labour market but the system of education and science require thorough control to regulate the scale of 'brain drain'. Because of this, and also considering the impact of the general standard of living in the country model 13 may be considered to be the most successful one. It describes the process of 'brain drain' with the help of the indicators of 'subsidizing of research', 'the illiteracy rate', 'quantity of the labour force in the country', 'spread of the mobile communication' and also 'sickness rate (citing tuberculosis as an example)'[1]. It is necessary to draw special attention to the last indicator because it allows to state that the instability of the health care system of the country of emigration also has a nonlinear influence on migration on the whole and the 'brain drain' in particular. On the one hand it can, among other things, serve as a 'centrifugal' factor stimulating the migration for the sake of looking for better living conditions and more solid social guarantees. On the other hand, however, as it is seen in model 12, the significant increase of the tuberculosis morbidity among population (as a result of the inadequacy in the medical sphere, hygiene, etc.) reflects the fall of the general standard of living, which at a certain stage creates obstacles on the way of potential migrants' movement.

As opposed to the majority of the considered models model 13 includes the resulting indicator in a linear variant. In the group given in table 5 of the linear models model 13 has the biggest coefficient of determination (0.428) and explains the dispersion of the resulting indicator by 42.8%. All the alternating models are significant at the level of 1% except pg and ln (tbinc100th), for which the level of significance was 2% and 7% accordingly.

Coming back to the consideration of the model with regard to Russia, it is worth noting that the indicators used to a considerable degree reflect the dynamics of the transformational processes which were taking place at the beginning of the 1990s and to a certain extent are still

[1] It should be specified that tuberculosis has been chosen as an indicator because of the existing detailed statistics of the scale of the population inclusion in the counties chosen.

going on. The decrease of the literacy rate, the transformation of the educational system and health care[1], the absence of the inner stability, on the one hand, and the integration of Russia in the world information and economic community, on the other hand, have created strong premises for the activating of the 'brain drain' process.

Besides, low financial backing of R&D projects in the 1990s, to a considerable degree promoted the outflow of the Russian researchers abroad, which not only resulted in irreparable losses of the intellectual potential of the country, but led to big financial losses, created the threat to stagnation of the science, education and defense capacity of the state. (Iontsev and Kamenski 1999). The most vividly revealed in the 1990s, the problems indicated are topical for Russia nowadays. And though it is difficult now to make exact qualitative evaluation because of the lack of data, the research of the general trends using the data available might be possible, interesting and extremely topical.

In conclusion special attention should be paid to two important circumstances which have not been reflected so far in scientific literature and which can considerably change the picture of modern 'brain drain', highlight its negative effects, even if emigration rate of highly skilled professionals decreases. The first is connected with the decrease of the quality of training, both at its highest and lower levels (for example Russia faces the deficit of well-qualified nurses, mechanics and many other different jobs). In other words, there grows the mediocrity tide, which was unambiguously stated at the beginning of the 1980s by the US National Commission on the quality of education, which in the federal report entitled 'A Nation at Risk. The Imperative for Educational Reform' stressed the following: 'Our Nation is at risk as the educational foundations of our society are presently being eroded by a rising ride of mediocrity that threatens our very future as a Nation and a people. …If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war' (*A Nation at Risk*, 1983). Something like this can be observed also in other countries, where the American system of education takes place, also in Russia. As follows, the USA being the main centre of attracting 'foreign brains' will have a need for them more and more.

On the other hand, the basis that supplies these 'brains' will narrow. This scenario is rather real, if we consider the second circumstance, namely the demographic crisis that has affected many developed countries and especially the post-Soviet states. The essence of the demographical crisis is in both quantitative unfavourable changes (the process of depopulation is growing, in some countries we can observe the natural population loss), and qualitative negative changes in population (growth of people with mediocre intelligence; spiritual, physical, psychical and psychological degradation of population, more and more families in developed European countries consciously refuse to have children, more and more children are born with serious diseases).

The demographic crisis in Russia has become especially astute: for the period 1992-2008 the natural decrease of population exceeded 12.5 million people; over 70% of children are born

[1] In table 4 of the Appendix the dynamics of the morbidity of tuberculosis out of 100000 people for Russia from 1990 to 2002, that shows the tendency for the growth in the period considered and evident of weak development of the health care system.

with diseases, the number of disabled children reached almost 700,000, the number of homeless exceeded 2 million, there is a constant growth of sickness rate of neuroses, death rate from drugs among teenagers grew by 42(!), the number of beer alcoholics under 14 years old increased 100,000, etc. Under such circumstances the departure from the country even considerably less amount than before of talented people could have far more serious negative consequences.

The following are the main conclusions from the above:

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1. Despite all the attempts to present the 'brain drain' as a mutually advantageous process, in its essence it remains an extremely negative process which prevents the development of the countries that act as suppliers of highly skilled professionals.

2. The policy of the immigration countries becomes of even more obvious governmental character in speeding up the involvement of foreign brains which play the important role in their further development, especially considering the negative demographic tendencies in these countries.

3. Econometric analysis of highly qualified specialists' migration confirmed the main ideas of the authors about the character and the consequences of the 'brain drain' by exposing, in particular, a dual role of education in this process. According to a modal analysis of 'brain drain' factors, the increase in education expenditure reduces the outflow of specialists, while the inclusion of population in education process at all levels intensifies it. Thus, not only the diversity of the influence of the system of education on the 'brain drain' becomes obvious but also the tendency of rich, developed countries to compensate the drawbacks in their own systems of education by attracting foreign talents, which is extremely negative for the less developed countries and demands close attention from the academic community and authorities.

4. Against the worsening of highly qualified specialists' training system and increased demographic crisis the developed countries, on the one hand, become more dependent on involving 'foreign brains', while the states - suppliers of specialists, on the other hand, experience a drastic increase in negative consequences, even if the scale of 'brain drain' reduces.

5. The increase of volume of intellectual migration which acquires an even greater importance in the 21st century could become a real counterbalance of 'brain drain'. Moreover, a free and equitable exchange of scientific ideas, achievements in production and medicine, national culture and art through the return, temporary migration of professionals is not only an economically and politically beneficial process for every local civilization and separate member-states, as well as for the world community as a whole. It is the only possible way of further progressive development of the world civilization considering its increasing 'fragility' and interdependence, as well as ecological and demographic threats which mankind and especially its certain civilizations face so acutely. The matter is primarily the European civilization which as soon as the middle of the 21st century under the impact of the increasing migration from Asia might be 'swallowed' by the Chinese civilization (providing modern demographic tendencies in Europe maintained). Something similar but

in a more remote perspective obviously threatens North American and Eurasian (with Russia in its centre) civilizations.

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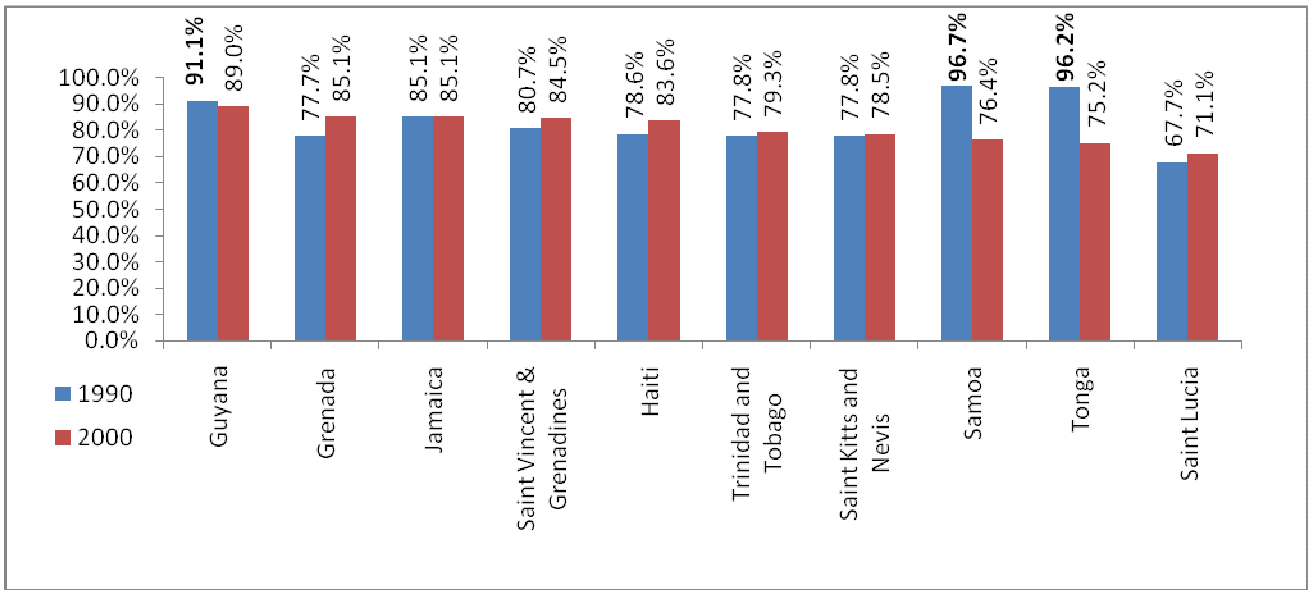
Appendix

Diagram 1. Intensity of the brain drain for 10 main sending countries



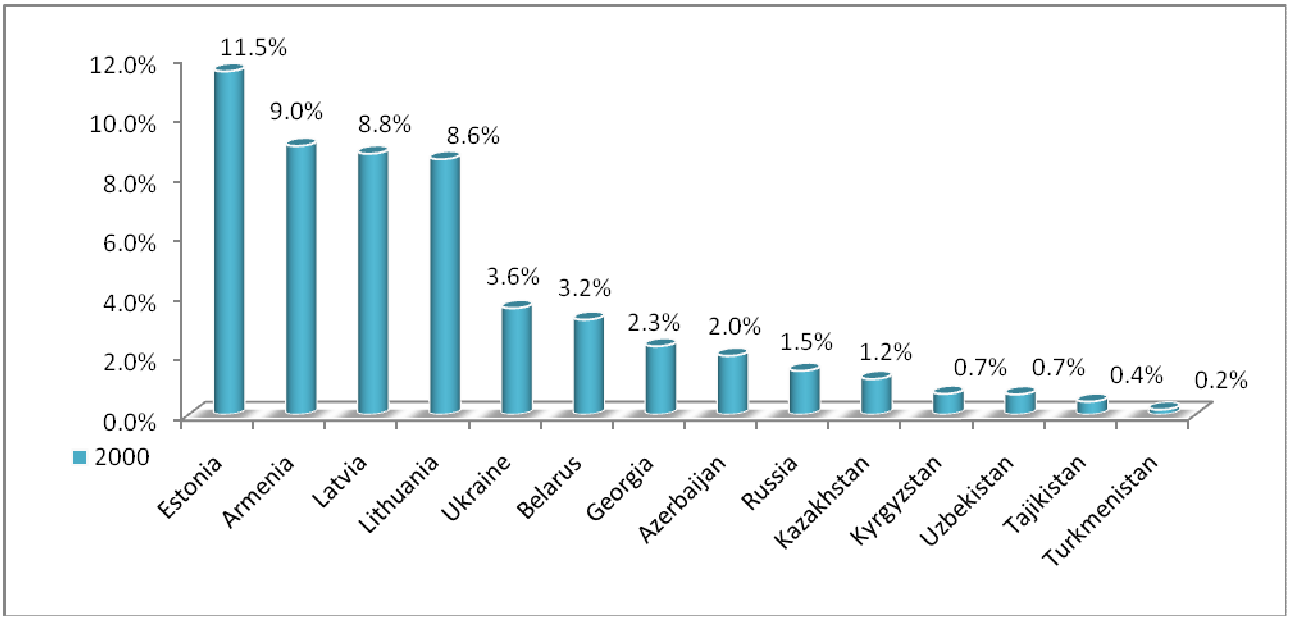
Source: *Measuring International Skilled Migration: New Estimates Controlling for Age of Entry, Michel Beine, Frederic Docquier and Hillel Rapoport, World Bank Research Report, July 2006*

Table 1. Waste of medical staff on Jamaica during the period 1978 – 1985.

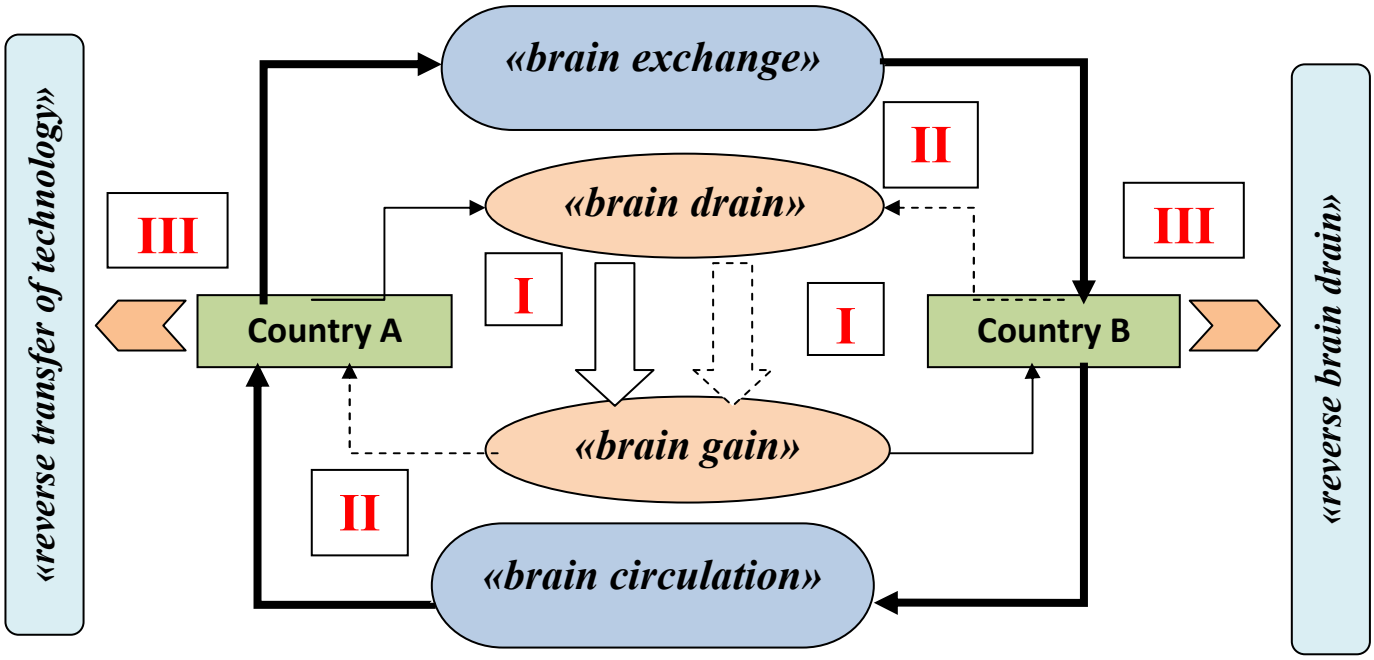
		Doctors	Nurses
1978	Total estimates	354	1 884
1978-1985	Output of the national educational system	393	1 822
1985	The total number expected (in the absence of losses)	747	3 706
	Estimates of the total number	441	1 972
	Disparity between the expected and estimated number	306	1 734
	Percentage of deficit in the ratio to the national education output	78%	95%
	Ratio of medical staff to population – recommended figures	1:910	1:769
1978	Ratio of medical staff to population – actual figures	1:5 900	1:1 108
1985	Ratio of medical staff to population – actual figures	1:5 240	1:1 172

Source: *Anderson, 1988*

Diagram 2. Intensity of the 'brain drain' from the ex-USSR republics



Source: *Measuring International Skilled Migration: New Estimates Controlling for Age of Entry, Michel Beine, Frederic Docquier and Hillel Rapoport, World Bank Research Report, July 2006*



Scheme 1.

Table 2. Indicators used to explain tendencies of the 'brain drain' process

group	Indicator	Signs used in models	Footnotes	Source of data
Demographic	Life expectancy rate birth	lifeexp	лет	*UN Databases (* http://data.un.org*)*
	Mortality infant rate	minfr	Per 1000 population	
	Crude death rate	dr	‰	
	Crude birth rate	br	‰	
	Fertility rate	fert	Number of birth per woman	*United Nations Statistics Division (*http://unstats.un.org/unsd/databases.htm*), National Statistical Data*
	Annual population growth	popgr	Per 1000 population, annual	*Calculated as the disparity between crude birth and crude death rate, source: UN Databases* (http://data.un.org*)*
	Number of population	pop	Number of people	*UN Databases (* http://data.un.org*)*
	Lebour force	lf	Number of people	
	Age dependency ratio	agedep	Ratio to population ate the working age	
	Age group 60+ (percentage to the whole population)	agegr60+	%	
	Age group 0-14 (percentage to the whole population)	agegr_014	%	
Economic	Urban population rate	upr	Ratio to the whole population	*United Nations Statistics Division (*http://unstats.un.org/unsd/databases.htm*), UN estimates*
	GDP growth	gdpgr	Annual growth, 1990 prices	
	GDP, constant prices (base in 1990)	gdp		*UN Databases (* http://data.un.org*)*
	Area of permanent crops	areacrops		
	Energy consumption	encons		
	Forestland	forestland		
	Direct investment	invdirect		
	Personal computers per 100 population	compper100pop		
	Cellular mobile phone subscribers	mob	Number of people	
	Lagged cellular mobile phone subscribers (1989-1990)	mob_8999	Number of people	

	Total unemployment rate	unempl	Ratio to the whole labour force	
Education? Science and health care	Human development index	hdi		
	Illiteracy rate	illr	Percentage of illiterate population at the age of 15+	*United Nations Statistics Division (http://unstats.un.org/unsd/databases.htm), UNESCO estimates*
	Primary education enrolment	edupr		
	Secondary education enrolment	edusec		
	Tertiary education enrolment	edutert		
	Education expenditures, percent to GDP	eduexpgni		
	Education expenditures, percent to the whole government expenditures	eduexpgov		*UN Databases (http://data.un.org)*
	Number of physicians per 1000 population	phys1000		
	Tuberculosis incidence rate	tbinc100th	Per 100 000 population, annual	*World Health Organization (http://www.who.int/whosis/indicators)*
	Patent grants	pg		*UN Databases (http://data.un.org)*
	Patent grants per patent application	pg/pa	Patent grants received per application	*Calculated with the help of indicators pg u pa, source: UN Databases (http://data.un.org)*

Table 3. Distribution of indicators according to the object they are related to in the model

Standards of living	Education	Efficiency of health services and demographic situation in the country	Labour market	Support of science and researches	Economic development
fert	illr	tbinc100th	agedep	eduexpgni	gdp
upr	edupr	minfr	unempl	pg	gdpgr
mob	edusec	phys1000	lf	pg/pa	upr
mob_8999	edutert	lf	agegr60+	eduexpgov	illr
compper100pop	eduexpgni	popgr	agegr_014		areacrops
hdi	eduexpgov	fert			encons
phys1000		agegr60+			forestland
lifeexp		agegr_014			invdirect
		dr			
		br			
		lifeexp			

Таблица 4. Ordinary least squares regressions of total number and of logarithm of total number of high and medium skilled emigrants to OECD countries. Each model demonstrates separate influence of each indicator on the 'brain drain' process[1]

Regressor[2]		Type of model	Linear (ms)			Logarithmic (logms)		
		group	Coefficient	Level of significance	R^2	Coefficient	Level of significance	R^2
Upr	N=384	Economic development and standards of living	2960.61	***	0,26	0.027	***	0,55
Logpop			56425.63	***		0.68	***	
Logupr	N=384		119393.65	***	0,26	1.31	***	0,57
logpop			55312.79	***		0.67	***	
Pg[3]	N=171	Support of science and researches	-417,45		0,449			
Pg/pa	N=167	Support of science and researches	-57677.28		0,23	-0.41	**	0,42
logpop			97509.64	***		0.63	***	
Eduexpgni	N=117	Education and support of science and researches	33799.91	**	0,25	0.104		0,404
logpop			101592.5	***		0.655	***	
Logeduexpgni	N=117		165369.7	**	0,26	0.58	*	0,41
logpop			101181.4	***		0.66	***	
Eduexpgni	N=117	Education and support of science and researches; Economic development and standards of living				-0,23	**	0,22
upr						0,038	***	
Logeduexpgni	N=117	Education and support of science and researches; Economic development and standards of living				-0,79	**	0,2
upr						0,038	***	
Illr	N = ?	Education	-2702.92	***	0,33	-0.04	***	0,55

[1] Levels of significance of explaining variables: *** — probability of mistake is 1% or less; ** — probability of mistake is more than 1% and less than 5%; * — probability of mistake is more than 5% and less than 10%;no sign in the cell means that the variable is not significant in this model

[2] As far as absolute indicators have been chosen as the explanatory variables, it is necessary to make a correction of variables included. This is the reason why the variable 'pop', that indicates the number of population of each country, is present in every model (in a linear or logarithmic form)

[3] Empty spaces in the table are related to the wrong specification of the model and incorrect estimates of the coefficients

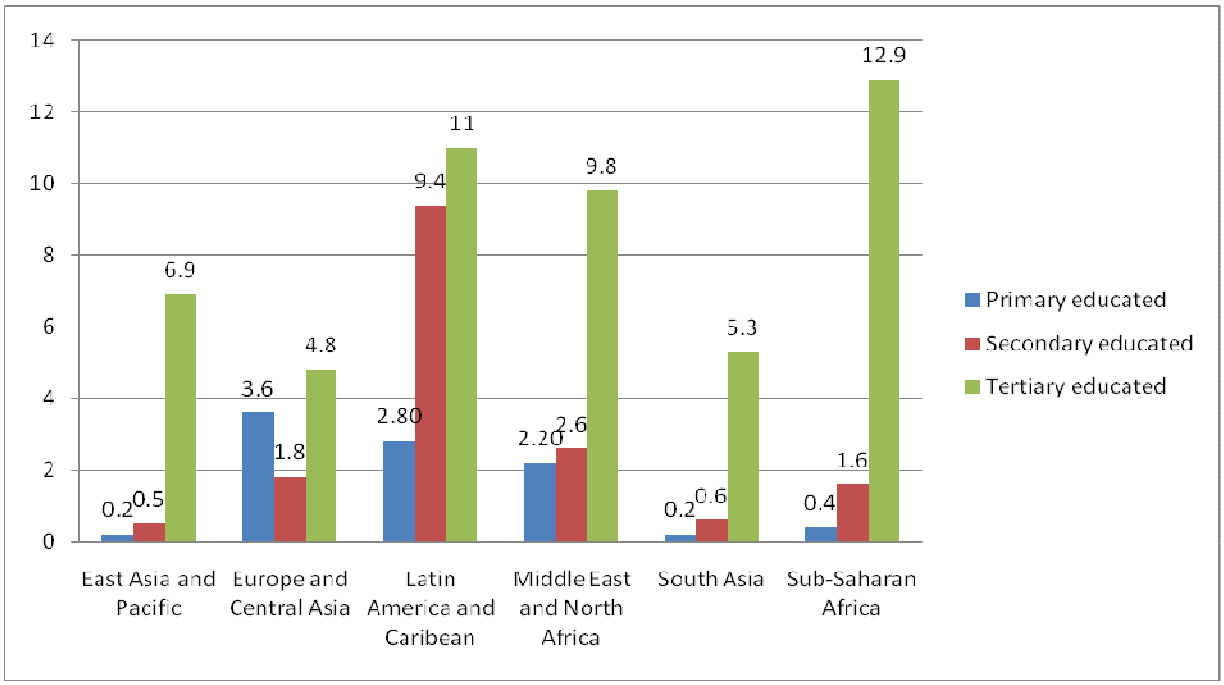
logpop			64102.03	***		0.69	***	
Logillr	N=268		-32749.22	***	0,3	-0.46	***	0,49
logpop			64064.91	***		0.69	***	
Unempl	N=148	Labour market				0.035	*	0,48
logpop						0.63	***	
logunempl	N=148		89918,4	***	0,067	0.32	**	0,46
loglf						0.63	***	
Agedep	N=351	Labour market	-408557.5	***	0,3	-4.88	***	0,56
logpop			68384.70	***		0.612		
logagedep	N=351		-272616.3	***	0,29	-3.22	***	0,55
Logpop			68491.84	***		0.614	***	
Minfr	N=366	Efficiency of health services and demographic situation in the country	-2222.153	***	0,306	-0.026	***	0,65
logpop			64752.39	***		0.69		
Logminfr	N=366		-89135.01	***	0,314	-0.95	***	0,624
logpop			64421.59	***		0.68	***	
Logmob	N=240	Standards of living	36250.11	***	0,3	0.215	***	0,52
logpop			48155.07	***		0.47	***	
Loglf	N=347	Labour market	73556,25	***	0,221	0,638	***	0,263
Logedupr	N=334	Education	61706	***	0,178	0,59	***	0,33
Logedusec	N=306	Education	71858,78	***	0,258	0,663	***	0,471
Logedutert	N=245	Education	81912,3	***	0,291	0,671	***	0,513
Loggdpgr	N=284	Economic development	-15876,91		0,0015	-0,077		0,00069
popgr	N=361	Economic development and demographic situation	-8866,615	***	0,11	-0,103	***	0,282
logpopgr	N=341		-78460,64	***	0,091	-0,903	***	0,202
Tbinc100th N=370		Efficiency of health services	-316,52	***	0,024	-0,0043	***	0,075
Logtbinc100th N=370			-47235,21	***	0,0425	-0,529	***	0,092
Fert N=171		Standards of living and demographic situation	-44596,02	**	0,0225	-0,442	***	0,082
Logfert			-112494,7	*	0,019	-1,079	***	0,066

N=171							

Table 5. Fragment of the correlation matrix. Only highly correlated indicators are included

	aged ep	fert	lf	minf r	popg r	gdpg r	mob	une mpl	upr	xpgn	edup r	edus ec	edut ert	illr	pg	Pg/p a	c100
Agedep	1	0.87		0.57	0.90									0.50			
Fert	0.87	1			0.93									0.61			
lf			1	0.51			0.55				0.88	0.985	0.95				
Minfr	0.57		0.51	1	0.57						0.67						
Popgr	0.90	0.93		0.57	1						0.58			0.52			
Gdpgr						1											
Mob			0.55				1						0.58		0.91		
Unempl								1									
Upr									1								
Eduexpgni										1							
Edupr			0.88	0.67	0.58						1	0.875	0.76				
Edusec			0.985								0.875	1	0.901				
Edutert			0.95				0.58				0.76	0.901	1				
Illr	0.50	0.61			0.52									1			
Pg							0.91								1		
Pg/pa																1	
Tbinc100th																	1

Diagram 3. Distribution of migrants to the OECD countries according to the education level and emigration rate



Source: *A. Burns, S. Mohapatra International Migration and Technological Progress, 2008*

Table 6. Ordinary least squares regressions of total number and of logarithm of total number of high and medium skilled emigrants to OECD countries. Each model includes combinations of different indicators

Explanatory variable	Explaining variables		Features of model			Footnotes	Numbe of variable include
	group	indicator	coefficient	Level of significance	R^2		
Ln (ms) (model 1)	Labour market	C	4,68	***	0,414	Lf<400000000	N=146
		Ln (lf)	0,55	***			
		Unempl	0,044	**			
		agedep	-3,35	***			
$(\ln (ms\_hig))^{0,5}$ (model 2)	Standards of living, science and researches	C	1,69	***	0,43	Explanatory variable is the number of high skilled emigrants only	N=163
		Pg/pa	-0,05	*			
		ln(lf)	0,81	***			
Ln(ms) (model 3)	Education, health services and labour market	C	2,37	**	0,47	These models include such variables as education enrollment on all the three levels, which are also absolute indicators. The mutual influence of these regressors and explanatory variable is sufficient to except the single negative effect of absolute indicators. So correction with the help of number of population or number of the labour force is not necessary any more	N=140
		Tbinc100th	-0,005	***			
		Ln(unempl)	0,46	***			
		Ln(edupr)	0,63	***			
Ln(ms) (model 4)	Education, health services and labour market	C	3,17	***	0,499		N=132
		Tbinc100th	-0,0034	***			
		Ln(unempl)	0,41	***			
		Ln(edusec)	0,58	***			
Ln(ms) (model 5)	Education, health services and labour market	C	3,96	***	0,54		N=119
		Tbinc100th	-0,001975	**			
		Ln(unempl)	0,27	*			
		Ln(edutert)	0,598	***			
Ln(ms) (model 6)	Economic development, education and health services	C	13,35	***	0,306	Indicator called «edu» is calculated as the sum of indicators «edupr» and «edusec»; Gdpgr>(-20) и gdpgr<20	N=171
		Ln(edu)	0,506	***			
		Mob	$3,56 \cdot 10^{-8}$	***			
		Gdpgr	-0,65	**			
		$(\ln(gdpgr))^2$	0,94	**			
		Tbinc100th	-0,002	*			
Ln(ms) (model 7)	Education, health services and state policy	C	14,105	***	0,385	Indicator called «edu» is calculated as the sum of indicators «edupr» and «edusec»	N=100
		Mob	$3,84 \cdot 10^{-8}$	**			
		Edu	$3,06 \cdot 10^{-8}$	***			
		Ln(minfr)	-0,764	***			
		Ln(eduexpgni)	-0,732	**			
ln(ms) (model 8)	Education, standards of living and demographic situation	C	11,88	***	0,273		N=150
		Mob	$7,26 \cdot 10^{-8}$	***			
		Edu	$2,17 \cdot 10^{-8}$	***			
		fert	-0,3897	***			
Ln(ms)	Education,	C	11,7	***	0,301		N=261

(model 9)	health services and demographic situation	Ln(Illr)	0,25	**			
		$(popgr)^2$	-0,00227	***			
		minfr	-0,0157	***			
Ln(ms) (model 10)	Health services and demographic situation	C	2,56	***	0,61		N=337
		Ln(lf)	0,62	**			
		$(popgr)^2$	-0,063	***			
		minfr	-0,02	***			
ms (model 11)	Education, scientific researches and information	C	208748,3	***	0,25	Indicator «fictyear» is equal to 1 for the observations related to the year 1990 and is equal to 0 for observations related to the year 2000	N=127
		Mob	0,015	***			
		Pg	-5,699	**			
		Pg*fictyear	10,94	***			
		illr	-2561,116	***			
ms (model 12)	Education, science and labour market	C	-1057721	***	0,41		N=125
		Mob	0,00777	***			
		Pg	-3,44	*			
		Illr	-3855,582	***			
		Ln(lf)	85269,38	***			
ms (model 13)	**Education, health services, scientific researches, labour market and standards of living**	**C**	**-1011257**	***	**0,428**		**N=122**
		Mob	**0,0074**	***			
		Pg	**-3,797**	**			
		Illr	**-3138,76**	***			
		Ln(lf)	**91067,68**	***			
		ln(tbinc100th)	**-34825,65**	*			