The evolution in theories of the brain drain and the migration of skilled personnel

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1) Introduction

Migrations have ever since been one of the most important phenomenon of human civilisation. It is therefore quite natural that social sciences have been interested in studying them since their origin. Until the end of the Second World War, migrants came from the poorest and less educated classes of their country of origin, and on these people all the first academic surveys were focused. The high qualified migrants were very rare, and often were or very relevant in historical or cultural terms and therefore considered as the topic for a biographical study of a singular case rather then for a wide scientific analysis. After the end of the War the way of production changed dramatically and started to include innovations stemming out of general scientific and technological development; the number and the economic importance of migrations of highly qualified people increased due also to the radical changes of the political and social international picture. These migrations started to get the interest of researchers starting from the first relevant case: the departure from Germany and Italy of scientists persecuted for political and racial reasons during the nazi and fascist dictatorships. It was very evident that this exodus had a strong effect on the economic and military potential both of origin and receiving countries (Huges, 1970). However the changes in socio-economic realities over the past 50 years have brought a strong evolution of the issues surrounding the migration of highly-qualified workers.

The original investigations of the phenomenon of highly-qualified migration were mainly focused on Anglo-Saxon researchers, and the term "brain drain" first appeared in report by the Royal Society of London published in the early 1960s (Royal Society, 1963). In its original sense, the term referred to the exodus of British scientists to the United States. This fact is hardly surprising given the conditions in the immediate aftermath of the Second World War, since only the number of researchers who moved from Germany or England to the United States during this period was both numerically and economically significant.

By the 1960s and 1970s, literature on the subject was chiefly concerned with the emigration of academics and professionals from developing countries. From the start of the 1970s, new political and economic realities had led to a shift in focus and the term «brain drain» was used also to refer to the burgeoning phenomenon of students from poorer countries opting to stay on in the developed countries where they had studied. This change in the academic interest had of course a specific political and economic cause: in the framework of the interest to the Third World, that in those days was assuming a considerable relevance, it was very important that the departure of the best-qualified

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citizens from developing countries was beginning to drain those countries of their already shallow pool of qualified personnel, and was thus depriving them of the very people who were most capable of revitalising their economies. As wealthier countries then used their skills, the result was a transfer of "unfair technological aid" from developing countries to the rich world (Boussaid, 1998). The United Nations Conference on Trade and Development (UNCTAD) (Resolution 39-III/1972) introduced this concept of the «reverse transfer of technology» in 1972.

On the basis of this concept, developing countries made two substantial claims. The first was that a country suffering from a shortage of qualified workers (either because of the weakness of its educational system or because a surge in its economy had led to a rapid increase in the demand for professional skills) should be permitted to take action to discourage the outflow and encourage the return of skilled workers. The second claim was for economic indemnification from developed countries to compensate for the loss of valuable human capital. One of the ideas mooted was the levying of an international tax on skilled workers who left their country of origin. This drew an immediate legal challenge from wealthy countries which disputed the claims on the strength of Article 13 of the Declaration of Human Rights, which enshrines the right of people to live where they choose. The poorer countries countered by invoking the principle of reciprocity in international trade.

Even so, the resolution adopted by UNCTAD was not put into practice. There were several reasons for it, one of which was the intrinsic weakness of the very concept of "reverse technology transfer" (Boussaid, 1998). The weaknesses were hardly negligible: the concept failed to distinguish between different types of developing countries; and failed to account for the fact that migratory flows were not always to the benefit of countries that could be neatly defined as completely "developed", as, for example, when a worker moved from Africa or Asia to one of the Gulf States. Furthermore, to be workable, the developing countries' demands required a general definition of what was meant by "highly-qualified migrants", which is no easy task. Nor did the concept take account of all the possible motivations behind a decision to emigrate, which could include a quest for political asylum or the desire to be reunited with one’s family. Finally, it was not clear what should be done in the case of a country, such as the United Kingdom since the 1960s, that exports one sort of skill and imports another.

The whole theoretical framework underpinning studies of the international migration of highly-qualified workers was anyway destined to change substantially with the publication in 1978 of a paper by the United Nations Institute for Training and Research (UNITAR). This study demonstrated that many of those who left their countries of origin, especially the most brilliant of them, returned home later in their career to become important forces for the development of their scientific field (Boulier, 1999). So, for certain period of time, it looked as if the «brain drain» was no longer a problem, and that developing countries were suffering no harm from what should better be termed "skills mobility". Since the 1980s, the development of communication systems, especially the Internet, and the general internationalisation of research has encouraged the belief that the geographical locality of academics is no longer of any great importance because nowadays anyone can work with anyone else regardless of where they live.

Another idea that gained much currency was that highly-qualified people were moving to emerging economies where they made their skills available South-East Asia and Poland appeared to be cases in point. After the major political upheavals, a significant number of
highly-qualified personnel arrived in the country (Rudolph and Hillmann, 1997). Other studies have shown that it is possible to maintain contact between those who have emigrated abroad and those who have remained behind. Colombia has proved the practicability of this through the "CALDAS" network, which, in 1995, brought together more than 1,000 Colombian scientists and students scattered abroad (Gaillard and Gaillard, 1999).

This is why after the 1980s, researchers concerned with the migrations of highly-qualified people turned their attention to labour market mobility within the confines of major multinational companies and the migration of experts within the context of international aid programmes and joint projects (see, for example, Beaverstock, 1992; Findlay et al., 1996, etc.)

In recent years, interest in the brain drain phenomenon has revived. The studies, however, have tended to focus mainly on region as Latin America and India (Castonos-Lomnitz, 1998; Iredale, 1999; Awasthi and Chandra, 1994; Robinson and Carey, 2000) where the state of scientific and technological progress in these regions is rather advanced. These regions therefore have more than a purely academic interest in understanding the factors that threaten to compromise their stock of human resources in the fields of science and technology (S&T).

The massive emigrations from Eastern Europe and the former Soviet Union after the break-up of the Warsaw Pact have been the subject of particularly intense research. A considerable number of surveys have been carried out of the actions and intentions of the highly-qualified migrants from Eastern Europe to assess the extent of the potential brain drain. The studies into the phenomenon include Ledeniova’s examination (1995) of the propensity to emigrate among university students of the former Soviet Union, Tychonov's (1995) study of the patterns of migration from the Russian military-industrial complex, Dolgikh's (1995) study of the migration of Russian physicists, Grecic's (1995) survey of the motivations of expatriate scientists and professionals from Serbia, and many others of a similar nature (see, for example, Francovich 2000 and references therein). The conclusions they reached, however, were rather contradictory. For instance, the studies mentioned above argue that what is taking place is not so much a «brain drain» as a "brain waste" because very few of these migrants from East Europe secure a job in the host country that matches their high qualifications. De Tinguy (1994) and other researchers, however, see the flow of research scientists from the former Soviet Union as no more than a normal instance of the international mobility of S&T human resources. The rate of outflow is above average, they contend, simply because it was previously sealed off for many decades by political circumstances, and they conclude that it will prove beneficial both for the countries of origin and the hosts.

Even so, if we look closely at these flows, we can find many good reasons for doubting those who remain optimistic about skilled migration in general, and migration from Eastern Europe in particular.

2) The open questions in highly skilled migration studies

International migration comes in many forms, and no universally accepted definition exists of the concepts of "highly-qualified" or "migration" (Salt, 1997). Even the term "brain" is used in many different ways depending on the context. For the purposes of some statistical analyses, the term «highly-qualified» is allowed to encompass skilled blue- and white-
collar workers (Boulier, 1999). Most researchers, however, concur on the definition of «highly-qualified» as referring to all those persons who have a university degree or equivalent, and may be grouped as belonging to the category of "intellectuals, scientists and technicians". But having a degree is not in itself sufficient to warrant the use of the term «highly-qualified» because, even in their own countries, many graduates end up in jobs that do not require a high-level qualification. Conversely, many people who are not graduates hold jobs that undoubtedly demand high-end skills. Todisco (2000), for instance, underlines the importance of artists, clergy e sportsmen. Qualifications can be acquired by experience rather than education or training. Accordingly, if we wish to evaluate the professional level of an expatriate worker, we would be well advised to distinguish between qualifications acquired through experience and qualifications conferred by educational establishments (Koser and Salt, 1997). Indeed, just distinguishing between different countries’ education curricula is already in itself a major aspect of research (see, for example, Brandi, 1998). We should also remember to attach due importance to an employer’s objective evaluation of an employee's level of qualification. Findlay et al. (1996) demonstrate how the concept of "technical experience" within businesses in Hong Kong, where workers are essentially international, has a specific cultural value. Some academics have even proposed that any definition of highly-skilled migration must include workers on training courses (Kuptsch and Oishi, 1995) and students (Li et al., 1996; Awasthi and Chandra, 1994).

Regarding this point Francovich (2000a) underlines the importance of students abroad in qualified migrations. For the intellectuals the decision of migrating may be linked to the evolution of the school, university or career patterns and the propensity to migrate is definitely higher during the initial phase of education or job.

In effect, when defining highly-qualified migration or seeking to pigeonhole migrants, we can approach the task from any one of three perspectives: the migrant's, the host country’s or the employer's (Salt, 1997).

Those definitions that focus on the migrant stress the difference between them and manual workers. Concepts such as brain drain, brain waste and brain exchange (Salt, 1983, Paganoni and Todisco, 1995, Bernstein and Shuval, 1995; Todisco, 2000) occur for the most part in research papers whose main purpose is to analyse the decision of a highly educated person to emigrate, and the effect of that decision on his or her country of origin. Yet, some people may emigrate for reasons unconnected with their qualifications, as we may see from the "ethnic" migrations that took place within the former Soviet Union (Rhode, 1993), or the exodus of Jewish academics and professionals from Eastern Europe to Israel (Bernstein and Shuval, 1995).

From the host country's point of view, the concept of "priority workers" introduced by Papademetriou & Yale-Loehr (1996) is more useful because it focuses on the part played by the host country which obtains benefits from highly-qualified expatriates whose skills are regarded as advantageous to the national economy. Even in cases where immigrants are accepted for reasons apparently unconnected with the advantages deriving to the host country from their presence, as with the influx of skilled Chinese workers to Canada following the Tiananmen Square repression, this consideration is nonetheless uppermost when technologically advanced countries are framing their immigration policies (Liu, 1997).

Highly-qualified migration can also be looked at from the third perspective, that of the
employer. Employers, especially trans-national corporations, are becoming increasingly involved in and responsible for the migration of qualified personnel. The definition that these corporations make of high qualification will obviously depend on their own specific requirements and organisational strategies (Salt, 1997).

These definitions must then be understood with reference to what is meant by migration, itself an imprecise concept for academics. One particular difficulty arises from the growing incidence of temporary migration. While the United Nations may define "migration" as a transfer lasting more than one year, current national statistics do not abide by any single standard definition of the term. Many academics have also acknowledged that using a timescale as a means of definition is not necessarily valid. It is far from clear that the international movement of qualified personnel should be defined as a migration, especially if there is a highly probability that the person will return home after a given period of time. Some scholars discuss the very applicability of the term "brain drain" for permanent movement of very high skilled professionals in the present socio-economic circumstances (Todisco, 2000). On the opposite extreme stand academics such as Prices (1989) who has suggested that professionals, technicians and employees transferred abroad for a period of 10 to 12 months as well as scientists and academics who work for a foreign institution for a period of 6 to 12 months should not just be included in the count, but should also be regarded as long-term rather than short-term or transitory migrants.

In light of these difficulties, it will come as no surprise to find that no generally accepted definition exists of «highly-qualified migration», sometimes also referred to as "skilled international migration" (Findlay, 1990), "skilled international labour circulation" (Cormode, 1994), "professional transients" (Appleyard, 1991), "migration of expertise" (Salt and Singleton, 1995) and «quality migration» (Todisco, 2000).

It goes without saying that this absence of a generally accepted definition of the phenomenon causes enormous problems for anyone trying to draw up a meaningful classification based on the traits of individual migrants or the circumstances in which the act of migration took place. Logan's (1992) classification of, for example, distinguishes only between international migrations from less to more developed regions and movements within the developed world. Gould (1988) had devised a more complex system of classification that separated workers who made a permanent changes of abode from those who were temporarily mobile, and distinguished between migration to the North and the South of the World. Another approach is based on the characteristics of the persons involved. For example, Salt (1997) distinguishes between:

1) Transfers within companies;
2) Technical workers on temporary assignments;
3) Professionals;
4) Project experts;
5) Specialist consultants;
6) Those who migrate for the purposes of career development and training;
7) Clerics and missionaries;
8) Entertainment workers, sports players and artists;
9) Businessmen and independent entrepreneurs;
10) Academics, including researchers and students enrolled in higher education institutes;
11) Military personnel and, in some cases,
12) the wives and children of the same.
Todisco (2000) proposes classifying migrants by their area of employment, as follows:

1) Scientists, researchers and academics;
2) International experts;
3) International functionaries;
4) Multinational managers;
5) Clerics and members of religious orders and organisations;
6) Artists, actors, entertainment and tourist workers;
7) Sports professionals;
8) Specialist workers;
9) Officers, NCOs and private soldiers;
10) Students and post-graduates completing their studies.

In addition to the uncertainty of the theoretical framework, very few migration statistics are available either from the countries of origin or the countries of destination and, even where they do exist, as in the United States, Canada and Australia, they tend to be inhomogeneous and difficult to compare (Koser and Salt, 1997). Some countries are able to provide statistical breakdowns by occupation of their foreign workers, but these are usually by industrial sector and therefore bundle workers with different qualifications into the one category. In some countries, the definition of "highly-qualified" is based on the foreign worker's educational qualifications, while in others the worker's profession is used. Also, different countries apply different types of classification for professions, and often use generic terms that make it impossible to identify migrants’ real occupations. Even translating terms relating to professions from one language to another can give rise to confusion (Brandi, 1998).

To add to these problems, highly-qualified migrants are so small in number that they are often statistically invisible, especially to polls such as the European Labour Force Surveys that are based on sampling techniques. Another reason for the scarcity of data is that highly-qualified migrants are very rarely considered a problem because they generally belong to the middle class and do not stand out socially by their skin colour or culture (Salt, 1997). In the specific case of Europe, a further complication arises from the fact that many expatriates are citizens of other European states who, moving within an area of free circulation, are easily missed by the statistics (Salt and Singleton, 1993; Rotheram and Salt, 1995).

It is not just the uncertainty of the data that has prompted many academics to argue that the concept of the brain drain may still be valid. On the contrary, many good reasons exist for supposing that the phenomenon persists and is, perhaps, escalating in the present socio-economic situation (Iredale 1999).

It is clearly a good thing for an academic to specialise abroad in a scientific field that is not adequately developed in the country of origin and then return home to put his or her experience to good use. Similarly, we should welcome the fact that countries whose resources are poor have been able to acquire systems of technological research and development through the efforts of nationals who have worked as expatriates inside high-level scientific circles abroad, and have thereby tapped into a flow of information and innovation that they would not otherwise have been able to reach (see, for example, Bettahar, 1999; De Tinguy, 1994 etc.).
To be sure, the economic development of some countries, especially Korea, Taiwan and South-East Asia (Teng, 1994; Pang, 1994; Skeldon, 1992, etc) has enabled many of their researchers who had gone abroad to come home again, and their return has then helped accelerate economic development.

On the other hand, it is also evident that if these favourable developments are to take place, the country of origin must contain a sufficiently large nucleus of scientists and retain at least a minimal scientific and economic potential before their expatriate scientists can contribute to its further development or be enticed back home (Boulier, 1999). In the absence of this, not only will the scientific and technical system of the country continue to deteriorate owing to the loss of trained human resources, but also all capable students will inevitably be forced to specialise abroad and remain there forever (for example, Iredale, 1999; Castanoz-Lomnitz, 1998). All studies on mobility show how a better organisation of the system in which researchers work plays a role as important as the one played by financial and personal advantages; Todisco (2000) explains how these and similar factors condition highly skilled migrations more than any other mass migration. In most emerging economies, these conditions are not satisfied and in some, such as Algeria, they have actually degraded over time (Bettahar, 1999). This can make an initially temporary movement a permanent one, especially if the new research system the person is involved in, is much more favourable to professional activity than the one left in the country of origin.

Another worsening problem is the progressive privatisation of research and its increasing inclusion within the production-manufacturing system. This process leads us to fear that private corporations will come to dominate the sciences and technologies with the greatest market potential, and will, in all likelihood, be unwilling to allow the networking of their knowledge (Boulier 1999).

Furthermore, developed countries are increasingly lacking S&T human resources partly as a result of low demographic growth and partly as a result of the sharp fall that has taken place in the number of students enrolled in science faculties, the causes of which have yet to be identified (see, by way of example, Le Scienze, 2001). Inevitably, then, developed countries will seek to select the most skilled from less developed countries and draw them into the ambit of their research systems. It is strongly probable that these professionals do not leave in their home countries any opportunity for other colleagues as the number of people with similar qualification that developing economies can train, is very small. (Todisco, 2000). We have seen that the figures are unreliable, but it is possible to estimate that between 1985 and 1990 no fewer than 60,000 African doctors, university lecturers and engineers left their countries of origin (Jeune Afrique Economie, 1997). France, for example, has already introduced a new type of so-called "scientific visa", and announced that it needs to increase the number of foreign students in its universities by a factor of four. In 1999, the United States, too, declared that it was lacking in human resources for science and technology, and simplified entry procedures for foreign scientists. Meanwhile, the Moroccan Minister for Technology has complained that French companies have headhunted the best Moroccan information technology students, and provided them with contracts of employment and French work visas even before they obtain their degrees (Boulier, 1999).

It is not even proven that the migrants themselves gain any substantial advantage from their diaspora. For example, Australia has received an increasing number of immigrants from non-English-speaking countries, including a record number of qualified workers. But
after a decade of receiving skilled foreigners, clear cases of indirect and direct
discrimination can be found, as shown in two studies presented by Hawthorne (1997). One
study, investigating indirect discrimination, showed how the federal government of
Australia has increasingly bowed to the lobbying of the medical association to limit the
influx and recognition of immigrant doctors through the imposition of an unjustified
requirement for a perfect command of the English language. The second case study looks
at a sample of elite expatriates chosen from the qualified immigrants to Australia. It looked
at foreign engineers of an age well suited for integration into the Australian workforce,
whose command of English was good, and who had excellent previous experience before
arriving in the country. The study showed the existence of clear-cut discrimination in
favour of immigrants whose mother tongue was English or who were of European origin to
the detriment of immigrants of Asian and Middle Eastern origin.

Robertson and Carey (2000) also illustrate evident cases of discrimination. Looking at the
phenomenon of Indian doctors working in the United Kingdom, they demonstrate that the
situation is far more complex than a mere statistical examination reveals. Their study
demonstrates that these highly-qualified immigrants have a great deal in common with the
impoverished Indian peasants who also travel to England. Both groups, the study found,
are greatly influenced by their colonial past, share a common cultural background and have
similar histories of earlier diasporas.

Denour and Junker (1999) studied the case of 8,000 foreign doctors working in French
public hospitals. They found that they were paid much less than their French peers and
were usually employed on temporary or precarious contracts. True, the situation, which has
for the most part arisen since the 1980s, is partly caused by the difficulties involved in
attributing the proper weight and value to different degrees. Mostly, however, it is the
result of naked protectionism by the medical lobby. The discrimination persists even
though the present French government is actively seeking to mitigate the disparity of
treatment between French and expatriate doctors with equal qualifications.

Finally, a study into the fate of experts from the former Soviet Union who recently
emigrated to Israel demonstrates that most of them are, at least temporarily, employed in
jobs that are not commensurate with their qualifications. This is a straightforward case of
"brain waste" (Bernstein and Shuval 1995): this should be therefore the case of a serious
"brain waste" as, considering the relative level of the education and technical systems of
Israel and ex USSR countries it is not conceivable that the qualification obtained in the
country of origin is not adequate for the receiving country, as it has been possible in other
cases (Todisco, 2000).

Furthermore, some researchers have highlighted the disproportionate presence of highly-
qualified immigrants in a limited number of "global cities". The primary reason for this
concentration is, simply, that cities have a greater availability of specialist work for
qualified expatriates and the higher salaries that go with it (Beaverstock, 1992; Salt and
Singleton, 1995; Findlay et al., 1996). Even if acceptance of foreigners is far greater in
these environments than elsewhere, it cannot be ruled out that a massive inflow of well-
qualified foreigners into a restricted geographical area could eventually give rise to
problems of rivalry and even ethnic friction in places that should be immune to such
things. Actually, we must not forget that the global economic situation is once again
evolving at great speed and while the policy of attracting qualified immigrants is generally
still practised, restrictions on other forms of immigration continue. There is some evidence
that the practice of almost automatically accepting immigration applications from highly-
qualified foreign workers is now being called into question. Misgivings have been expressed in the United States, Canada and Australia regarding the efficacy of "emigration market" policies designed to draw in highly-qualified workers (Borjas, 1990). The impact of this sort of immigration on the local skilled population is now a matter of discussion (Papademetriou & Yale-Loehr, 1996). David North (1995) has even gone so far as to claim that the ready and cheap availability of immigrants with scientific training and preparation is sapping the ability of the United States system to take effective action to combat the steep decline in the number of students enrolling in science faculties. He argues that the number of entrance visas for foreign scientists and technicians should be restricted to force more Americans to enter the field of science and technology.

Furthermore, many academics have claimed (for example Findlay et al., 1996; Salt, 1997) that there is a positive correlation between the inflow of skilled labour and investment spending, as foreseen by a model of expertise migration following the economic theory of the «globalisation», but this is certainly not always the case. Boyle et al. (1994) examined the relationship between foreign investment and the transfer of experience in the case of small French companies operating in Great Britain. They demonstrated that the relationship between investment and the presence of experienced workers depends also on the local availability of adequate skills in the first place, either in the form of expert local workers or skilled expatriates already present. It is also clear that European and US trans-national corporations have, in recent years, tended to favour a model of expansion that makes use of far fewer international transfers than Japanese companies (Koser and Salt 1997). On the other hand, no one has yet examined in detail the effects of the recent economic crisis in South-East Asia. It is thus possible that the mobility of skilled personnel in this region, that has been often cited as proof of soundness of the globalisation model, is now following patterns that do no more fit the same model (Iredale, 1999).

The relationship between highly-qualified migration and technology transfer to the less developed nations is far from clear (Lamarra, 1992). Findlay (1990) offers two reasons why such transfers are limited in number. In the first place, experience suggests that trans-national corporations are very reluctant to let citizens from other countries achieve high technical or administrative rank within the company. These posts remain occupied by expatriates on transfer to the countries in which the trans-national company operates. Secondly, these companies do not see it as being in their interest to release their technical know-how to the local workforce (see, for example, Kanjanapam, 1992).

For these reasons, it is far from safe to assume that the international migration of S&T human resources should be studied only in the light of economic globalisation.

3. The key question: to differentiate the international mobility for R&D from brain drain

A review of literature dealing with the phenomenon of skilled migration evidences the need for a survey that will distinguish between the international mobility of S&T human resources, which can only be interpreted as a positive thing, from the «brain drain» phenomenon whose effect is the "reverse transfer of technology" (CNUCED, 1972) and can only aggravate imbalances in the world economy and the social injustice that ensues. It is interesting to note that many of the studies carried out by researchers in receiving countries are mainly concentrated on positive aspects of highly qualified migrations, and on the other side the analysis made by scholars living in countries with a high migration
rate generally underline the negative aspects of the phenomenon.

We need to bear in mind that the concept of «brain drain» implies that the departure of highly-qualified workers must be marked off as a loss to their country of origin’s stock of S&T human resources ("Canberra Manual", OECD, 1995). It follows, therefore, that if the migration involves a person who is completely trained and ready to carry out a qualified professional activity, and if that person opts to work elsewhere, this must always count as a loss for the country of origin which will have wasted resources in training a permanent expatriate. Whether the act of migration constitutes an advantage for the host country or the expatriates themselves, and whether it leads to some sort of return such as a financial or cultural remittance, the diminishing intellectual unemployment (Todisco, 2000) for the country of origin will depend on the economic and social conditions surrounding the act of migration; but it is still an example of brain drain.

The problem is more complicated in the case of the researcher who never ceases to study and train. In this case, as many academics have pointed out, living abroad provides an opportunity for expatriate researchers to increase their knowledge and eventually apply their full potential when they return home. Alternatively, the researchers may transfer their knowledge to the scientific community back home without even having to return, something that rarely occurs in other professions. So it may not be automatically assumed that the stock of S&T human resources in the country of origin is compromised by the diaspora of researchers, and we may not necessarily speak of a brain drain.

The challenge, therefore, is to make a quantitative evaluation of the loss suffered by the country of origin by the absence of the researcher, and the advantage gained by the host country. If the losses exceed the gains, we have a case of brain drain; if not, we should be speaking instead about «mobility» or «scientific networking».

The main factor to examine here is the length of the period of absence. The longer the absence, the more the host country can avail of the expatriate’s labour, and the weaker become all links with the country of origin. On one extreme, it is clear that if the expatriate worker completely severs contacts with his or her country of origin and never returns, then the loss is total. The age of the migrant at the beginning and at the end of his or her period abroad is also relevant. Although researchers are continuously learning and training, at the start of their career they obviously spend more time acquiring knowledge than producing it. Only when they grow older and gain more experience do they start producing more and learning less. It follows that a young researcher can spend more time abroad than an older researcher without causing an equivalent loss to his or her country of origin. Indeed, if the entire early period - during which learning prevails over productive activities - is spent abroad, and the subsequent period - when output is highest - is spent at home, the country of origin gains rather than loses.

We also have to ascertain whether this increasing productivity with age and experience holds true for all disciplines, for it has often been claimed that in certain sciences, researchers peak in their early years and lose creativity thereafter. In this case, if the «golden moment» in the researcher’s career coincides with his or her time abroad, then no matter how brief the absence, the country of origin is the net loser.

Time is not the only determinant. A researcher may return at the end of his or her career having accumulated experience not available in the country of origin, and transplant a whole new activity that would not otherwise have taken root in the native soil. This is what
happened with Italian physicists who emigrated to the United States in the 1930s as a result of the Race Laws. If we take account of the fact that some gains can only take place after the return of scientists, the timescale over which losses and gains are calculated also assumes considerable importance.

Even if a researcher were to come home after retirement, or not return at all, the country of origin could still obtain some advantage in respect of its S&T stock of human resources. If the researcher contributes to the education of an entire generation of researchers in his or her country of origin, then the country will have increased its stock of knowledge whether the researcher returns or not. We must also keep an eye on the sort of contacts that exist between the expatriate researcher and the scientific community in his or her homeland. If the contacts are kept up by, for example, the training of PhD students in the country of origin or by creating research openings for compatriots, the length of the absence becomes less important provided that the country of origin is equipped to take advantage of the opportunities created by its scientific diaspora. If the country of origin is not in a position to take advantage, then the maintenance of close contacts can, on the contrary, set off a chain reaction of emigration without return. This is what happened for a long period with Indian doctors (Robison and Carey, 2000).

A particular problem concerns the qualified migrations within European Union (Frankovich, 2000): during the last two decades, mobility of university students and human resources for R&D has been generally recognised as a powerful means to make economic levels and cultures of European Union countries homogeneous, and as such it has been and still is incentivized (Ruberti, 1997). Up to our days, due also to the mentioned statistical difficulties, there has not been a study which has analysed the consequences of the increased movement of people (either permanent or not) within the European area. It is therefore of primary importance to verify if the expected results have been met and if the possible benefits have been homogeneously distributed among all European countries;

The difficulty lies in quantifying these parameters in a way that makes it possible to calculate where gain stops and loss begins. The only way of resolving this difficulty is to carry out a direct survey on a sufficiently large sample to discover the true character of the international migration of S&T human resources.

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