DETERMINANTS OF HUMAN CAPITAL THEORY, GROWTH AND BRAIN DRAIN; AN ECONOMETRIC ANALYSIS FOR 77 COUNTRIES

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Abstract
The study aims to analyse the relation between human capital, growth and brain drain in 77 countries. These variables are also affected by numerous other variables. This study researches human capital, growth, migration, their determinant variables and the interlink ages between them. Models constructed for these purposes are tested by panel data analysis for the period 1990 – 2001.

Key words; Human Capital, Growth, International Migration, Panel Data Analysis.
JEL Classifacation: C240, O100, O400, F220, C330

1. Theories of Human Capital

Application of capital concept on human is not recent. The view that human and his qualifications might be a part of capital has proponents among economists, since the birth of science of economics. W.Petty, W.Farr, A.Smith, J.B.Say, N.Senior, F.List, J.S.Mill, A.Marshall, V.Thunen, W.Roscher, W.Bagehot, E.Engel,

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Acknowledgement. We are gratefull to Prof.Dr.Maria-Carmen Guisan for their helpful commets and suggestion

H.Sidgwick, L.Walras and I.Fisher are most prominent of these economists. Classical English School has accepted that skills gained by human are some form of capital while some economists assert that the human himself is capital. Walras and Fischer defend the second view while the second view is accepted by economists who are involved with income distribution and production theory. Human Capital Theory (HCT), together with homogeneous work force assumption of neo classic theory is replaced by heterogeneity of labor. Differences in levels of education and skills gained by persons require that they receive different wages (Gonçalves(1999), pp.1-4) The consequence of this is a shift from a functional distribution income to an individual distribution of income(Zweimüller(2000), pp.1-16). First views on this subject are based on the studies of Smith and Mill. According to the compensation view of Smith, labor mobility gives rise to wage differences that equalize net advantage and disadvantage of the work. In the non-competing group's doctrine of Mill and Cairnes, lack of sufficient labor mobility causes real wage differences and this brings about legal, cultural and social hierarchy (Mincer(1994) pp.110-11). Research on labor market has proceeded on these two principles. Smith's compensating principle is applied on wage differentials caused by vocational education. Smith argues that a person receiving education was in loss because of not working and such qualified people were to be paid more wages and only then they could fulfill their costs of education and receive gains. This view has constituted the basis of human capital analysis. Succesively the theory is improved by Becker (1964), Mincer (1957-1958), Schultz (1961), Denison (1971) and Harbison and Myers (1965). Human capital is criticised from different points of view in time. One of the criticisisms is that the theory is difficult to be tested, quality of education is not considered and those who take investment decisions can not calculate its possible rates of return. Another point criticised is the problem of skills. Finally, another criticism of the theory is the dual job market in the context that education will not be sufficient in eliminating income inequality.

Another topic to be analysed in the study is growth. Growth theory has experienced three waves. The first wave is represented by Harrod-Domar model, the second wave is represented by neoclassical

growth model (majorly Solow's model) and the third one by endogenous (new) growth model. Endogenous growth theory asserts that factors such as knowledge, human capital and technological progress that are excluded or assumed to be exogenous by other models should be internalized. In endogenous growth models that are developed by important studies of Romer (1986) and Lucas (1988) by the end of 1980's, the role of the state increases. However the role of the state in these models is different than that of Keynesian investing and producing state. The role of the state is defined by ones which increase the effectiveness of private sector such as R&D, education, innovation and technology transfer, reduction of transaction costs, protection of property rights, strengthening communication networks, sustaining an open system and removal of impediments to competition. According to this, the more successful is the state at these functions, the higher is the economic performance (Foss(1997), pp.1-4). Romer (1986) has made an important contribution to endogenous growth theory. Romer's study follows the line of studies of Young, Marshall and Arrow (1962) who has studied learning by doing. According to Romer, since knowledge is a factor of production that has increasing returns, growth is also progressive, thus cumulative growth can be observed. New approaches on growth concentrate on two basic views such as accumulation of knowledge and human capital. Knowledge and human capital are not subject to law of decreasing returns and they provide unlimited technical progress (Sheehan(1999), pp.1-3). Human capital is the sum of abilities, knowledge and skills that are specific to individuals. Endogenous growth models differ from Solow model in that they emphasize increasing efficiency of physical and human capital. According to this, a small investment on physical or human capital or an increase of resources allocated to these factors has significant effects on output. The characteristic that makes new theories different than old ones is how they view investment. Old theories consider capital accumulation as the engine of growth. Keynesian economists such as Lewis and Kaldor concenterate on how the savings will be increased in order to finance required investment. The reason that poor countries develop less is considered to be the insufficient stock of capital. According to Kaldor, there is a linkage between level of savings and income distribution. On the other hand,

new theories state that basic determinant of investment (on physical and human capital) is the wave of innovation in the economy. Moreover, these innovations are not exogenous; they are motivated by profit seeking. Many endogenous growth models emphasize increasing incomes while some other considers growth of consumer utility. A third model is concerned with sources of growth. Main sources of growth are: 1) knowledge accumulation (Romer P.), 2) Public infrastructure (Barro R.), 3) Human capital (Lucas R.), 4) R&D (research and development) expenditures.

Another impact of human capital on development is given by the contribution to lower down excessively high fertility rates, contributing to moderate population growth and to increase real GDP per inhabitant and other socio-economic variables, which favour human well-being, as shown in the econometric model by Guisan, Aguayo and Exposito(2001) and other studies.

In this study brain drain is another subject to be analyzed. The concepts of brain drain emerged in mid-1960 as England started to lose a considerable amount of highly skilled labor force and scientists to North America and other countries. There are different views on how the movement of high skilled labor movement among countries begin and proceed. These reasons are handled with theoretical approach at one side and survey based studies are conducted at the other. In theoretical assertions and surveys, skilled labor movements are explained by "attracting and repelling forces". There are also approaches of "core-periphery" and "imbalance of supply and demand". Other important approaches in theorical context of brain drain are international and nationalist view. Social scientists that support the internationalist view in context of brain drain assert that immigrants rationally mind their personal welfare when they voluntarily migrate and this increases the total welfare of the society. According to the internationalist view brain drain makes scientists serve more to humanity. This is a neoclassical view (Lowell(2001), p.1-2; Straubhaar(1992), p.81). Grubell and Scott(1966), proponents of internationalist view have formed a general theoretical framework which determines the factors leading to decision of migration. Another proponent of internationalist approach, H. G. Johnson's view is that circulation of human capital is a normally, this type beneficial process since it is a consequence of free will of people.

Normally this type of migrations causes an overall increase in world output as in the case of circulation of other factors; thus, the world on the overall benefits from migration. In this mechanism human capital flows to regions where the rate of return is highest and by this way migration maximizes efficiency on a world scale. Thus, it is not right to impose limitations on free movement of human capital with nationalist concerns. According to internationalist view, brain drain is a consequence of negative conditions in developing countries. By sending excess skilled labor to other countries, both developing countries and migrating workers become better off. By increasing the overall efficiency of human capital world output will be maximized and income and welfare of skilled labor will increase, purchasing power inequalities will be decreased. For this reason, many humanists perceive brain drain of scientists as an important step for globalization. Another important point concerned by the proponents of internationalist view is that whether the situation of remaining people of the country is deteriorated or not after the brain drain. As in all other factors of production, investment on human capital has its costs. When skilled labor force migrates, it performs its productivity in a foreign country. Income generated by this efficiency is taxed at the destination country. Thus a country receives tax revenue from an income for which it incurred no costs and the country of origin parts from a source of taxable income which it once invested on. On the other hand internationalist approach emphasizes the externalities generated by high skilled labor force (Reichling, F, 2001, pp.3-5). In a similar way, scientists also create externalities since science is the common property of all humanity. In other words it is not important where an invention is made because its consequence is available for everybody. The nationalist model assert that countries of origin are impoverished due to human capital losses caused by educated personnel that start to work abroad by minding their personal benefits. By this way impoverished countries become more dependent on economic assistance while developed countries gain the opportunity to accumulate wealth by transferring skilled labor force. This increases the inequalities between countries. According to the nationalist model developed by Patinkin, brain drain is boot a problem for the country of origin in the short run; however, it emerges serious problems in the long run. Migration skilled labor is

not a problem if it returns to country of origin after increasing its skills further. On the contrary, it is even beneficial since it contribute to development of the country. But if it returns after a long period, it can not be useful. Since it will not adapt to local conditions, skilled labor force will tend to return to destination country. Patinkin also objects the view that labor force be allowed to move freely between countries. Because it will hamper the economic growth of countries. For this reasons there has to be limitations on immigration. Proponents of nationalist view think that it is not easy to account the real magnitude of loss caused by brain drain. In analyzing the dependence of a developing country to developed countries i) current losses are not mentioned or underrated, ii) gains are exaggerated, iii) some gains may happen to be actual losses when analyzed in detail. Because of the education system financed by taxes, potential tax revenue of origin country is terminated in case of brain drain. The immigrant pays the taxes in the destination country and brings up new generations. Moreover, nationalist model emphasizes that immigration forms a misleading model in the minds of young generations by objecting the internationalist view that immigration plays an incentive role by requiring that immigrated personnel be replaced by the young

2. Skilled Labor and Brain Drain

Actually brain drain term refers to a problem that is mostly experienced by developing countries (Liki(2001), p.72). Developed countries that import skilled labor increase their human capital level with these people and receive "brain gain". On the other hand, developing countries can not receive any gains and even face significant losses with the migration of skilled people that are educated and brought up to fulfill strategic tasks in development (Straubhaar(2000), p.8). Besides, the problem of "unemployed intellectuals" is an important issue. Many of these countries have bottlenecks in providing positions for university graduates. Thus it is a disputable issue that whether brain drain is a loss, a safety valve for domestic unemployment or an overflow of brain that can not be utilized (brain overflow). Existence of skilled unemployed people in a country indicates that investment on human resource is not

accurately made and human capital is intensely wasted. Migration with positive effects for the country that sends immigrants, there exist a surplus of brain, brain export and brain exchange or circulation while brain outflow or brain waste can be mentioned for countries that experience negative effects due to brain drain. The LDC may improve their economies by brain export, brain exchange and brain circulation. It also has to be noted that although these types of brain drain are different from each other, these distinctions are only at logical level. It is difficult to argue that they are empirically different from each other. One single approach is not sufficient to measure these differences. Brain surplus and brain drain is very important in terms of its various consequences for developing countries. Migrated countries are generally ones like USA, England, France, Germany, Australia and Canada that provide a higher Standard of living. Additionally, traditional, cultural and historical links as language, religion; geographical proximity, immigration policy of destination country, economic and political relations with the home country are other factors that effect the form of migration (Salt and Ford (1993), pp.295-6). Migration from North or South America (Jamaica, Guana, El Salvador, Trinidad and Tobaggo, Mexico, Panama, Dominic Republic) to OECD countries is totally towards USA but no other country. Labor force potential of regions such as Indian Peninsula, Sudan, Indonesia, Philippines migrate to England, Canada and USA while skilled labor force of Algeria, Tunisia, Morocco and Nigeria migrate to France (Carrington and Detragiache(2003), pp.13-4).

In 1993, number of enrolled tertiary level (graduate and undergraduate) foreign students in 10 selected OECD countries was 759,400 whose majority was Ph. D. Students. The number of foreign students in OECD countries has increased by 4.6% in the period from 1995 to 1998. There are dfferences among countries in terms of these increases. This increase has happened to be 40% in Australia and Australia is followed by Sweden, England, Denmark, Germany (14%) and USA (2.5%). A great majority of foreign students go to USA, England, Germany, France, Australia, Switzerland and Austria.

Table 1. Stock of foreign students and regions of origin, 1998

Destination Country	OECD	EU	Africa	Asia - Pacific	South America	Europe non OECD
Australia	18.4	41.7	2.0	73.8	0.5	1.3
Austria	65.6	76.9	3.5	14.0	1.1	17.3
Belgium	62.8	85.7	15.4	18.1	2.4	1.9
Canada	42.1	48.8	15.5	39.4	3.1	2.7
Czech Rep.	27.6	84.5	6.2	13.9	1.3	34.0
Denmark	42.0	42.4	2.3	12.0	1.1	20.5
Finland	35.9	62.1	14.2	23.6	1.4	27.3
France	26.8	69.6	43.1	11.2	2.3	3.8
Germany	56.3	48.0	9.3	35.9	2.3	0.7
Hungary	35.8	64.2	3.2	16.3	0.3	49.0
Iceland	81.4	64.6	0.5	6.7	3.1	24.2
Ireland	72.3	68.9	4.4	23.1	0.1	2.5
Italy	64.5	93.5	10.4	14.2	3.3	7.0
Japan	38.3	4.5	1.0	92.3	1.3	0.9
Korea	31.2	4.4	1.3	80.3	1.3	3.2
Luxembourg	84.3	99.8	1.1	0.2	0.4	1.8
New Zealand	21.5	27.2	1.1	84.4	0.8	0.7
Norway	54.5	74.9	10.5	19.1	2.7	17.0
Poland	17.7	40.5	9.2	19.3	1.0	56.5
Spain	65.7	88.1	10.3	3.9	14.9	4.2
Sweden	63.1	65.5	3.4	18.7	3.0	23.0
Switzerland	72.7	90.4	5.8	6.9	3.0	5.8
Turkey	8.9	93.3	2.7	72.5	0.1	15.9
England	59.8	75.4	7.1	34.2	1.2	3.3
USA	39.0	24.2	4.8	65.0	5.3	2.7

Source: Tremblay, 2002, p.52

Table 2. Countries that send students to selected OECD countries, 1998

Destination Country	Departed Country (ranked in percents)				
Australia	Malaysia (14.7)	Singapore (13.4)	Hong Kong, (12.2)	Indonesia (7.2)	England (4.9)
Austria	Italy (23.3)	Germany (19.1)	Turkey (4.0)	Bulgaria (3.7)	Iran (3.3)
Canada	France (10.7)	USA (10.0)	Hong Kong (8.2)	China (7.2)	Japan (4.0)
Denmark	Norway (10.5)	Iceland (5.7)	Germany (5.3)	Sweden (3.9)	Iran (3.9)
France	Morocco (11.8)	Algeria (10.9)	Germany (3.5)	Tunisia (3.4)	
Germany	Turkey (15.2)	Iran (5.2)	Greece (5.0)	Austria (4.0)	Italy (4.0)
Italia	Greece (49.1)	Germany (4.4)			
Japan	China (45.6)	Korea (33)	Malaysia (3.7)		
New Zealand	Malaysia (32.0)	Japan (6.1)	Hong Kong (4.9)	USA (4.9)	Thailand (4.8)
Spain	France (13.4)	Germany (11.0)	Italia (10.0)	England (8.1)	Morocco (6.8)
Switzerland	Germany (22.4)	Italia (15.6)	France (10.6)	Spain (6.0)	
England	Greece (12.1)	Malaysia (8.2)	Ireland (7.8)	Germany (6.2)	France (6.0)
USA	China (9.8)	Japan (9.8)	Korea (8.9)	India (7.0)	Canada (4.6)

Source: Tremblay, 2002, p.53

The country with the highest stock of foreign students is Luxembourg. Asian countries constitute the major group of countries that send immigrants. In 1998, China, Japan, Hong Kong, Korea and Malaysia are major countries that send immigrants. Europe both sends and receives immigrants. Germany, Greece, France and Italy are other important countries that send immigrants. In Africa, Morocco and Algeria are major sources of migration.

The direction of student migration is determined by one of these three factors: 1) Geographical proximity: more than 25% of foreign students in France, Germany and England come from other European countries. 2) Cultural and lingual similarities: English-speaking students tend to migrate to USA, Canada and England while French-speaking students migrate to France, Belgium and Canada. 3) Past colonial links: African students of England, France and Belgium come from former colonies of these countries.

In the socio-economic status of immigrant students, schooling and education level of parents are important. Besides, being privately funded or receiving scholarships and coming from a minority or majority group affect their status. Students coming from a majority group have a higher chance of being officially supported. Students with low socio-economic status are generally receivers of scholarships and they come from majority groups of their countries. Middle-class students are privately funded and they are members of minority groups in their countries. There are some differences between migrating students and professionals. Except for those who depart temporarily for work, labor force generally stays for long periods and provides social and economic contribution for the destination country

On the other hand students are young and less qualified. They have less Professional commitments in migrating. Although they consider migration for a short period or during their educations, there is not a significant increase in the number of students that do not return toothier home countries. According to a study by Myers, students who are given job opportunities in USA, have wives in USA, stay for long periods in the country, graduate students and students of

medical sciences are the ones with higher tendency of settling in USA (OECD Observer, 2002, p.2).

Magnitude and complex structure of brain drain brings some difficulties and constraints. International movement of high skilled labor force has political, sociological, cultural, psychological and most principally economic dynamics. It is a global issue since it concerns both home country and immigration country. Additionally, it is not possible to determine the magnitude and volume of the movement precisely. There is not a schedule that depicts all movements of skilled labor force among countries. Generally internal and external migrations are incomplete at national level. Due to impossibility of assembling, utilization of many data on national level is very limited. Since brain drain is a dynamic process, it is difficult to determine its extensiveness. The tendency of using some countries passage paths to some other countries (for example moving to Canada in order to be able to migrate to USA) makes determination more difficult (Devoretz, D. J. and Ma Hkust Z., 2001, pp.2-10).

2.2. Historical Approach to Brain Drain: The study covers the period after 1990. Thus, the emphasis will be on recent developments in brain drain. However it should be noted that the history of brain drain goes back to 600 BC. Brain drain had been towards Athens during the period 600 BC. to 300 BC. Despite the difficulties of traveling, students, lecturers and researchers had been moving to Athens. Academia founded by Plato in 338 BC. and Lykeon (Lycee) founded by Aristo in 335 BC. are the first foundations of education and research. After 500 AD. the new center of science, arts, thought and research was the east of Iran. In Cundishapur a university was founded by those who escaped from Byzantine and scientists, physicians and researchers from all over the world and especially from the christian world were seduced. According to science historians, the first brain drain had started with scientists from Bologna University moving to other places. Many universities (Azerro, 1215; PAdua, 1222; Vercelli, 1228; Siena, 1246; Ziza, 1343 and Florance, 1349) were founded thanks to the drain from Bologna university. Similarly Oxford University is founded by drain from

Paris university and Cambridge is founded by drain from Oxford (Orcan, M, 2003, p.86). In the period between WW I. and 1815, more than 10,000 US citizens have gone to Germany in order to conduct advanced studies.

In the period between two world wars brain drain had increased extensively. Most important increase in brain drain is experienced after WW II. At the end of the war, the US had transferred 22,800 billion USD part of a public fund of 33,800 to Western Europe in accordance with Marshall Plan between 1945 and 1952. After 1952, military aid has replaced economic aid. With the flow of US capital to Europe, the direction of labor movement has also turned to Europe. After the war, USA became the major country that attracted skilled labor by deregulating inflow of some categories of skilled labor. Between 1949 and 1961, 43,000 scientists and engineers whose majority is from LDC have migrated to USA. Following mid-1960's this incresase has accelerated even more. The share of technical personnel in overall migrated labor force was 16.2%in 1950 and this ratio increased to 17.9% by 1960. After 1980, brain drain has increased even more. Three general consequences of this drain are: 1) Population of relatives of qualified immigrants are negligible when compared to overall international migration. 2) Stock of qualified foreign labour is of significant magnitudes and it is increasing. 3) Migration of qualified labor increases much faster than that of unskilled labor. Skilled labor migration to Australia, Canada and America is a relatively small portion of family migrations to these countries. However, in the last decade, each of these countries has taken steps to increase the skill level of migrating labor. Number of skilled immigrants in Australia has tripled between 1984 and 1990. In Canada, number of immigrants selected according to their potential economic contribution in 1992 has decreased to 15% as it was 18% in 1990 share of skilled labor in the aggregate number of immigrants has increased to 38% in 1998 from 25% in 1993 (Helliwell, J. F., 1999, pp.6-16). The increase in the skill levels of immigrants can also be observed in America. Skilled workers and their families constitute an important part of employment based perpetual migration. In 1995, professionals and intra-corporate transfers formed the majority of 464,000 workers that migrated to

America. In Netherlands, number of scientists, managers and administrators have reached 62,000 by an increase of 19% in 1995 from a 57.000 in 1987. In 1995, employees of these three categories constituted 28% of all foreign workers. 75% of these workers had migrated from European Union countries. In 1990 census of France 200,000 foreign workers are reported at fields of technology and professional management and this number forms 12.5% of overall foreign workers stock. Approximately 85,000 (42%) of this group has migrated from European Union countries (Orcan , M., 2003, p.90). In Luxembourg, one third of foreign workers are employed in insurance, banking and financial sectors. For the period 1980-1994, 60% of workers migrating into and out of England work as professionals or managers. In 1994 number of immigrants in professional management and technology sector was 137,000 and males held the majority of this group. In Finland, average socio-economic status of foreigners are higher than that of natives in all age groups. In 1990, 30% of foreigners were white collar workers while only a 13% of Finlandians worked in such positions. Additionally, foreigners took more roles in education and research fields. Majority of immigrants from regions other than Baltic region come from Germany, England and former Soviet Union. Those who come from Germany and England are generally professionals, managers and technology specialists who reside for short periods while immigrants who came from former Soviet Union are unskilled people. Africans, Southern Europeans and Asians are generally employed in service sector positions with low wages. In Sweeden nearly 90% of working permits issued are given to specialists, artists and holders of key positions at multinational firms. In recent years, number of permits given to Europeans has decreased and permits given to Asians (especially Chinese) and Americans has increased. In these years, 14,000 temporary permits are sued in order to fulfill temporary shortage of labor. In a research conducted in 1990, it is found out that education level of foreigners is higher than that of natives. 22% of foreigners have educational degrees while only 15% of natives have such degrees. Even though foreign workers do not have very high skills, the number of specialist workers continuously increases in Italy. In Spain, a major increase has been observed in employment of foreigners between late 1980's and early 1990's. In 1991, number of

working permits issued for employees in professional management and technology sector has increased from a 12,900 of 1987 to 23,100. This number has decreased to 7,700 in 1994. Number of professional and technical workers has doubled in the period 1987-1991. These people with high skills come from EU countries such as England, Germany, France, and Italy with which Spain has developed close relations in commerce, manufacturing and finance sectors. In Portugal, more than one third (approximately 20,000) of workers that received working permits held positions such as professionals, managers or administrators in 1991. In 1989-1991 rate of increase in these three occupational groups was higher than that in all labor categories. Distribution of people who receive working permits varies according to their country of origin. Europeans constitute 60% of these people while 57% comes from North and South America and 11% comes from Africa. In Eastern Block, many employees in science sector became redundant after the collapse of communist regime. In 1990-1991 Bulgaria increased the number of workers in science sector by 25% and reached 86,300 but decreased this number to 47,000 in 1992. Though the number of employees that became redundant was less dramatic in Central Europe, the rate of decrease was at considerable levels. In former Czechoslovakia the volume of employment in science sector decreased to 65,600 in 1991 while it was 108,400 in 1989. After the collapse of the regime, decreases in employment and investment in science sector caused brain drain from east to west. In Poland 9,5% of personnel in science sector left the country between 1980 and 1991. However, the rate of loss has decreased after the collapse. In Hungary, 15% of all researchers have moved to other countries. Moreover, the volume of brain drain out of Soviet Union was even larger. In 1991 more than 90,000 scientists has left former Soviet Union (Straubhaar, T. and Wolburg, M, 2000, pp.2-5). Eastern European countries send skilled labor force to other countries while they attract skilled labor force of other countries. In Czech Republic, majority of working permits issued for Western Europeans were given to employees in professional management and technology sectors, advisors and language teachers. In 1993, 21% of working permits (2,100 of 10,300) are given to citizens of Austria, Canada, Germany, Italy, England and USA. In Poland the number of working permits has decreased to 10,400 in 1995 while it was 12,000

in 1992. according to occupational analysis made in 1996, two thirds of workers workers were categorized as "skilled" while 10% was considered to be "high skilled". In 1995, 55% of working permits were issued for skilled persons. In Bulgaria, three fourths of 618 working permits are issued for managers, advisors and teachers.

Table 3. Brain Drain From Eastern Europe

Country of Origin	Volume and profession of immigrants	Destination Country
Russia 1990 1991-93	 18.000 scientists and intellectuals 7.000-70.000 scientists	Germany Israel (4.400 engineers 8.500 Ph. D. students) America
Bulgaria 1989 1990-92	 2.000 scientists 4.000 scientists	 Germany, Ireland, France, England
Former Czechoslovakia 1989	%34.4 of immigrants were intellectuals	Germany
Romania 1980-84	%12.1 of immigrants were high skilled	Germany, Hungary, Israel
Poland 1980-87	76.300 skilled personnel (engineer, scientist, academician, doctor, nurse)	Germany, America, France

Source: Straubhaar, 2000, p.11

In Asian Region migration of those with high skills forms an important part of global immigration. During 1950's and 1960's, there was brain drain out of the region. Today, additional to the return of those who had migrated, considerable amounts of high skilled work force migrates to Asia-Pacific Region. Asians migrate to America mostly and then to Australia or Canada. For instance, 200,000 Asians from India, South Korea, Philippines and China who had education on scientific fields have migrated to America (Orcan, M., 2003, p.80.). In 1992, 50,000 foreign professionals whose majority was those working for transnational firms were employed in

Indonesia. This figure is 20,000 in Malaysia. In Japan, 37,000 employees were transferred overseas by their firms while 6,000 were sent abroad for temporary provision of services to clients in 1980. In 1989 these figures have increased to 97,000 and 15,000. 42,000 of Japanese immigrants work in North America while 26,000 work in Europe. According to a report issued by UNDP, 100,000 professional computer specialists from India have migrated to America. Considering that providing education for each professional costs 15,000-20,000 USD, annual loss of India due to brain drain is about 2 billion USD. Besides direct costs accounted by UNDP there are indirect costs that are even higher. Lack of skilled labor deteriorates India's competitiveness in industry. Rate of turnovers in IT sector is above %20. cost of replacing each employee that migrates is around 120% of his salary (Chugh, P., 2001, p.17).

Generally America is the country most frequently migrated by Indian engineers and doctors. On the other hand, aging population and lack of skilled labor in Europe started to attract Indian engineers in recent years. As a consequence, Germany has opened a quota of 20,000 for high skilled immigrants. In 2001 America has increased H-1B quota from 115,000 to 200,000 in order to attract Indian IT professionals. Additionally, Indian government applies a policy that encourages brain drain out of the country for its FX revenue. According to their assumptions, those who migrate will not lose their links with their home lands, facilitate technology transfer and return to India and provide skilled labor when required. As unofficial figures depict, only one or two of 1,000 professionals that leave India return to their country.

In Table 4, the number of immigrant from developing country to U.S.A. according to levels of education can be seen. One of the reasons of brain drain in India is unjust distribution of education expenditures. In 1960's foundations supported by the government (IIT-Indian Technology Institute for instance) have provided well educated personnel by giving world class university education. Consequently, majority of the population remains uneducated and illiterate while a very small portion receives high quality education.

Table 4. Immigrants from developing countries to U.S.A. in 1990.

Country of Origin		School Levels		
	Total	Primary	High	University
Asia-Pacific	2,376,277	95,320	818,860	1,462,177
Bangladesh	12,385	180	3,860	8,345
China	404,579	48,420	190,560	165,599
Indonesia	32,172	220	8,800	23,152
Fiji	11,420	740	7,120	3,560
Philippines	728,454	10,680	224,700	493,074
India	304,030	6,960	68,800	228,270
Iran	150,906	3,740	41,640	105,526
Korea	377,940	13,060	163,420	201,460
Malaysia	15,261	260	4,820	10,181
Pakistan	52,717	1,680	14,940	36,097
Sri Lanka	8,751	20	2,280	6,451
Syria	27,504	1,580	12,780	13,144
China (Taiwan)	152,957	2,880	32,060	118,017
Thailand	53,118	2,120	21,300	29,698
Turkey	43,605	2,780	21,540	19,285
Africa	127,853	2,060	30,640	95,153
Benin	180	20	80	80
Algeria	43,904	60	1,280	2,564
Gambia	747	100	120	527
Ghana	12,544	40	3,400	9,104
South Africa	22,678	200	4,980	17,498
Rep. of Centr. Africa	160	0	60	100
Egypt	53,261	980	13,020	39,261
Cameroon	1,694	60	200	1,434
Kenya	8,372	40	1,420	6,912
Congo	200	0	20	180
Lesotho	160	0	20	140
Malawi	460	0	120	261
Mali	2200	0	100	120
Mauritius	1,100	0	260	840
Mozambique	920	80	280	560
Rwanda	200	0	20	180
Senegal	1,370	180	420	770
Sierra Leone	4,155	80	1,060	3,015
Sudan	2,496	0	760	1,736
Togo	460	20	140	300

Tunisia	2,816	60	1,120	1,636
Uganda	5,060	120	1,000	3,960
Zambia	1,613	0	340	1,273
Zimbabwe	3,161	20	420	2,721
North America	3,761,084	436,420	2,677,420	647,244
Republic of Dominic	187,871	13,000	132,420	42,451
El Salvador	263,625	30,320	188,840	44,465
Guatemala	127,346	12,820	88,840	25,686
Honduras	54,346	3,440	35,840	15,066
Jamaica	159,913	3,060	90,220	66,633
Costa Rica	28,784	660	15,340	12,784
Mexico	2,743,638	368,540	2,027,880	347,218
Nicaragua	61,168	3,100	34,920	23,148
Panama	68,583	340	28,780	39,463
Trinidad Tobago	65,810	1,140	34,340	3,330
South America	616,004	16,320	314,780	284,904
Argentina	64,080	900	27,980	35,200
Bolivia	18,772	380	7,080	11,312
Brazil	53,904	1,080	23,560	29,264
Colombia	162,739	5,940	93,000	63,799
Ecuador	89,366	2,720	55,020	31,596
Guano	61,936	2,260	34,440	25,236
Paraguay	4,313	60	2,020	2,233
Peru	86,323	1,920	40,820	43,583
Uruguay	15,716	360	8,960	6,396
Venezuela	22,634	220	6,100	16,314

Source: Carrington and Detragiache, 1998, pp.15-6

With the increasing impact of globalization, these well educated personnel migrate to developed countries and remaining unskilled people work for local firms. 75% of those who graduate from IIT start to work abroad within 5 years following their graduation. According to Global Competition Report (2000), India ranks as the 47th among 59 countries that manage to keep their personnel with highest skills within the country.

In Latin America in 1980 three major receivers of migration were Venezuela, Argentina and Brazil with 25,700, 18,200 and 12,200 professionals, managers and technology specialists (PMT's). In

Venezuela architects, engineers and teachers constitute majority of PMT work force while in Argentina, teachers and nurses; in Brazil architects, engineers, doctors, dentists, lawyers, mathematicians, statisticians and artists form the majority. In Colombia, high rates of crime (especially kidnapping) causes educated people leave the country. In 1996-1999 800,000 Colombians left their countries for America, Canada, Spain, Costa Rica and Australia seeking for a safer life. None of those who migrate for education retuned. According to "Global Competition Report 2000", Colombia ranks as the 55th among 59 countries that manage to keep their personnel with highest skills within the country.

In South Africa in this period, England had concerns about migration of scientists, physicians and other professionals out of the country. In the period up to 1980's, the situation reversed and new generation of South Africa preferred to leave the country and develop their skills abroad. Additional to outflow of skilled labor, inflow of unskilled people to the country due to political instabilities in neighboring countries has deteriorated the balance between skilled and unskilled labor and emerged a lack of skilled personnel. In South Africa per capita income has decreased and income distribution has deteriorated. Loss of skilled labor has both direct (decreasing economic output) and indirect (loss of employment and tax revenue) effects. Main reasons of migration are high rates of crime, low wages, limited career possibilities and insufficient health services. Sectors that suffer lack of skilled labor the most are IT and financial services. In these sectors, number of skilled personnel required to dampen the negative effects of brain drain out of South Africa varies between 350,000 and 500,000. Since international organizations, pay more for the skilled personnel, South African banks loses their skilled personnel to these foundations. Other components of professional work force such as doctors, nurses, engineers, teachers and journalists are among these who migrate for higher incomes and security. In the report mentioned above, South Africa's rank is 57 (Orcan, M., 2003, p.82). Brain drain effects not only South Africa but other countries of Africa also. Every year, 23,000 graduates leave Africa. Nearly all migration to OECD countries is directed at America. Number of African scientists, doctors and engineers is

higher than that in Africa. With the brain drain, 20,000 remaining scientists and engineers have to serve the population of 600 million. Zambia is an example of most negative effects of brain drain. Only 400 doctors remained in the country while there existed 1,600 until recently. Majority of these doctors have migrated to America. Among the countries that send highest number of immigrants to America are Egypt and Ghana other than South Africa.

4. Data selection and empirical results

In this study, equations are formed in order to understand the relation between brain drain, human capital investment and economic growth and to understand which variables effect these three variables in what ways. The first equation is a model to explain brain drain, the second equation explains human capital and the third one explains growth. Models constructed for these purposes are tested in the context of world economies. In the study where panel data analysis is applied, 77 countries are analyzed for the period 1990-2001.[1] The countries are classified as developed, developing (emerging) and least developed countries. In the making of this classification the human development index in Human Development Report 2002 of UNDP (United Nations Development Program) is utilized. According to this, the countries whose GDP and human development index is below 0.5 are considered to be LDC.

[1] Countries analysed in the study are: Norway, Sweeden, Canada, Belgium, Australia, USA, Iceland, Netherlands, Japan, Finland, Switzerland, France, England, Denmark, Austria, Luksembourg, Germany, Ireland, Italy, Spain, Israel, Greece, Hong Kong, Singapore, Korea, Malaysia, Thailand, China, Indonesia, Portugal, Malta, Argentina, Hungary, Poland, Chile, Uruguay, Costa Rica, Kuwait, Mexico, Bulgaria, Romania, Venezuela, Saudia Arabia, Brasil, Philippines, Khazakstan, Peru, Turkey, Jamaica, Azerbaijan, Sri Lanka, Iran, Algeria, South Africa, Bolivia, Egypt, Nicaragua, Guatemala, Nambia, Morocco, India, Ghana, Kenya, Kongo, Pakistan, Togo, Nepal, Bangladesh, Nigeria, Zambia, Ivory Coast, Gambia, Republic of Central Africa, Chad, Etiopia, Mozambique and Niger.

The countries with GDP indexes within the interval 0.50-0.85 and human development index within the interval 0.50-0.88 are considered as developing or emerging countries. Countries with GDP indexes above 0.85 and human development indexes above 0.88 are assumed to be developed countries. The data used in testing the models are gathered from Human Development Report, Human Poverty Index, World Development Indicators (2002), World Development Report, Financial Statistical Yearbook (2002), Global Development Finance, International Financial Statistical Yearbook, United Nations Annual Statistics, and various statistics from OECD, IMF, World Bank, National Statistical Office, Eurostat, ILO, ISI, DIMA, IOM, and LFS. In determining variables to be used in the models, ones that could explain brain drain, human capital and economic growth in the best way are seeked. In this analysis brain drain is measured by migration rate, human capital is measured by human development index. In this paper, schooling rate was not measure of human capital. Because human capital is related to human development and while schooling rate is increasing human capital is rise.

Variables used in the models are: average life expectancy (avglex), adult literacy rate (lit), schooling rate (schr), per capita income (pci), average living index (avglix), education index (edind), GDP index (gdp), human development index (hdi), human living index (hlix), inflation (inf), exports (exp), imports (imp), growth rate (growth), regional development differentials (rdd), general population growth rate (gpgr), urban population growth rate (upgr), educatiopn expenditures (edex), urban unemployment (unemp), wages (wage), wage index (wagind), net rate of migration (migr) and workers' savings (ws).

A panel data approach is preferred as the method of analysis. In the study, 77 countries are subjected to panel data analysis before the clustering mentioned above is applied. Obtained results can be seen in related tables.

In the migration model unemployment, wages and per capita income negatively effect migration. Rate of migration falls as people receive higher incomes or become unemployed and fail to afford the cost of migration. There is a positive relation between human life

index and migration rate. As the lower limit of poverty increases, people tend to migrate to countries where better living conditions prevail.

In human capital model, education index and average life expectancy are positively related to human capital. Since people invest more on human capital as average life and education period increases, level of human capital in the country rises. On the other hand there is a negative relation between human capital investment and regional development differences. Since human capital investment is related to economical conditions of countries, level of human capital investment happens to be low in regions at low economic levels.

In the growth model constructed with human capital, migration, and growth rate of urban population, all three variables effect growth in a positive way. With urbanization and urban population rising at one side and increasing rate of return on human capital due to migration at the other, people increasing their human capital investments accelerate economic growth. Besides, variables used in models are different for groups of countries.

Table 6. Results for 77 countries

		R^2	P
(1)Migr	3.15-0.31unemp -0.12wagind -5.93pci + 0.2hlix (1.55) (2.55) (2.18) (0.34) (2.17)	0.57	0.004
(2)Hdi	-0.035+ 0.49edind + 0.53avglex – 0.01 rdd (2.14) (18.41) (17.28) (3.20)	0.97	0.00
(3))Growth	-1.01+ 0.01migr + 3.98hdi + 0.56upgr (0.82) (0.34) (3.03) (3.67)	0.21	0.0014

Note: W values: 13 in (1), 2311 in (2) and 15.48 in (3).

These three models constructed in some way to include 77 countries are tested separately for countries of different development levels (developed, emerging, Asian tigers, crisis countries and LDC). Models are reconstructed by regrouping the countries according to their socio-economic levels in order to see whether such differences effect or do not effect the outcomes.

Table 7. The Result of Emerging Countries

		R^2	P
(1)Migr	-13.19 - 0.02wageind - 0.04schr + 0.02inf + (1.56) (2.37) (1.70) (2.15) 0.64upgr + 20.77avglix (1.60) (2.77)	0.52	0.0001
(2)Hdi	0.32 + 5.27lws + 0.011pci + 0.47edind - .01wage (8.65) (2.04) (5.24) (11.27) (-1.11)	0.80	0.00
(3)Growth	-1.12+0.00ws+2.41hdi+0.00unemp+ 0.001edex (12.44) (0.95) (22.14) (1.23) (0.26)	0.76	0.00

Note: W values: 25 in (1), 200 in (2) and 522 in (3).

In the migration model constructed for emerging countries, schooling rate and wages negatively relate with migration while there exists a positive relation between urban population growth, average life expectancy and migration. People migrate less as human capital investment and its return, wage, increases. Besides, factors that deteriorate welfare of people such as high inflation and rapid growth of population encourage them to migrate to developed countries. In the human capital model adult literacy, per capita income and education index is found out to be positively related to human capital level and wage is found out to be negatively related. In emerging countries, wage does not constitute a an incentive for human capital investment since expected return on education at foreign countries is higher and skilled labor may receive higher wages by migrating to other countries. Human capital positively effects growth. Education and human capital increasing growth in developing countries is consistent with both the primarily constructed model for all countries and with economic theory. Since migration is relatively high in developing countries workers' remittances sent from other countries positively contributes growth. Existence of unemployment dos not effect growth because there exists implicit redundancy in these countries. For it is considered that emerging countries do not exhibit homogeneity, panel test is primarily applied to Asian tigers that have a somewhat more homogeneous structure.

Table 8. The Result of The Asian Tigers

		R^2	P
(1)Migr	-7.26+0.18avglix -0.6wageind-0.06unemp -0.98edex (2.56) (1.35) (3.49) (0.28) (3.67)	0.16	0.00
(2)Hdi	1.3 -0.108avglex + 5.43pci + 0.216lit - 0.017migr (8.65) (1.3) (7.46) (12.7) (8.7)	0.71	0.00
(3)Growth	-1.27+0.26exp -0.74inf-0.98unemp+47.62hdi– 0.16migr (12.44) (11.45) (9.9) (7.62) (11.99) (4.69)	0.26	0.00

Note: W values: 25 in (1), 392 in (2) and 82 in (3).

Even though a smaller R^2 is found in results of models with migration and growth than those with other variables, this is not of great importance in panel data analysis. In explaining growth in Asian tigers, exports and human capital are utilized. These two variables are very important for such countries. It is observed that both variables positively relate with growth. Additionally, the coefficient of human development variable is of significant importance. Inflation rate, migration rate and unemployment rate have a negative relation with growth. Migration is explained by life index, wage, unemployment and education investments. Migration, wages, unemployment and education investment have a negative relation. Human development is positively related with per capita income, adult literacy and negatively related with average life expectation and migration.

A second clustering performed on emerging countries includes countries that have experienced financial crisis such as Mexico, Brazil, Argentina and Turkey. This group of countries is defined as crisis countries. In migration model per capita income has a negative sign while human development hdi and unemployment have positive signs. In human capital model, wage has a negative sign while literacy has a positive coefficient.

Tablo 9. The Result of Crisis Countries

		R^2	P
(1)Migr	-0.53 + 0.85hdi+0.22unemp - 0.0028pci – 0.80rdd (0.22) (2.3) (7.15) (3.84) (0.43)	0.97	0.000
(2)Hdi	1.3 -0.0074avglex + 0.070lws - 0.0058wage (8.65) (0.2) (3.97) (1.15)	0.85	0.00
(3)Growth	2.51 + 0.53exp - 0.002 inf +1.79 hdi – 0.94migr (0.22) (1.59) (0.38) (2.13) (1.36)	0.16	0.62

Note: W values: 57 in (1), 32 in (2) and 2.8 in (3).

Table 10. Brain Drain, Human Capital and Growth in LDC

		R^2	P
(1)Migr	12.56- 0.20unemp + 0.25wage - 22.51avglex (1.90) (1.970) (1.43) (2.15)	0.94	0.000
(2)Hdi	0.12 + 0.012lws + 0.001schr+ 0.29gdp (8.61) (8.69) (5.14) (28.55)	0.85	0.0000
(3)Growth	16.58- 0.18upgr -18.64avglex +0.003pci (1.24) (2.09) (1.77) (0.64) -0.12imp -0.04exp - 0.1wage+ 0.04ws (2.03) (0.31) (0.63) (0.89)	0.84	0.000

Note: W values: 28 in (1), 1240 in (2) and 34 in (3).

In LDC unemployment and average life index are inversely related with each other. People can not afford the cost of migration due to loss of income and con not make sufficient investment on human capital. There is a positive relation between wages and migration. Human capital investment increases thanks to increases on wages and another point becomes obvious with this effect: wage level in LDC is not high enough to keep skilled labor force in the country. Human capital is directly proportional with adult literacy, schooling and growth in LDC as in other countries. The higher is the economic growth rate, the more people invest on human capital and the higher is the schooling rate and literacy, the higher is the level of human capital in the country. After analysing the model solutions for LDC and emerging countries, it will be useful to construct models for developed countries in order to achieve a more satisfactory comparison.

Table 11. Factors Determining Growth, Human Capital and Migration in Developed Countries

		R^2	P
(1)Migr	-10.33 - 0.16unemp - 0.23wage - 0.11wageind + (1.56) (1.55) (2.26) (2.95) 0.27inf - 0.01pci + 0.01hlix (3.62) (2.95) (0.02)	0.48	0.000
(2)Hdi	-0.05 + 0.8lws + 0.01schr + 0.14avglex + .02edex (0.35) (5.89) (2.04) (2.41) (2.28)	0.79	0.000
(3)Growth	-0.07 +1.42hdi-0.002unemp+0.001migr-0.001inf (0.41) (7.54) (0.74) (2.11) (7.89)	0.69	0.000

Note: W values: 29 in (1), 57 in (2) and 207 in (3)

In developed countries wages and per capita income negatively relate with migration while the relation becomes positive when inflation and human life index are variables of concern. Due to loss of income caused by unemployment, people can not spare sufficient resources for investment on human capital. For this reason migration decreases with increases in unemployment. Wages and per capita income on the other hand are at sufficient level to keep skilled labor within the country. So migration decreases as income rises. However, migration increases when minimum level of poverty and inflation rises since these variables deteriorate economic and social living standards of people. In developed countries, there is a positive relation between literacy, schooling, education investment, average life expectancy and human capital. Education period, expenditures on education, schooling rate, literacy and human capital are also increasing. In the model constructed for growth, human capital and migration effect growth in a positive way while the effects of unemployment and inflation are negative. As the return on human capital increases abroad, people invest more on human capital and as its consequence, human capital level of the country rises. Thus, economic growth increases.

4. Conclusion

In constructing models for countries of different development levels to analyze the effects of brain drain on human capital and

economic growth, it is observed that migration increases growth in developed countries and in the world generally while it slows down the growth in LDC. General results of the constructed equations are: 1) According to the migration model, when unemployment, wages and per capita income increases, migration decreases and when minimum poverty level increases, migration increases. The reason why migration decreases as unemployment increases is that people can not invest in human capital and can not afford the cost of migration. It was not important whether the migrating labor force at the beginning and the middle of last century was skilled or unskilled. However the qualification of labor force is determinant in migration. For this reason, skilled labor has a higher tendency to migrate and factors such as schooling rate, high wages and better living standards encourage migration. This important point becomes significant in its consequences at developed countries and LDC. In developing countries migration is inversely related with wage level and schooling rate while it is positively related with urban population growth and average life expectancy. As the ratio of people attending schools increases and people receive higher wages, rate of migration decreases. As inflation rises and incomes of people fall due to unemployment caused by population growth, index of unhappiness increases. Under these circumstances, people migrate more intensely. Migration has an inverse relation with unemployment and per capita income in LDC and developed countries. Wages in developed countries are inversely proportional to migration since wage levels in LDC are not sufficient to keep people away from migration. In developed countries, on the other hand, migration rises, as rises human life index and inflation. 2) Variables such as education index, adult literacy rate, schooling rate, education investments, per capita income, growth rate and average life expectancy are positively related to human capital in virtually all countries. Thus, increases in these variables increase human capital. 3) There is a relation between migration, human capital, education investments, literacy, per capita income, workers' savings and growth. Increases in these variables may increase growth. On the other hand in LDC pace of increase in urban population, average life expectation index, imports, exports and wages effect growth in a negative way. It is to be stated that for

the LDC, the data related to growth are so insufficient that it is not possible to reach meaningful inferences.

References

Abadan, N. (1964) Bati Almanya'daki Türk Isçileri ve Sorunlari, DPT Yayini, Ankara.

Abadan-Unat, N., Keles, R., Pennix, R.,.Renselaar, H.V., Velzen, L.V., Yenisey, L., (1975), Göç ve Gelisme-Uluslararasi Isgücü Göçünün Bogazlayan Ilçesi Üzerindeki Etkilerine Iliskin Bir Arastirma, Ankara Üniversitesi S.B.F. Yayini, Ankara.

Açma, B., (2002), "Economic Consequences of International Migration: A Case Study of Turkey", European Society for Population Economics Conference.

Antecol, Heather, Deborah A. Cobb-Clark and Stephen J.Trejo(2001). "Immigration Policy and the Skills of Immigrants to Australia, Cadana and the United States", IZA Discussion Paper, No.363.

Beine, M., Donquier F., and Rapaport, H., (2001), "Brain Drain and Economic Development: Theory and Evidence", Journal of Economic Developments, No.64,.

Beine, Michel, Frederic Donquier and Hillel Rapaport(2002). "Brain Drain and LDCs'Growth: Winner and Losers", Stanford University Working Paper, No.129.

Brinley, T., (1968), "Migration-Economic Aspects", *Encyclopedia of Social Sciences*, Vol.X.

Büchel, F.and Joachim, F., (2003), "Immigrants in the UK and in West Germany-Relative Income Position, Income Portfolio and Redistribution Effects", IZA Discussion Papers, No.788.

Byongju, J., (1998), "Measurement of Human Capital Input Across Countries: A New Method and Results", CERGE-EI.

Carrington, W.J., ve Detragiache, E., (1998), "How Big is the Brain Drain?", IMF Working Paper, no: 201

Christian, D., and Kirchkamp, O., (2001), "The Optimal Migration Duration and Activity Choice After Re-migration", IZA Discussion Paper, No.266.

Chugh, P., W. McMillan-Turner and B. Turmer, (2001), "The Brain Drain", http://econpapers.hhs.se/script/search.asp

David, P., (2001), "Migrant Labour and evelopment",www.david.enigmati.ca/politics/.
Deboretz, D. J., and Z. Ma Hkust, (2001), "Triangular Human Capital Flows Between Sending, Entrepot and the Rest of the World Estimations", RIIM Working Paper, no: 01/30
Dörte, D., (2002), "Trade and Human Capital Accumulation-Evidence from US Immigrants", Universitat Pompeu Fabra.
Eckaus, R. S., (1963), "Investment in Human Capital: A Comment", Journal of Political Economy, October.
Faini, R., (2001) "Development, Trade and Migration", World Bank Working Papers.
Financial Statistical Yearbook.
Gayathri, V., (2002) "Rethinking High Skilled International Migration: Research and Policy Issues for India's Information Economy", International Mobility of the Highly Skilled, OECD, Paris.
Global Development Finance 2001.
Global Finance Statistics Yearbook 2002.
Graeme, H., (2002), "Migration Policies Designed to Facilitate the Recruitment of Skilled Workers in Australia", International Mobility of the Highly Skilled, OECD, Paris.
Guellec, D., and Cervantes, M., (2002) "International Mobility of Highly Skilled Workers: From Statistical Analysis to Policy Formulation", International Mobility of the Highly Skilled, OECD, Paris.
Guisan, M.C., Aguayo, E. and Exposito,P.(2001). "Economic Growth and Cycles: Cross-Country Models of Education, Industry and Fertility and International Comparisons". *Applied Econometrics and International Development*, Vol. 1-1, pp. 9-37.
Harbison, F. and C.A. Myers. (1965), Manpower and Education: Country Studies in Economic, Development. New York: McGraw-Hill.
Haroon, B., Meyer, J. B. and Mlatsheni, C., (2002), "Skilled Labour Migration from Developing Countries: Study on South and Southern Africa", ILO International Migration Papers, No.52.
Helliwell, J.F., (1999), "Checking the Brain Drain: Evidence and Implications", Policy Options, September

Herbert B. G., and Scott, A. D., (1966), "The International Flow of Human Capital", American Economic Review, No.56.
Hope, E. T., (2002), "Skilled Labour Migration from Developing Countries: Study on the Caribbean Region", ILO International Migration Papers, No.50.
Im, K.S., Pesaran, M.H., and Shin, Y., (1997),Testing for Unit Roots in Heterogeneous Panels, Ders Notu, Department of Applied Economics, University of Cambridge.
IMF National Statistics, www.imf.org/
International Financial Statistical Yearbook 2002.
International Labour Office (ILO), www.ilo.org/
Jonathan, C., Dumont J. C., and Visco, I., (2001), "Trends in Immigration and Economic Consequences", OECD Working Paper, No.284.
Levin, A., and Lin, C.F., (1992), "Unit Root Test in Panel Data: Asymptotic and Finite Sample Properties, Discussion Paper, No:92-93, University of California at San Diego.
Liki, A., (2001), "Moving and Rootedness: the Paradox of the Brain Drain Among Samoan Professional", Asia-Pacific Population Journal, March
Loehr, S. Y., and Erhardt, C., (2001), "Immigration and Human Capital: A Theoretical Comparative and Practical Perspective", http://ideas.repec.org/.
Lowell, L., and Findlay, A., (2001), "Migration of Highly Skilled Persons from Developing Countries: Impact and Policy Responses, ILO International Migration Papers, No.44.
Luo, Y.L. and Wang, W.J., (2002), "High Skilled Migration and Chinese Taipei's Industrial Development", International Mobility of the Highly Skilled, OECD, Paris.
Lutz, H., (1999), "The Economic Performance of Immigrants: A Theory of Assortative Matching, Arizona State University Working Paper.
Mario, C., and Guellec, D., (2002), "The Brain Drain: Old Myths, New Realities", OECD Observer.
Oded S., ve Wang, Y., (2001), "Inducing Human Capital Formation: Migration as a Substitute for Subsidies", IHS Economic Series, No.100.
OECD Economic Outlook No.73, www.oecd.org/statistics/

OECD, "International Mobility of Highly Skilled", OECD Observer, 2002.
OECD, Human Capital Investment: An International Comparison, 1998.
OECD, Trends in International Migration, 1997.
Orcan M., (2003) Beseri Sermaye Yatirimi ve Uluslararasi Beyin Göçü, Yildiz Teknik Üniversitesi Sosyal Bilimler Enstitüsü, Istanbul.
Orrenius, P. M., and Zavodny, M., (2003), "Does Immigrants Affect Wages?A Look at Occupation Level Evidence", Federal Reserve Bank of Atlanta, Working Paper, No.2003-2.
Philip, M., (1991) The Unfinished Story: Turkish Labor Migration to Western Europe, ILO.
Philip, M., (2002), "Policies for Admitting High Skill Workers into the U.S.", International Mobility of the Highly Skilled, OECD, Paris.
Reichling, F., (2001), "Brain Gain Through Brain Drain: A Theoretical Analysis of Human Capital Accumulation in the Presence of Migration", Stanford University Working Paper.
Salt, J. and R. Ford, (1993), "Skilled International Migratipn in Europe", Mass Migration in Europe: the Legacy and the Future, ed. Russell King, Belhaven Press, London
Schaeffer, P., (2002), "Human Capital Investment Decisions of Immigrants", West Virginia University Working Paper.
Schultz, T.W., (1961), "Investment in Human Capital," *American Economic Review* LI, March, 1- 17. American Economic Association Presidential Address.
Siegfried, B., and Gunter, H., Seifert-Vogt, (1992), "A Microeconomic Model of Migration", Migration and Development, Ed. Zimmermann, K. F.
Simon, C., Kangasniemi, M., and Winter, L.A., (2002), "The Brain Drain: Curse or Boon? A Survey of the Literature", NBER Working Papers.
Stephen, C., and Kosack, G., (1985), Immigrant Workers and Class Structure in Western Europe, Oxford University Press.
Straubhaar, T., (1992), "The Impact of International Labor Migration for Turkey", Migration and Development, Ed.Klaus F.Zimmermann.
Straubhaar, T., (2000), "International Mobility of the Highly Skilled: Brain Gain, Brain Drain or Brain Exchange", HWWA Discussion Paper, No.88.

Straubhaar, T., and Wolburg, M., (1998), "Brain Drain and Brain Gain in Europe", Centre for Economic Policy Research, London.
Sunal S., (2003), 500 Büyük Sanayii Kurulusunun Panel veri Yöntemiyle Analizi, Marmara Üniversitesi Sosyal Bilimler Enstitüsü, Istanbul.
Tremblay, K., (2002), "Student Mobility Between and Towards OECD Countries: A Comparative Analysis", International Mobility of the Highly Skilled, OECD, Paris
Turkish Republic, T.R., Ministry of National Education, Higher education statistics, www.meb.gov.tr/
T.R. Prime Ministry State Institute of Statistics (DIE), www.die.gov.tr/
T.R. Prime Ministry State Planning Organization, Economic and Social Indicators, www.dpt.gov.tr/
UNDP. Human Development Report 2002-1990, www.undp.org/
UNDP.Human Poverty Index 2002-1999, www.undp.org/
UNITAR, The Brain Drain from Five Developing Countries, 1971.
United Nations Annual Statistics 1999, http://www.un.org/
Williamson, S., (2000), "A Perspective on the International Migration of Skilled Workers", IRPP/CERF Conference.
Wong, K.Y., and Chang K.Y., (1999), "Education, Economic Growth and Brain Drain", Journal of Economic Dynamics and Control, Vol.23, No.5-6.
World Development Indicators 2001-1990.
World Development Report, Workers in an Integrating World, 1995.
World Economic Outlook 2001-1990.
Yang-Jin, K., and Lee, J.W., (1999), "Technological Change, Investment in Human Capital and Economic Growth", CID Working Paper, No.29.
Zimmermann, K. F., (1995), "Tackling the European Migration Problems", Journal of Economic Perspective, Vol.9, No.2.

Journal published by the Euro-American Association of Economic Development. http://www.usc.es/econo met/eaa.htm