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International mobility of the highly skilled: Brain gain, brain drain or brain exchange

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DISCUSSION PAPER

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Thomas Straubhaar

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HWWA DISCUSSION PAPER

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List of contents:

I	Introduction	7
II	Some Stylised Facts	8
III	Some Theoretical Considerations	13
IV	Accumulation of Human Capital: Make or Import?	17
V	Summary and Conclusions	19
	Bibliography	22
Table 1	Brain Drain from Eastern Europe According to the Literature	11
Table 2	East European Cumulated Immigration Flows into Germany According to Qualification	12
Table 3	Aggregate Cumulated Skill Ratios of Migrants in Germany	13
Figure 1	Knowledge and Skills in a New Growth Framework	15

International Mobility of the Highly Skilled: Brain Gain, Brain Drain or Brain Exchange.

I. Introduction

The Green Card initiative by the German chancellor Gerhard Schröder has brought back migration issues into the focus of the political debate - not only in Germany. Remarkably enough, a rather fast growing part of the public opinion has changed mind slowly. More and more natives and citizens realise that the consequences of immigration are very complex and ambiguous. Economic effects depend on the magnitude, the speed, the intensity and the structure of immigration flows with regard to age and qualification. Furthermore, they depend on the economic business cycle of the receiving economy (especially the magnitude of unemployment) and the ability to cope with a rapid structural change.

Economic theory has stressed the ambivalence of migration issues (for a very recent evaluation see Fischer 1999). In a nutshell, it has been indicated that migration is an arbitrage phenomenon in a short run and consequently supports positively the adjustment process of an economy. The long term effects of migration are not so clear cut. In many cases, migration will not matter that much, at least not for long-run growth and development processes. *And if migration matters, it is emigration and not immigration that might become a macroeconomic „growth problem“!* The basic reasoning behind this statement is that *economically* induced inflows of workers under the assumption of full employ had increase or at least do not decrease per capita income in the *immigration* area. This positive evaluation of immigration is confirmed by the so called New Growth Theory. It evaluates very positively the additional availability of „imported“ human capital. An inflow of human capital might produce positive externalities that spill over to other sectors and regions of the host economy. Thus, regions should *apriori* be interested in becoming the targeted destination of mobile qualified labour force.

In light of the positive evaluation of immigration of qualified labour force, it is the intention of this paper to discuss more precisely the question how societies could attract and keep highly skilled people. While historically, the United States have been extremely pragmatic and have rolled out red carpets to immigrants with specific skills (see Carrington/Detrageache 1999 for details) Europe has been reluctant to open its

borders. It is only nowadays that minds start to change after qualified workers in the information and communication sectors have become scarce. The German chancellor's idea to offer about 20'000 green cards to computer and software specialists from outside the European Union (EU) is a clear signal that new ideas gain attention. Why should the EU leave the playing field to other areas of the world?

In what follows, I discuss in section II of the paper three case studies which represent (i) a 'Brain Gain', where there is an increasing level of human capital, (ii) a 'Brain Exchange', where there is no net loss or gain of human capital but movement between areas and (iii) a 'Brain Drain', where there is a net loss of human capital. In section III, some theoretical considerations of the New Growth theory are discussed shortly with reference to positive externalities. In section IV, the discussion turns to how best to accumulate human capital, whether it is creation or use that is important, and how the European Union could develop a successful 'Brain Gain' strategy (i.e. 'how can Europe be Americanised?'). The final section summarises the main issues of the paper.

II. Some Stylised Facts

Once again the USA seems to be best prepared for the needs and trends of the 21st century. Due to its long immigration tradition the US economy is open enough (and labour markets are flexible!) to welcome the global citizens that are looking around for the most promising places to live, to work, to earn money and to spend it. The USA has, for a long time already, been well aware of the benefits to the US population that could be collected by capturing mobile skilled foreign professionals. Thus, a real business has been established that starts with education, goes on with attractive local complementarities (like sand, sun and fun) and ends with easy access to the local labour market for foreign specialists.

The „export“ of education services (by an „import“ of foreign students) has become a money machine for the US. Every year foreign students contribute over \$7bn to the US economy (see List 1998). They draw about 1/2m foreign students. The growth rate of foreign students in the USA is 5% p.a. (see Brinck 1999). This not only qualifies education as one of the best selling US exports, but also means that, in effect, the US is experiencing a net 'Brain Gain'. „Almost half of all the PhD recipients in the USA in

any year are now foreigners“ (Mahroum 1999: 19). This ‘Brain Gain’ has consequences, not just for the ‘education business’, but also for the future of the economy.

This raises the question as to why American education is so popular and what are the consequences? Apart from the promise of ”excellent lesson quality and excellent professors” (for which the students are willing to pay on average \$5.000 per year) they also, more than often, offer a seducing study environment. And this goes far beyond attractive ‘sun, sea and sand’ dimensions for leisure! There are close links between universities and industry, thus the students themselves can make valuable contacts and thus improve future career possibilities. It is also a good opportunity for them to improve their English language abilities (intensive English courses are offered). English will be the language of the ‘globalised’ world. American study time is short, with masters courses and the like lasting only 1 or 2 years. And probably most important is that successful foreign students have a very good chance to get an allowance to stay further in the US. In early 2000, the US congress has discussed a „Brain Act“ (Bringing Resources from Academia to the Industry of our Nation Act) that offers foreign students the opportunity to get a work permit in the US. If a US employer is willing to pay a fee of about US\$ 1’000 they can hire students directly after their graduation (see Neue Zürcher Zeitung 2000 for more details).

As a result of this openness towards foreign students a large number of jobs for US-Americans are created, directly and indirectly. Merely to provide for the service demands of the foreign students, about 100.000 jobs are created (see Brinck 1999). For example, jobs are created directly through the need for lectures, tutorials and student administration. Also, jobs are created indirectly through the extra demand for consumer goods and local services that the extra students generate.

What is even more important than the immediate benefits in terms of student fees and the direct or indirect employment effects are the longer term (growth) impacts on the economy. Firstly, during their time of study, foreign students become used to the American way of life. They consume American products and study with the aid of apparatus, hardware and software produced by American firms like IBM and Microsoft. Then, in their careers and future, they become promoters of American lifestyle. Thus even after they leave the US they will keep their „American way of life“. They will buy a Ford and not a Volkswagen, they are familiar with Compaq and not with Siemens, they are trained with Windows and not with a European software.

Secondly, and of greater direct consequence to the US economy, many of the successful students, and especially the very successful, stay in the USA after their studies have ended. They stay and work for American companies or apply for jobs with American firms that send them to work in their former country of origin. About 50% of all (European) doctoral graduates stay in the USA when they have finished their studies, and many do not return at all (see Mahroum 1999:20).

Compared to the US, Europe is increasingly unsuccessful at attracting the highly skilled. This is especially troublesome because many (if not most!) European universities offer almost tuition-free higher education! „It is only with Japan that the EU enjoys a surplus. ... The number of Europeans going to North America is double those arriving from there“ (Mahroum 1999: 21). Of course the main reason is that the immigration options for people from outside the EU into the EU are extremely restrictive. And even for students or PhD candidates the hurdles to surmount are time-taking, troublesome and even sometimes rather arbitrary. In the field of education, foreign diplomas and certificates are not fast and easily treated as equivalent to domestic ones -what again generates waiting, information and application costs. Consequently, and not really surprisingly, it can be seen that less and less foreign students are choosing European universities. For example a study by the ”Deutsche Studentenwerk” has shown that a large number of foreign students were accidentally there or because of an exchange programme. Also, that if they had been able to choose, most of them would have gone to another country (see Das Parlament 1999)

This low tendency of highly skilled to come from the outside to the EU to study and to stay here corresponds to the inner-EU experience. Despite all the efforts to stimulate the mobility of the higher qualified labour force within the EU, the amount of migration of the highly skilled is low and it increases only slowly (see Wolter/Straubhaar 1997). Contrary to the „Brain Gain“ strategy of the US the EU migration can be evaluated in terms of a „Brain Exchange“. This ‘Brain Exchange’ experience of Europe is also being fuelled by the Europeanisation of production, which has occurred over the past decade or so. The Europeanisation of production has come about through a wide variety of causes including developments in microelectronics, competition from abroad, and the process of European integration. In many cases short term (business or project oriented) trips and cross-border commuting or the statistically non-relevant intra-firm mobility of technical and managerial experts (internal labour market movements) are far reaching substitutes for „traditional“ migration flows. In some (smaller) EU countries (in

particular Sweden, Holland and Ireland) graduates are trained to become suitable to work abroad and to be able to cope with the growing internationalisation of the business activities of their domestic companies (see Mahroum 1999).

Table 1: Brain Drain from Eastern Europe According to the Literature

Country of Emigration	Volume and Occupation of Emigrants	Country of destination
Russia 1990 1991-93 1992 1991	250 Scientists of the academy of science (20%) 18.000 Scientists and Intellectuals 7.000-70.000 Scientists 600 members of the academy of science; the most productive 4% of the emigrants are students, 80-90% want to leave permanently	not specified; permanent contracts among others Germany Israel (44.000 engineers, 8.500 Ph.D.s) contracts , primarily Israel, Germany & the US
Bulgaria 1990-92 from 1989	40.000 Scientists 20.000 Scientists per year	Work in the West primarily Germany, Ireland, France, UK; intend to emigrate permanently
Ex CSSR 1989	34,4% of the emigrants are intellectuals	Germany
Hungary ?	many want to emigrate permanently	US
Rumania 1980-84	12,1% of the emigrants were highly qualified	Germany, Hungary & Israel
Poland 1980-87 1983-87 1980s	76.300 academics 59.700 with university degree 19.800 Engineers, 8.800 Scientists & academics, 5.500 doctors, 6.000 nurses	Germany, US, France and others Germany from 81-88 approx. 50-55% migrated to Germany, a great part being ethnic German emigrants (<i>Aussiedler</i>)

Source: Wolburg (2000)

A third stylised fact can be seen in Eastern Europe. Here, a „Brain Drain“ is one of the most severe economic problem for the near future and especially for the negotiation process of becoming new EU members. According to the microeconomics of migration (see Fischer/Martin/Straubhaar 1997) it would be most probably the rather skilled, relatively young and dynamic men who will leave Central and Eastern Europe to look for their luck in other countries of the EU – most likely Germany. But then, an old story gains new interest. It is the negative effect of the emigration of skilled people on those

left behind which has been called „Brain Drain“ in the development literature. By definition brain drain is the permanent emigration of qualified persons. Table 1 provides a short survey over some recent studies on brain drain in Eastern Europe.

To stress further the loss of brains in Eastern Europe, the example of the migration flows towards Germany is self-evident. The *skill ratio* (i.e. the share of highly qualified immigrants out of all immigrants) might serve as a measure for the instantaneous human capital content of migration. By summing up the qualifical specific migration pattern over time we can then construct an index that displays the average qualifical structure of migration within the period considered. This is done in the following Table 2 where the qualifical structure of migration within the period of 1992-94 is analysed.

Table 2: East European Cumulated Immigration Flows into Germany According to Qualification, 1992-94, in 1,000 Persons

Sending Country	Aggregated Immigrants according to Qualification		
	highly qualified (1)	total (2)	skill ratio (flows) (3) = (1):(2)
Poland	9.02	48.41	0.19
Ex CSSR	1.76	10.60	0.17
Hungary	3.78	10.87	0.35
Romania	6.11	63.47	0.10
Bulgaria	3.74	9.65	0.39
EX Yugoslavia	18.58	236.16	0.08
Albania	1.11	14.72	0.08
EX USSR	37.79	370.63	0.10
Total	81.89	764.51	0.11

Source: Straubhaar/Wolburg (1999).

Table 2 demonstrates that the cumulated share of highly qualified immigrants varies across countries. Whereas it is highest for Bulgaria, immigrants from the former Yugoslavia exhibited the lowest skill ratio. This is not very surprising since the civil war in the former Yugoslavia induced asylum migration which cannot be compared to voluntary economically induced migration as it takes place in case of the other

countries. From Table 3 we see that the share of highly qualified persons in the German population is 0.13 for the period considered. Compared to the average qualification of persons residing in Germany, the human capital content of immigration from Poland, the former Czechoslovakia, Hungary and Bulgaria lies significantly above this value. Consequently, indeed we can observe a definite „Brain Drain“ for those Eastern European countries.

Table 3: Aggregate Cumulated Skill Ratios of Migrants in Germany, 1992-94

Aggregate cumulated skill ratio (stock)	Average (1992-94)
German population	0.13
Poland	0.19
EX CSSR	0.21
Hungary	0.22
Romania	0.21
Bulgaria	0.17
EX Yugoslavia	0.04
Albania	0.07
EX USSR	0.27

Source: Straubhaar/Wolburg (1999).

To summarise this section, the stylised facts make it obvious that we have a brain gain for the US, a brain drain for Eastern Europe and a brain exchange with no clear strategy in the European Union. Why does the EU not change gears and plays an active strategy to attract brains from all over the world? Especially the (skilled) migrants from the Eastern European candidates should be seen as a positive economic stimulus to the EU economy and not a danger that has to be kept out.

III. Some Theoretical Considerations

Why is it so important to attract brains and to accumulate human capital? In this section I will provide shortly some arguments to show the macroeconomic reasoning behind a brain drain strategy. The key factor lies in the positive externalities that are related to the immigration of skilled people. While *pecuniary* externalities of migration stem from an alternation of relative factor rewards in response to migration and are of no direct importance to the impacts of factor allocation the so called *technical* externalities of the

mobility of highly qualified people are much more important. Characteristic for the latter is that the aggregate welfare for the society as a whole can be affected. To keep a long story extremely short, I only refer to the main results of the extensive brain drain literature that starts with the seminal work by Grubel/Scott (1966), Berry/Soligo (1969) and reaches a first climax with the work by Bhagwati and his scholars (see Bhagwati, 1976, 1976a, 1979, 1985, 1985a; Bhagwati and Dellalgar, 1973; Bhagwati and Hamada, 1974; Bhagwati and Rodriguez, 1975).

1. *Positive technological externalities of immigration* arise by the additional human capital that is available to the host economy. The theoretical arguments go back to the development literature of the 1950's (the famous *Hirschman, Myrdal, Perroux, Wallerstein* divergence or vicious circle or core-periphery view). They have seen a revival in the mid-1980's with the birth of the so called New Growth Theory. Starting with the seminal papers by *Paul Romer* (1986, 1987, 1990) or *Robert Lucas* (1988) the immigration of skilled migrants has been evaluated as stimulating the dynamics of economic growth (see Walz 1996 for a specific treatment of migration effects in a new growth world). According to the New Growth models, a distinction should be made between skills, that are tied to people, and knowledge, which is not tied to individuals (see *figure 1*).
 - a) Human capital, or skills, can be thought of as inseparable from people, they are achieved through investment during the course of a persons life, and they have a finite lifetime (i.e. the life span of the individual). As a result, the use of human capital is rivalry and ownership rights make it possible to exclude those who are not willing to pay for it's employment (e.g. through contracts). Thus, skills can be labelled as private goods. As such, the carrier of these skills is also able to internalise the benefits by demanding a better income and working conditions.
 - b) Knowledge, however, is not tied to individuals and is, thus, non-rivalry. Insider knowledge can be fully internalised, however, other knowledge is generally available and is, therefore, not firm specific. Although, property rights can be used to protect knowledge from competitors, for example through patents. This ability, to partially internalise knowledge, creates the incentive for private firms to invest in research and development. The remaining knowledge that can not be fully internalised creates positive externalities, that spill over the entire economy, and can be, more or less,

costlessly used. The costs invested in the production of new knowledge are high, however, the marginal costs of using it are very low. So general knowledge can be relatively cheaply used in terms of imitation and reproduction. The technological externalities created by knowledge, in the form of increasing returns to scale, therefore, produce a long term positive effect on the growth of an economy, in opposition to the Neoclassical Theory. Also noteworthy is that, because the results from investment in knowledge can not be fully internalised, it is likely that in the markets a sub-optimal level of knowledge is produced. This provides the reasoning for state subsidy of basic research.

Figure 1: Knowledge and Skills in a New Growth Framework

TECHNICAL FEASIBILITY	SKILLS • Rivalry • Factor-bounded • Embodied in persons	KNOWLEDGE • Non-Rivalry • Non-factor-bounded • Non-embodied in persons
LEGAL FEASIBILITY		
FULL EXCLUDABILITY	HUMAN CAPITAL	SPECIFIC KNOWLEDGE (Insider knowledge)
PARTLY EXCLUDABILITY	Mobile skilled people (Job jumpers)	Specific Technologies (Patents)
NO EXCLUDABILITY		BASIC KNOWLEDGE

Source: Own presentation following Romer (1990).

2. A second source for positive externalities of the mobility of highly skilled people are locally limited spillovers. They stem from the fact that in reality, skills and knowledge can not be totally separated. The use of skills is a prerequisite for the creation of new knowledge. As a result, knowledge is also bound to individuals. Also, employees can change their jobs and, even when there are restrictions on the transferring of knowledge, they will transfer a part of their knowledge and, therefore, produce a positive externality for the new employer. So that there is an

absolute symbiosis of skills (that can be internalised) and knowledge spillovers. This leads to the point that positive externalities of general knowledge are in fact locally limited, because, firstly, the use of skills makes a transformation of knowledge into products and services possible. Studies have shown that this interaction doesn't happen evenly, but locally clumped around catalyst crystallisation points. i.e. areas with a concentration of researchers and firms, who convert their knowledge into goods and services (the 'Silicon Valley' effect described by Zucker/Darby/Armstrong 1998 or Zucker/Darby/Brewer 1998).

Thus, the stimulating growth effects of knowledge externalities, and the fact that knowledge spillovers are locally limited are the key issues for the positive macroeconomic impact of the stock and flow of highly skilled people. The evidence that knowledge is unevenly dispersed in clusters means that a 'core-periphery' divide occurs, with underdeveloped 'periphery' countries/ regions losing the highly skilled, and thus income potential, to the higher developed 'core' regions, who gain from an over-proportional income increase. Thus, disparity is enlarged. So the 'Brain Drain' restricts growth in the less developed 'peripheral' regions and encourages it in the 'core'.

The effects of the 'Brain Gain - Brain Drain' are the same as those encapsulated by Lucas (1990) in his article entitled "Why doesn't capital flow from rich to poor countries?" Less developed regions have a lack of skilled people, who allow higher capital profitability to be achieved. This means that capital stays away. Therefore, average productivity is low. This provides a bigger incentive for the highly skilled to leave, and the 'Brain Drain' is intensified. Thus, a 'vicious circle' develops. Southern Italy provides a vivid example of this (i.e. the so called "Mezzogiorno" effect).

To summarise, from a domestic macroeconomic point of view it is definitely more positive to follow a brain gain strategy than to become a brain drain area. Of course, this provokes the question what determines the starting point of the vicious circle and whether by policy actions areas have a choice to become core or periphery.

IV. Accumulation of Human Capital: Make or Import?

As far as human capital accumulation generates some positive spillover effects for an economy, a strategic decision has to be taken by the policy makers: Should they produce their brain gains by themselves and invest in the accumulation of human capital by publicly subsidised schooling and research activities? Or should an economy „free ride“ and „import“ human capital that has been produced outside the country (and that has been financed by others!)? This is a fundamental strategic decision. Historically the solution had a strong tendency towards a home-based accumulation of human capital. Schooling and the education of students have been seen as typical national tasks. However, the national dimension of human capital has changed dramatically in the last years. Advances in microelectronics, further progress in computer technology, new telecommunications developments and modern transportation systems have reduced transaction costs and the costs for long distance movements of human capital. Human capital has become internationally mobile. People can move around the world within hours, their human capital goes even much faster and is available world-wide within seconds. Highly skilled people have the opportunity to communicate and sell their knowledge around the globe. As such, they can choose their place of residence by maximising the expected return on their human capital investments. For this, they don't even have to move in person. Cyberspace and internet allow them to become functionally mobile while staying at their home base. All this means that the place of generation or production and the place of use of human capital might differ substantially.

If, for the moment, we lay aside information, selection and efficiency problems of the human capital production and assume that positive externalities are indeed achieved, this still raises the question of the use of human capital and the location where its spillovers can really be captured. Even when subsidy of the production of human capital is successful, this does not necessarily mean that the benefits will increase the welfare of that economy where they are produced. In reference to the previous discussion on the effects of the mobility of the highly skilled, it can be seen, that subsidy of the production of human capital may actually lead to the subsidy of other countries if the highly skilled then migrate. Thus, investing in human capital creates even larger negative effects in a 'Brain Drain' situation i.e. when the country of production is 'losing it's minds' to other nations.

The success of the Americans in the accumulation of human capital, in terms of 'Gaining Brains', begs the question: How can the European Union implement a successful 'Brain Gain' strategy? With this in mind, it is important to stress that a successful 'Brain Gain' strategy requires that Europe creates the environment to which the highly skilled are attracted. This statement shifts the focus from the production of skills and knowledge towards the use of it. The main issue is how to capture the geographically localised positive (knowledge) externalities of skilled people. If we look at the US we see immediately how successful the US plays this strategy. America is good at attracting the highly skilled because a number of natural and unnatural benefits. Quality of life is very important to the highly skilled. They want to live where the weather is nice and the environment is clean. Safety, freedom of choice, flexibility to do and to move, secured property rights and a friendly surroundings in which they can raise healthy children are additional factors that influence the decision. Therefore, in addition to natural attributes, such as clean air and water, man-made political and social factors play a role in attracting the highly skilled.

Sadly enough, the EU ignores the fundamental economic relevance of high skilled immigration. This is especially true with regard to Eastern Europe. In the nearby back yard (or front garden?) of the EU, highly skilled people with a strong affinity to Western Europe, with specific European language skills and with a familiarity to Western European culture and habits could and should be motivated to come to the EU instead of leaving Europe for the US. But in the EU and especially in Germany there is still a fear of being invaded by a treck of people from the East.

However, for long term macroeconomic growth, the openness of the system is important, such as openness to innovation and knowledge, and the openness to foreigners. The ability to enter and leave with out significant barriers such as residence registration and other 'red tape' could make the difference. Also, prospects for family members and tax levels are mobility influencing factors which are important to attract highly skilled foreigners into the EU. In the case of America, there are close connections between research centres (such as universities) and industrial development (see Jaffe 1989). These clusters attract the highly skilled. Firstly, they attract students who think about future career prospects and secondly, they attract the highly qualified from other areas because of high wages, an innovative environment and career prospects. In turn, the supply of highly skilled attracts other companies to locate in these 'core' areas.

Evidence can be seen of this in Europe too. For example, in economics and business administration students choose Frankfurt because of a close connection to the banking places. Many work for the banks already during their studies to earn money but also to try to secure a future job. The banks themselves also have a cheap way of vetting future employees and enjoy the advantage of having a good supply of highly educated people from the universities and the other banks.

In addition, an attempt to replicate the attractive university structure of the US is under way in Europe slowly but with increasing scale. Many American universities establish branches in Europe. 'The International University in Germany' has opened their doors recently. This is a private, fee paying, university that offers an American university structure. All courses are in English and three quarters of the students are foreign. The foreign students are required to learn German during their two year study of Information Technology or Business Administration and the German students learn another language, in addition to English. Also, there is a very close connection to industry. Students work for DaimlerChrysler, SAP, Alcatel, Deutsche Telecom, Siemens, IBM, Microsoft and others during their time of study, who, in addition, contribute largely to the funding of the university. Industry is showing a lot of interest and if successful, this could represent the way forward to a successful 'Brain Gain' strategy in Europe.

V. Summary and Conclusions

The aim of this paper was to shift the focus from a negative prejudice about immigration towards a much more positive evaluation. More and more the migration pattern changes from a blue-collar migration of low qualified workers towards a white-collar mobility of highly skilled professionals. It has to be stressed strongly that - strikingly enough - most migrants are relatively well qualified. Just to mention a new IMF study (Carrington/Detrage 1999:47), the US data show that immigration flows of individuals with no more than a primary education are quite small, and reach only about 500'000 individuals out of a total of 7 million immigrants! „For most countries, people with a tertiary education have the highest migration rate ... Thus, migrant to the United States tend to be better educated than the average person in their home (that is the sending) country, and the proportion of very highly educated people who migrate is particularly high“ (Carrington/Detrage 1999:48). So, these data clearly indicate that

there is a substantial brain drain. Another question of quite similar importance is, why the US only should get a brain gain. Why not the EU?

The immigration of highly skilled is crucial and decisive for growth and wealth of nations in the 21st century. Once again this is clearly seen and strategically developed in the US. The USA attracts highly skilled people from all over the world because of a number of natural as well as artificial benefits ('sun, sea, and sand', close relations between industry and universities etc.) and, therefore, experiences a 'Brain Gain' that stimulates growth. In the case of Europe, mobility is mainly intra-European, representing a 'Brain Exchange'. This is being fuelled by the Europeanisation of production and the creation of an internal labour market. However, the EU lacks the magnetic power to attract high skilled foreign scientists and to become leading centres of research intensive (service) production. For Eastern Europe there is a fear of a 'Brain Drain' that will not be directed towards the EU but rather towards the US.

As opposed to the traditional Neoclassical Growth Theory, the New Growth Theory argues that human capital produces positive knowledge externalities that spill over the economy in which they occur. Therefore, countries which have high levels of human capital, grow more quickly. Due to the fact that spillovers are locally limited, there is a strategic interest to create clusters by concentrating human capital intensive research and production activities around catalyst crystallisation points like Silicon Valley.

As a result, a 'core-periphery' divide develops, such that there are dynamic highly developed 'core' regions and underdeveloped 'periphery' regions. Thus, the highly skilled gravitate towards the 'core', which gains from a more than proportional increase in income. A 'vicious cycle' develops; the poor regions become poorer and the rich regions become richer and the 'Brain Gain/ Brain Drain' effect is intensified.

The creation of human capital faces a number of problems, not least of which is the fact that subsidy of human capital production can lead to subsidy of other countries if the highly skilled emigrate. Thus, the result arises that, in order to keep and accumulate human capital, countries have to make themselves attractive to the highly skilled in terms of openness to innovation, strong links between research and industry, openness to foreigners, a flexible system and low taxes etc. These man-made political factors of relative attractiveness complement natural elements, like clean air and water, that are

considered attractive by the highly skilled, who can choose their place of residence by maximising the return on their human capital investments.

Therefore, attractiveness plays a large role in the accumulation of human capital. It does start with a high standard ambitious education system. But this first step is not enough. Education needs to be supported by the existence of factors that will hold the highly educated and attract the highly skilled from other areas/countries. So it remains to be seen if projects such as 'The International University in Germany' will be successful in producing and attracting the highly skilled. Industry is being actively enthusiastic, implementing a large amount of investment and supplying students with work experience. However, this brain gain strategy will be successful only if these new highly educated, highly skilled, multilingual students will stay. This will be the case if the EU policy makers, opinion leaders and vested interest groups realise that skilled immigrants do not hinder but support economic prosperity. Global citizens of the 21st century have many options. Closed doors here and red carpets there could mean that the brains of the future will be lured by the Americans.

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