

PART 4. FLOWS AND THE EU

Germany



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Germany

1. Preface¹

The issue of international mobility of the highly skilled is a widely and hotly debated topic in Germany, witness the recent public discussion of the Green Card initiative. Scientific research on brain drain - brain gain exchange is lagging behind, partly because adequate hard data are hard to come by².

International mobility in this paper is analysed at two levels, namely:

- The mobility of researchers and scientists
- The mobility of highly skilled workers

Given the lack of hard data, this paper has been written with the support of a number of existing research activities in the field and looks at both brain drain and brain gain in Germany.

The lack of structured data capable to quantify the "**stock**" of German intellectual capital abroad and the reasons why students, scientists and skilled workers have left the country, makes it difficult to understand the causes determining the outflows of intellectual capital and the effects on the German economy.

Amongst other information sources analysed for this paper, of particular relevance were:

- *On brain drain, brain gain and brain exchange within Europe* written by the Hamburg Institute of International Economics;
- *Why do firms recruit internationally* written by IZA ?
- *Karriere mit Doktorrtitel* Universität Gesamthochschule Kassel; and,
- *German Scientists in the United States* by the Center for Research on Innovation and Society.

2. Introduction

The New Growth Theory evaluates positively the additional availability of imported human capital, as inflow of human capital might produce positive externalities that affect directly or indirectly the overall economic system of the host economy. Therefore, countries that have a high income in terms of human capital, experience a faster growth. 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 such as the Silicon Valley³.

While the public debate in terms of pro and cons of migration can be understood, it goes without saying that — based upon the finding of the New Growth Theories — countries

¹ This paper was written by Piero Dell'Anno commissioned by CNR-IRPPS Rome for the project *The Brain Drain - Emigration Flows for Qualified Scientists*.

² Quot. R. Winkelmann (2000) "Why do firm recruit internationally" IZA Bonn

³ Quot. T. Straubhaar (2000) *International Mobility of the Highly Skilled. Brain Gain, Brain Drain or Brain Exchange*. Discussion Paper HWWA Hamburg

should feel privileged to become the target destination of the mobile qualified labour force.

Overall, at global levels we can identify two macro trends, from one side America that has been largely interested in attracting immigrants with specific skills, to sustain the internal labour demand and. On the other side, Europe, with the exception of the UK, has been quite reluctant to promote a flexible approach even to qualified and highly skilled migrants.

Lately, things are changing. In Germany, under Schroeder, 20,000 "green" cards were produced to foster the recruitment of specialists in the IT fields and to sustain the development of a sector that is of fundamental importance for the take off of the German economy.

In terms of migration flow, Germany presents a heterogeneous structure. In fact, the socio-economic situation in the new lander is strongly dependent on the ability to create the environment that will foster immigration of capital and intellectual skills. For some⁴, any further deterioration in East Germany could lead to a lasting cultural withdrawal from West Germany and rising nationalism.

Thierse suggests that the economic take off of East Germany is determined by the: "dramatic deconstruction of the East German industrial potential, especially in the field of research and development"⁵. For Thierse, there has been a constant brain drain of young skilled people to the western parts of Germany and to Berlin. Those persons who remained were the older and less skilled segments of the population. As a result, the regions lost both their ability to compete economically and their demographic sustainability.

In terms of student migration, Germany is suffering as much as many other countries in Europe. A recent study by the "Deutsche Studentwerk"⁶ has highlighted that a large number of foreign students were in Germany accidentally or because of an exchange programme. Moreover, the study revealed that if the foreign students had the option they would have gone somewhere else.

3. Immigration in Germany — At a Glance

Wolter and Straubbhaar claims that — Germany as the rest of Europe — is quite slow in attracting foreign intellectual capital despite all the efforts to stimulate the mobility of the higher qualified labour force within the EU and, when compared with the US, where a brain gain is evident, Germany seems to experience more the effects of a brain exchange.

The German economy is strongly dependent on migrants. During the 1960s the massive recruitment of guest workers to support the native labour force was a clear sign of Germany's needs in the labour market.

The share of foreign workers in Germany's labour force amounts at 9.4%⁷. Table 1 presents data on employed foreigners by economic activities in 1996.

In general, foreigners are in low-skilled jobs. While the average employed foreigner is equal to 9.3% the percentage increases in agriculture, forestry, fishing, mining and construction.

⁴ W. Thierse, President of the Bundestag

⁵ Quot. Central Europe Review, "News from Germany" Vol 3. N. 1 8 January 2001

⁶ Quot. T. Straubhaar (2000) *International Mobility of the Highly Skilled. Brain Gain, Brain Drain or Brain Exchange*. Discussion Paper HWWA Hamburg

⁷ C.Klos (2002) "Dependance on Migrants in Germany, legal reactions on needs of economy"

The presence of foreigners is strongly lower in white-collar jobs especially in banks and insurance. In the public sector positions can often be held solely by Germans or EU nationals

Economic Activity	Values in absolute terms	As a share of total labour force
Agriculture, forestry and fishing	27,272	13.4
Construction	196,070	12.7
Manufacturing	823,118	11.3
Services	588,558	10.2
Transport and communication	103,425	9.2
Commerce	217,282	6.7
Energy and mining	21,899	5.9
Non-profit organisations, private households	35,492	5.7
Local authorities, social insurance	48,909	3.5
Banks, insurance	22,609	2.4
Total	2,084,634	

Source: Christian Klos, Dependence on migrants in Germany.

that determines a lower presence of foreigners in this category.

In Germany, a higher presence of foreigners is registered in certain professional categories (Table 2).

It is also quite interesting to note that, back in 1995 amongst the foreign population working in Germany about 239,000 were self employed, 40,000 of which were of Turkish nationality⁸. The share of self-employed in the foreign labour force run up to 8.7% in 1995 compared to the 7.2% registered in 1987.

Professional category	Percent
Cooks	29.5
Metal workers	23.3
Fitters	25.4
Service personnel	24.3
Unskilled workers	23.9
Plastic manufacturing	23.9
Cleaning personnel	22.8
Miners	22.1

Source: Christian Klos, Dependence on migrants in Germany.

The admission to work in Germany is permitted under the principle of bipolarity. Migrants need two permissions to legally work: (1) a residence permit; and, (2) a work permit.

While the residence permit is granted by the alien's office (Auslanderbehörde), the work permit is delivered by the public employment agency (Arbeitsamt). The requirement of bipolar permission is partly overlapped by privileges of specific nationals. For instance, EU nationals have a right of residence according to Art. 8 of the EU Treaty⁹.

In terms of inflows from Eastern Europe, since the collapse of the Eastern European block, Germany has become an attraction for scientists, students and qualified (Table 3).

⁸ *Ibidem*

⁹ C.Klos (2002) *Ibidem*

Country of Emigration/Year	Volume and occupation of emigrants	Country of destination
Russia		
1991-93	18,000 scientists and intellectuals 7,000 -70,000 scientists	Israel - 44,000 engineers; 8,500 PhDs
1992	600 members of the academy of science; the most productive	Contracts primarily in Israel, Germany and the US
1991	4% of the emigrants are students, 80-90% want to leave permanently	Contracts, primarily Israel, Germany and the US
1990	250 scientists of the academy of science (20%)	Not specified - permanent contracts
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
Romania		
1980-84	12.1% of the emigrants were highly qualified	Germany, Hungary and Israel
Poland		
1980-87	76,000 academics	Germany, Us, France and others
1983-87	59,700 with university degree	Germany
1980s	19,800 engineers; 8,800 scientists and academics; 5,500 doctors, 6,000 nurses	from 81-88 approx. 50-55 migrated to Germany, a great part being ethnic Germans
Source: Straubhaar/Wolburg (1999).		

Between 1992-94, the skill ratio that measures the share of highly qualified immigrants out of all immigrants highlights the qualification structure of migration within the period examined. The data shows how Eastern Europe (within the observed period) has lost a considerable amount in terms of human capital to the benefit of the German economy (Table 4).

Sending country	Aggregated immigrants according to qualification (in thousands)		
	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	0.88
Albania	1.11	14.72	0.80
EX USSR	37.79	370.63	0.10
Total	81.89	764.51	0.11
Source: Straubhaar/Wolburg (1999).			

4. Dimension and Causes of Brain Drain

4.1 International drain of students and researchers

Germany seems trapped in the dual aspects of brain drain. From one side, the country needs highly qualified and skilled personnel and tries to become more attractive and open. From the other side, Germany wishes to keep its own researchers and avoid providing other countries with German home-produced intellectual capital.

Over 2% of German students¹⁰ enroll in foreign universities. This is the highest rate within the G7 countries. Moreover, few foreign students move to Germany.

A study¹¹ published by the Center for Research on Innovation & Society (2001) highlights that in 1999, more than 4,400 Germans were enrolled as graduate students in US universities. As shown in Table 5, Germany holds 9th place in supplying the US with graduate students.

Germany is again the only western European country registering such a high number of recipients. As can be observed from the table Asians dominate the top ranks. Germany ranks 6th in number of doctorate recipients among the key suppliers, and above the number earned by Russians and Japanese. Table 6 shows the ranking of doctorate recipients.

It is interesting to note that during 1998-99, German-born received more than 400 doctorates from US universities and well over half of them were in fields of science and engineering.

Table 5. Foreign graduate students at US universities, selected countries, 1998-99		Table 6. Foreign doctorate recipients at US universities, selected countries, 1998-99	
Country	Number of graduate students at US universities	Country	Number of doctorate recipients from US universities
1. China	41,237	1. China	2,571
2. India	26,590	2. India	1,259
3. Korea	19,109	3. Korea	1,100
4. Taiwan	16,379	4. Taiwan	1,027
5. Canada	9,369	5. Canada	448
6. Japan	8,618	6. Germany	288
7. Thailand	8,297	7. Russia	216
8. Turkey	5,278	8. Japan	205
9. Germany	4,416	Source: National Research Council	
Source: Institute of International Education			

¹⁰ Data obtained by the Frankfurter Rundschau 28.07.2001

¹¹ C.F. Buechtemann (2001) *"Deutsche Nachwuchswissenschaftler in den U.S.A. - Ergebnisse der Vorstudie"* Center for Research on Innovation & Society, Berlin.

A different reality is highlighted amongst the foreign scholars population - within US universities - during the academic year 1998-99. Scholars are mainly post doctoral and visiting professors. Germany with almost 5,200 people is below China that has almost 12,000 representatives and Japan with over 5,500 scholars (Table 7).

Country	Number of foreign scholars at US universities
1. China	11,854
2. Japan	5,572
3. Germany	5,183
4. Korea	4,660
5. India	4,369
6. UK	3,154
7. Canada	3,129
8. France	3,015
9. Russia	2,693
10. Italy	2,017

Source: Institute of International Education

Country	Number of foreign faculty at US universities
1. India	6,876
2. China	4,830
3. United Kingdom	3,426
4. Taiwan	1,820
5. Germany	1,309
6. South Korea	1,218
7. Greece	1,244
8. Japan	1,022

Source: Institute of International Education

In the US in 1997, there were 1,308 professors and lecturers from Germany. The only other western European country with a higher number of faculty reported was the United Kingdom with 3,428 professors actively working at US universities (Table 8).

Comparing the number of German graduate students at US universities (that amounted to 4,489 in 1998) versus the German born faculty at US universities (1,309 in 1997) it is reasonable to assume that those graduate students who were not registered as faculty in US universities have most probably :

- gone back to Germany to work either at universities or for the private sector; or,
- stayed in the US but left academia.

Other research¹² published by the Center for Research on Innovation & Society aimed at collecting first hand information about the situation of German Scientists and postdoctoral scholars in the US and their intention to stay in the US or to return to Europe, as well as their assessment of the German versus the US higher education and science system.

The 632 respondents who filled in the online questionnaire represent quite a heterogeneous group including:

- students currently accomplishing their post doctoral;
- former postdoctoral students who have stayed on in the US;
- German scholars and scientists living in the US; and,
- Germans who, after some years in the US, returned to Europe.

¹² C.Buechtemann, V.Tobsch (2000) "German Scientist in the United States" Center for Research on Innovation and Society

The questionnaire asked the respondents to compare their experiences in the US and to compare the US science system with what they had experienced in Germany. The picture obtained is clear: the German system needs reform.

The large majority of the respondents (68.4%), had come to the US for a postdoctoral appointment. Just a small part (6.5%) had entered to enroll in a graduate or doctoral program at a US university. Amongst the reasons for choosing to study in the US, the market value of a postdoc obtained from a US university dominated along with the leading edge knowledge in the specific field of interest offered by a US university (Table 9).

Table 9. Reasons for going to the US.	
Reasons	Percent
To enroll in a graduate/doctoral program	6.5
Postdoc appointment	68.4
For a research visit	15.9
To take up a professor position	2.8
Other reasons	6.4
Source: German Scientist in the US CRI&S	

Two thirds of the ongoing postdoctoral respondents stated that in the US they had the chance to acquire new knowledge in areas where Germany has little to offer and more than 50% were advised by their advisor to pursue their studies in the US.

Factors such as the lack of postdoctoral jobs in Germany had no influence on the decision to move to the US.

In terms of financial support, the vast majority of German postdocs receive scholarships to finance their stay in the US and, in most cases, this support came from a German scholarship institution (Table 10).

Table 10. Financial support during postdoc.	
Answers	Percent
Yes, scholarship during postdoc	87
No, did not receive scholarship	13
Source: German Scientist in the US CRI&S	

Along with the scholarship, the majority has also received financial support from the host university. On average, the host institution funding amounted 40% of total funding during the postdoctoral studies. Thirty-two percent of the postdocs considered the scholarship support essential while 46% qualified it as at least helpful in helping them obtaining a postdoctoral position at their host institutions (Table 11).

Table 11. Sources of funding.	
Source of funding	Percent
Received no funding from host institute	25.2
Entirely funded by host institute	15.6
Follow-up host institute	27.9
Initial host institute support	11.1
Parallel host institute support (co-funding)	19
Source: German Scientist in the US CRI&S	

In terms of financial help, one quarter of the respondents valued the scholarship as sufficient. A lower share of 15.6% said they found the duration of the scholarship sufficient. In terms of advice and guidance provided by the sponsoring agency, almost one in five said it was sufficient (Table 12).

Table 12. Assessment of scholarship support.	
Assessment	Percent
Amount of scholarship has been sufficient	25.2
Duration of scholarship has been sufficient	15.6
Advice and guidance by scholarship agency has been sufficient	19.0
Source: German Scientist in the US CRI&S	

In the medical and natural sciences, respondents feel that the time allocated to training and work is well balanced (55.7% of respondents in the medical sciences and 45.4% in the natural sciences) (Table 13).

Table 13. Balance between work and training during postdoc studies.		
Work situation aspect	Medical and related sciences	Natural sciences
Work aspect prevails	25.7	40.2
Training aspect prevails	18.6	14.4
Sound balance of both	55.7	45.4
Source: German Scientist in the US CRI&S		

From a work situation point of view, 50% of the respondents declared that the research projects they were involved in were designed primarily by the host institution. Only some 33% of the postdocs were engaged in pure basic research without any commercial value, while quite a significant share of the respondents (30%) stated that their research work has a

commercial relevance.

Most German postdocs find their experience in a US laboratory a very positive experience when compared with a German one. The respondents highly appreciated the level of funding, the resources available for research, the research infrastructure and the additional support services as well as the quality of relationships with professors, which are assessed as to be more friendly when compared with those experienced in Germany. The postdoctoral students in medical sciences were particularly positive about their experience in the US.

The value-added of specialising in the US for the German postdocs pertains to aspects such as the learning of new methods and techniques as well as the improved professional knowledge. Higher market value that one can acquire after a period of study in the US were also among considerations.

Half of the respondents found very interesting and challenging the chance to work and live in an international and multicultural research environment. The skills acquired in a market-driven research setting seems to be relevant to just a few.

Over half of the German postdocs received a job offer from their host institution or from another US company or university by the end of their studies (Table 14)¹³.

Table 14. Offers to stay in the US.	
Type of proposal	Percent
Neither host institution nor other employer	44.0
Received offer from host institution	45.2
Received offer from other institution/employer	14.8
Source: German Scientist in the US CRI&S	

Despite the extremely active market, two in three postdocs wished to return to Germany and only a small share (18%) had already decided to remain in the US (Table 15).

Table 15. Plans to return to Germany after the postdoc.	
Type of decision	Percent
Will return to my previous job	9.9
Have firm job offer to return to	16.8
Plan to return, but no job in sight yet	37.4
Considering staying longer in the US	9.2
Firmly plan to stay in US but no job offer yet	4.6
Firmly plan to stay in US and have firm job offer	4.2
Undecided	17.9
Source: German Scientist in the US CRI&S	

Just under one in five were undecided. All in all, one out of 4% German postdocs had firm plans to stay in the US. The percentage of those who return to Germany is higher amongst the medical doctors and related sciences (73%) due to the lack of recognition of many of their academic achievements in the US coupled with the strong internal demand for young and

¹³ For additional detail on Germans planning to stay in the US, refer to Section VI-3.

highly qualified medical doctor in Germany.

A different reality comes to light for those who are in the natural sciences who, by contrast, consider to stay in the US due to the difficult work environment they need to deal with upon their return to Germany.

Amongst the reasons to stay, former postdocs who remained in the United States, did it for work related reasons of employment opportunities and treatment and career prospects (Table 16).

Table 16. Reasons for staying in the US.	
Type of decision	Percent
Host institution offered follow-up position	42.9
Received attractive job offer from another employer	50.0
Did not find adequate position in Germany	33.0
Was offered more attractive job conditions in the US than in Germany	69.6
Superior medium term career prospects in US	60.7
US offer superior research opportunities in specific field of study	50.9
Personal reasons	33.6
Source: German Scientist in the US CRI&S	

The difficulties and, in many cases, the failure to find an adequate job in Germany is only relevant to 33% of those who have stayed on. The decision to move back to Germany for personal reasons and for the attractiveness of the job offers involved respectively 50% and 40% of the audience targeted by the survey. Of particular relevance is also the desire to obtain the professional habilitation in the home country (39%). A consistent part (18%)

Table 17. Reasons for returning to Germany.	
Type of reason	Percent
Was on leave and returned to old position	18.0
Received attractive job offer in Germany	40.0
Wanted to do my 'habilitation' in Germany	39.0
Saw better medium-term career prospect in Germany than in the US	13.9
US visa ended/could not be extended	7.0
Did not find follow-up job in the US	4.0
Personal reasons	50.0
Source: German Scientist in the US CRI&S	

moved back to their old jobs, as they were on leave during their studies in the US (Table 17).

Almost all (80% to 90%) of those addressed by the online survey rated the US system as definitely better or somehow more rewarding than the German one. Additionally, the German researchers in the US also specify that the US has a research funding system of a higher quality when compared to that in Germany, offering better research grant opportunities for

young researchers. Half of the respondents also believe that the material resources and equipment of US research labs is much better in the US while only 20% rate this aspect higher in Germany.

The US is also winning from a communication and relationship point — the majority of the respondents state that communications at all hierarchical levels, performance and achievement orientation of the academic career system are superior in the US, which are also assessed to be more flexible in the opportunities offered for interdisciplinary research.

Greater transparency (over 50% of the respondents) is considered the criteria used in academic appointments in the US. The *objectivity and fairness* of research grant awards are considered by the interviewees of equal standard in both countries.

Finally and surprisingly, none of the respondents attributed to Germany, in any of the dimensions covered by the survey, a higher score compared to the US.

Overall, the US seems to register a higher degree of flexibility and openness to new types and areas of scientific knowledge and ensure faster progress in terms of scientific advance. While the US is clearly dominating in the postdocs segment that ensure greater speed of scientific advance, the respondents' perception is different concerning the training up to the doctorate that is considered equally good (31%) or even better (28%) in Germany. This may explain why the US is welcoming so many Germans postdocs and why so many Germans continue their research in the US.

4.2. Countries of Destination of German students

In terms of countries of destination within Europe, German students are predominantly attracted by the UK which host 19.3% of the German students followed by France with a share of 13.8%. Spain and Italy are less favoured by German students (with 6.9% and 5.6%,

Country	Percent	Country	Percent
Austria	2.8	Italy	5.6
Belarusse	0.2	Netherlands	1.9
Belgium	0.8	Norway	0.9
Bulgaria	0.1	Poland	0.6
Czech Republic	0.8	Portugal	6.9
Denmark	0.6	Romania	0.2
Estonia	0.1	Spain	6.9
Finland	0.7	Sweden	1.8
France	13.8	Switzerland	3.8
Greece	0.9	Turkey	0.7
Hungary	0.9	Ukraine	0.1
Iceland	0.1	United Kingdom	19.3
Ireland	1.8	Yugoslavia	0.2

respectively) (Table 18).

An analysis of global flows highlights that:

- 63.0% of German students access European universities;
- 15.7% of German students are studying in both Canadian and US universities;

- 3.4% are doing their research in Africa
- 5.7% are currently based in Eastern Europe
- 4.4% are studying in Asia
- 2.3% in the Middle East.

5. Government Initiatives to Reduce Brain Drain and Stimulate Brain Gain

The German Government has recently announced an \$82 million package of measures aimed at increasing its scientific talent. The establishment of new programs at the Alexander von Humboldt Foundation and the Academic Exchange Service Agency is the first step to encourage top scientists to collaborate with Germany and prevent young talent from leaving the country.

The Alexander von Humboldt Foundation promotes international cooperation between scholars from abroad and specialists in Germany. The Foundation has built up an international network that currently accounts for more than 20,000 individuals in 130 countries.

The scope of the Foundation includes an aim to maintain intensive academic, cultural, political and economic contacts with Germany. Various sponsorship programmes sustain the access of new members every year, together with contact established on a long-term basis that are sustained via specific funding.

During the year 2000, 2,036 academics were sponsored by the foundation under its regular programmes. In addition, the Foundation also grants a variety of other fellowships, awards and cooperation funding.

The Foundation, whose main founder is the Ministry of Foreign Affairs, ensures maximum freedom and flexibility to its scholars. Researchers are free to choose the time and content of research periods within a broad framework.

In 2000, the sponsored scholars were divided as follows:

- 429 research fellows began research in Germany;
- 619 research fellows extended research visits beyond the originally planned period;
- 329 research fellows continued their research projects in Germany after an interruption;
- 63 research fellows spent periods of between one and three months in Germany at the invitation; of the Foundation and their German academic cooperation partners.

In total, the Foundation sponsored academic work carried out by a total of 1,440 research fellows from 90 countries and in some cases funded visits by family members to Germany.

The 2000 annual report from the Foundation highlights that the majority of scholars came from European countries (44%). The largest number of sponsored guest researchers from any one country showed The People's Republic of China sent 161 research fellows, followed by India (149) the Russian Federation (119), the USA (116), Poland (73) and Japan (67). The given geographic structure has been relatively stable over the past four years.

With regard to disciplines, a relatively steady continuity in the allocation of research

fellowships has been registered. The ratio of humanities and social science scholar was 27%, the natural scientists were 62% and engineers 11%.

Apart from research fellowships, the Foundation also grants awards to internationally renowned scholars as a lifelong tribute to past academic accomplishments.

Altogether, 290 Humboldt Research Award winners participated in research programmes in Germany in the year 2000, 217 of which were natural scientists, 38 came from humanities and social sciences and 35 were engineers. As in previous years, the majority of research award winners came from the US.

In cooperation with the Max Planck Society, the Foundation grants awards to foreign and German scholars to promote international academic cooperation at a high level of research. In 2000, 12 scholars were granted.

The Foundation is particularly active in promoting its network throughout the world via the Feodor Lynen Programme for young German scholars. The Feodor Lynen research fellows spend up to four years at the home institute of Humboldtians.

In the year 2000, the Foundation offered its foreign research fellows and award winners a wide range of opportunities to continue academic work in their home countries and to maintain contact with German partners in cooperation, namely:

- 329 scholars again spent extended research periods in Germany;
- 63 scholars returned to Germany following the invitation of the Foundation and their German academic hosts;
- 263 scholars received financial assistance enabling them to attend academic conferences in Germany to engage in short-term research with colleagues in Germany or to coordinate research projects;
- 177 scholars in 38 countries with limited foreign currency reserves received scientific equipment;
- 147 scholars in 51 countries received donations of academic literature.

The network is also sustained by the organisation of meeting between former Humboldt guest researchers and new participants. In the year 2000, those events were organised worldwide in countries of Ireland, Israel, Mexico, Ukraine, Moldova, and Vietnam.

Smaller programmes covered by the Foundation have granted:

- 23 prospective leaders from the USA in economics, political and social sciences and the arts, who came to Germany for a year;
- 38 young scholars from nine countries in central and eastern Europe;
- 35 transatlantic research projects by German and American humanities and social science scholars;
- 5 publications by guest researchers.

A recent study found that about 14% of German science students move to the US to start a graduate or postdoctoral position in the United States, and up to a third of them do not return.

The Humboldt foundation is using its share of extra funding — \$46 million over the next 3

years — to launch new programs and awards.

The Wolfgang-Paul awards aim to attract between 15 and 20 top scientists on a yearly basis by offering grants up to 3 million over three years. The grants are aimed mainly at non-German scientists though Germans who have worked abroad for more than 5 years can also benefit. Young scientists are also supported by the Humboldt foundation by a 3-year grant of up to \$1.1 million.

The Academic Exchange Service Agency (DAAD) will benefit of \$34 million over three years with a view to setting up 2 new programs:

- Innovatec which will support 50 guest scientist annually and open to professors at all levels outside Germany which intends to work within German Universities;
- a program that will fund exchanges of a considerable number of post graduate students.

Most probably in the near future all these initiatives, coupled with a considerable number of retirements will create, within universities, new opportunities for young and talented scientists.

Besides the initiatives to bring some 20,000 foreign computer experts to Germany, the government has simplified the procedures for obtaining a work permit for foreign IT professionals, designed to ease access into a country that is renowned for its tough immigration laws.

Under this new scheme, the work visas (20,000 targeting IT professionals in the year 2000) have benefited from a faster procedure. In order to fall into this scheme, applicants had to have a university degree or an assurance of a salary of 50,000 Euro per year. IT specialists were drained mainly from Russia that has been a key provider of people in the IT field. Germany can provide to these highly skilled professional more attractive working and living conditions compared to those existing in Russia. The drain is not solely affecting Russia. Germany's green card initiative has attracted application from China, India, Singapore and other Eastern European countries.¹⁴

6. Brain Gain in Germany

6.1 Professional Brain Gain

A recent survey¹⁵ on recruiting needs of German firms highlights that 39% of the 340 surveyed firms employ foreign highly qualified employees (FHQE). In these firms, highly qualified workers account for 9% of the workers. The average share among all German firms that were surveyed is 3.5%, which highlights a limited but not negligible level of international mobility. The concentration of foreign highly skilled workers is higher in certain sectors such as R&D and IT.

The analysis by country of origin highlights that German firms recruits mainly from Eastern Europe. The IZA research investigates the number, origin, skills and functions of foreign graduates, as well as the experiences of firms recruiting internationally. The survey

¹⁴ O.Yablokova (2000) "Brain Drain Fears From Germany's Labour Laws" Daily Telegraph 14th December 2000.

¹⁵ R.Winkelmann (2001) "Why do firms recruit internationally?" IZA, Bonn

highlights the reasons for recruiting internationally is predominantly a lack of special skills in the domestic market, being the skills international competence or specialized know how.

FHQE are a part of the high qualified employees category and differentiate from the latter substantially for having received their degree abroad and because they do not hold the citizenship of the country where they work.

Within the four countries surveyed by the IZA research (Germany, UK, The Netherlands and France), Germany is positioned at the bottom in terms of employment of highly qualified employees. Results for Germany show a share of 28.1% FHQE among all employees that is well below that of France where the figure is 39.4%. However, the German figure is not far

Country	Percent
Germany	28.1
France	39.4
UK	31.4
Netherlands	31.4
Total	32.6
Source: IZA International Employer Survey, 2000.	

from the 32.6% share of highly qualified persons of total employees reported for all countries in the survey (Table 19).

Almost 39% of the German firms investigated by the IZA declared to employ FHQE (Table 20).

Germany positions itself just above the average of the countries investigated by the IZA research but well below the UK that reports a presence of FHQE in 49.6% of the firms.

Among all highly qualified employees, the FHQE account for 9.1%. The figure for Germany is not that much different compared with the average reported for France and the UK each

Country	Share of all firms employing FHQE (Percent)	Average share of FHQE in firms with highly qualified employees (Percent)
Germany	38.9	9.1
France	34.4	10.9
UK	49.6	10.9
Netherlands	33.3	16.7
Total	39.1	11.9
Source: IZA International Employer Survey.		

with 10.9%. It is within the Netherlands the representation of foreign is highest — 16.7% (almost double the share reported in Germany).

Industry	Share of all firms employing FHQE (Percent)	Average share of FHQE in firms with highly qualified employees (Percent)
Chemical industry	41.0	9.9
Manufacturing	30.2	8.7
Financial services	30.8	6.1
IT	57.1	12.6
R&D	68.4	16.1
Total	45.5	10.7

Source: IZA International Employer Survey.

Table 21 shows the presence of FHQE across industries for German firms and all firms.

In Germany, the highest share of firms employing FHQE is reported in the R&D firms with 68.4% followed by the IT industry with 57.1%. Across the firms with FHQE, it is in the R&D sector the largest share are reported followed by the IT industry. The lowest presence is reported in financial services.

Table 22 highlights firms' international identity. Close to one in five (17.9%) of the German firms are a multinational. In terms of ownership structure, 34.6% of the firms report some

Category	Share foreign owned (Percent)
Multinational company	17.9
Foreign ownership	34.6
Main competitor abroad	17.6
English as most important language at management level	85.2
Share of foreign business	32.2

Source: IZA International Employer Survey, 2000.

foreign ownership. Foreign business accounts for almost one third of the business.

A large proportion of the firms addressed by the IZA research declared to invest at some level in R&D (76.5%) an activity which requires highly qualified employees without preference of their nationality (Table 23).

Orientation	Percent
Firm engaged in own R&D	76.5
Telework	42.9
Registration of patents during the last two years	61.5
Marketing and sales via the Internet	86.7

Source: IZA International Employer Survey, 2000.

More than half of the firms with technological orientation have proceeded to patent registration (61.5%). The Internet is an important tool with 86% of the firms using it for marketing or sales purposes. Telework records a low level of market penetration being used by less than half of the firms.

The IZA survey analysed the reasons for the recruitment of FHQE at two levels. First, do firms employ FHQE and what is the share of FHQE among all highly qualified employees? Second, understanding the causes for demand of FHQE can provide answers to a number of questions.

Why do German companies show relatively low presence of FHQE? How can this knowledge help predict a future scenario to estimate demand, both in terms of quality and quantity for proactive immigration policy rather than reactive? The IZA survey addresses two key questions:

- are FHQE predominantly in demand due to a local lack of skilled labour ?
- are they in demand due to the added value they can contribute in terms of competence and qualifications?

Table 24 provides a picture of the reasons why employers seek foreign workers. It should be noted that the questions in the IZA research were asked only of firms that employ FHQE.

Table 24. Reasons for the employment of FQHE.			
	Strongly agree	Somewhat agree	Disagree
Reasons	Percent		
Foreign highly skilled employees are the best applicants	8.9	39.5	51.6
There is a lack of good German applicants	11.1	43.6	45.2
They know foreign markets	34.9	28.6	36.5
They speak foreign languages	46.5	25.2	28.4
They speak English well	33.1	33.1	33.9
The type of knowledge required for these jobs is not produced by the German education system	4.7	23.6	71.6
Their skills better fit our work tasks	15.0	36.2	48.8
They have lower wage demands	0.8	9.4	89.8
They work harder	1.6	12.0	86.4

Source: IZA International Employer Survey, 2000.

It is quite striking to note that the highest concentration is found around language knowledge. German employers seek highly qualified workers, before everything else, for language needs and then because they provide intelligence on foreign markets.

A very small part of the firms interviewed (4.7%) strongly agree that FHQE are hired because they have a type of knowledge that is not produced by the German education system.

FHQE are not regarded as having a higher work ethic compared to Germans. In fact, only 1.6% of the firms agree that the foreign employees work harder than the German ones whereas while 86.4 % strongly disagreed.

A critical analysis of how the questions were formulated highlights that, apart from those on

foreign languages and foreign markets, all the others intrinsically compare, from a qualitative point of view, the FHQE with the German ones and perhaps predetermining the nature of the answers.

There are various reasons for a German company to recruit a specific candidate:

- his/her knowledge of foreign markets;
- his/her knowledge of technologies;
- his/her knowledge of the languages;
- local shortage of skills and competencies.

The IZA survey question on the country of origin of the foreign highly skilled employee has two components as highlighted by Rainer Winkelmann¹⁶: "Firstly respondents are asked to list all the countries from which some foreign highly skilled employees in the firm originate. In the likely case of multiple origins, it was then asked from which of the aforementioned countries most of the FHQE originate".

The EU countries dominate in terms of sources of origin headed by France. Particularly striking is the data regarding Eastern Europe — 41.1% of all firms employ qualified workers from those regions and for 18.4% of all firms, Eastern Europe is the main source. Eastern Europe has become the leader compared to other non-EU regions such as North America (7.8%), Asia (4.8%) and North Africa (1.9%) Table 25).

Country/region	Any FQHE from (Percent)	Most FQHE from (Percent)
France	41.9	11.6
Netherlands	21.8	5.8
UK	40.3	8.7
Austria	29.8	10.7
Switzerland	18.5	1.0
Other EU	53.2	24.3
Eastern Europe	41.1	18.4
North America	37.1	7.8
Asia	29.8	4.8
North Africa	16.9	1.9
Other	16.9	4.9
Source: IZA International Employer Survey, 2000.		

In terms of region of origin of the FHQE, Germany has the smallest proportion of firms that exclusively employ FHQE from EU-countries and the largest share of firms that predominantly or exclusively employ FHQE from non-EU countries.

Winkelmann states in his research that: ".....this could seem astonishing since it is commonly claimed that obtaining a work permit in Germany can be highly problematic, and since the recruitment of these FHQE from non-EU countries has taken place prior to the

¹⁶ Quot. R.Winkelmann (2001) "Why do firms recruit internationally?" IZA, Bonn pag 11.

German Green Card initiative. The data clearly show that recruiting internationally was possible even within the previous legal framework"¹⁷. Eastern Europe leads in terms of supplies of FHQE followed by North America and Asia (Figure 1).

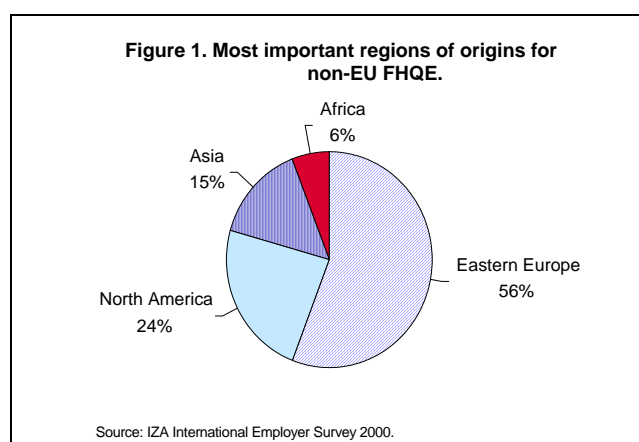


Table 26 provides a breakdown of educational qualifications of German highly qualified employees and FHQE within firms that employ highly qualified employees. It shows that among native Germans, persons who have a background in business studies account for the largest share (69.5%) followed by computer scientists (64.8%), persons with expertise in engineering and mathematics (56.2%).

Field of degree	Native Germans (Percent)	FHQE (Percent)
Engineering	56.2	45.2
Mathematics	56.2	38.9
Computer science	64.8	47.6
Law	21.9	4.8
Business studies	69.5	40.5
Medicine	11.7	7.1
Other fields	14.8	9.5

Source: IZA International Employer Survey, 2000.

A different scenario emerges for FHQE who appear to be recruited by German firms mainly for their knowledge and skills in computer sciences (47.6%) and engineering (45.2%). Persons with business studies rank third with a 40.5% share.

Given professional functions are, in most cases, directly related to the field of study, we can observe a certain degree of consistency between the data shown in Table 25 and Table 26. The results observed in Table 26 are supported by the results presented in Table 27.

¹⁷ Quot. R. Winkelmann (2001) "Why do firms recruit internationally?" IZA, Bonn pag 17.

Table 27. Function of domestic and foreign highly qualified employees.				
	Domestic HQE		FHQE	
	All responses	Most frequent responses	All responses	Most frequent responses
Sector	Percent			
R&D	59.8	42.1	52.3	40.5
IT	32.3	10.3	25.0	14.1
Production	22.8	7.1	14.1	7.4
Marketing, distribution	39.4	19.8	35.9	17.4
Administration	29.9	6.3	18.7	7.4
Other	15.0	14.3	15.6	13.2

Source: IZA International Employer Survey, 2000.

Within Germany, a certain amount of international mobility of the highly qualified employees emerges, especially among those in R&D and IT. With regard to the regions of origin, this varies depending on the sector. However, overall we can observe that Germany tends to source its highly qualified people from Eastern Europe.

Two main considerations can be made with regard to the reasons why German companies recruit from abroad. Companies recruit abroad with the scope to acquire access to knowledge that is not available nationally and, they seek the competence and skills of foreign-born persons and/or persons who have lived abroad extensively.

6.2. Educational Brain Gain

The dynamics of migration flows are changing. Once brain drain was a phenomenon affecting developing countries or, those countries positioned between the industrialised economies and the emerging ones. More recently, however, brain drain has increasingly affected western European societies that have are facing the need to be more attractive from a research and professional point of view. This is important not only to attract new and fresh talents but also to keep their own intellectual capital from heading increasingly to the US.

The contraction in the number of postgraduate students and the increased need for qualified personnel in the emerging areas such as IT, biotechnology, finance has made the phenomenon of brain drain even more relevant.

After September 11th 2001, foreign students seemed to experience more difficulties in obtaining permits to study in Germany. Police controls have increased, and the social pressure has grown up on foreign students, especially on those arriving from the Middle-east and Northern Africa.

Foreign students who do not belong to the EU must prove to have a deposit of at least 5,000 Euros in their bank account and in some of the Lander a deposit of 5,000 must be available over the duration of the student's course of study.

Legally, foreign students cannot work for more than 90 days. Most of the students fully

subsidize their studies abroad which makes their life quite difficult.

Most of the students who come to Germany are supported by a preexisting network. For example, foreign students come to Germany because they have relatives who can help, university education is free and because to move to Germany is quite easy. Students who have low incomes do not come to Germany but instead go to the US, Australia or Canada (Der Kontext).

In 1998, the German scientific community created the Emmy-Noether Program, an initiative aimed at attracting German-born scientists who, in the past, emigrated back to Germany. This initiative has as a key objective the sustainability of projects of young and talented researchers abroad and assist them in setting-up, once back in Germany research group in any German university.

An additional initiative to reduce the effects of the brain drain is the *junior professor initiatives*, modeled on the basis of the US experience, which has the scope to provide young researchers with temporary contracts within universities.

Germany is one of the European countries trying to address increased competition in the area of brain drain at the global level which in real terms is headed by the US.

7. Intellectual Capital: Self-Production or Buying Out?

The process of producing human capital requires investment in research and schooling. Alternatively, an economy can opt for the "free ride" and import human capital that has been produced and finance elsewhere. From a historical perspective, most economies have had the tendency to produce their intellectual capital and to accumulate it, and schooling has been perceived as a national activity.

The high mobility of human capital has fundamentally changed and challenged the traditional thinking. Moving around the globe has become easier for highly skilled people. The barriers are easier to overcome for knowledge workers compared to the less skilled emigrants. The progress in telecommunication and the modern transportation systems facilitates mobility. Cyberspace and the telecoms infrastructure allow skilled people to decide where to live and they do not need to move to provide their services. As highlighted from Straubhaar¹⁸ "All this means that the place of generation or production and the place of use of human capital might differ substantially".

If from the one side high mobility of human capital can guarantee accessibility of knowledge from any place in the world, then from the other side there is no guarantee that investment in knowledge creation will increase the welfare of the nation who is responsible for the knowledge production. Studies have shown that investment in knowledge creation can subsidize the economy of countries where the high skilled people have migrated.

With a view to become a magnet for highly skilled human capital, Germany (as with the rest of Europe) should consider the design and implementation of a strategy to retain its own highly skilled persons and how to attract those from abroad. How can Germany make the best of knowledge produced elsewhere? This shift in the focus creates a new environment in which strategy and decision-making should be identified and implemented.

¹⁸ T. Straubhaar (2000) "*International Mobility of Highly Skilled: Brain Gain, Brian Drain or Brain Exchange*", Discussion Paper HWWA Hamburg

One way to proceed could be the identification of the main factors attracting the high skilled. Highly skilled persons are particularly sensitive about quality of life, are keen to live in countries where there is safety, freedom of choice, where their intellectual growth is continuously nourished and where they can raise a family. This means that a number of factors, besides the financial and knowledge ones, play a vital role in the decision making process.

Since the collapse of the communism, Germany and Europe have had a great opportunity to attract people from Eastern Europe who could contribute to Western European economies with their knowledge, competence and skills. The fear of a cultural and numerical invasion from Eastern Europe has prevented Western Europe from putting in place systems aimed at attracting and retaining persons with fundamental skills, especially in the sectors that have suffered due to a lack of human capital (i.e. technology, telecoms, health, etc.).

The dynamic of development of high skilled people seems to be following the thinking of Straubhaar. First of all, as proved by the US, there is a close connection between research centers and the industrial world. These clusters attract high skilled people, and especially students who are keen to invest in those areas where the career perspectives are higher. The chances to work in areas where innovations are high attract highly qualified persons who seek strong career prospects. Highly skilled persons are also attracted to establishments that invest in human capital and, last but not least, industries are attracted to invest in these areas as human capital and skills are easily accessible.

Straubhaar affirms that evidence of this can be seen in Europe too highlighting the example of students in finance and public administration in places such as Frankfurt and London where the chance to access the banking and finance worlds are quite high. Many of the students apply for temporary jobs and internship while studying with a view to access a job at the end of their studies.

8. Conclusions

Migration patterns have changed dramatically over the years and the belief that migration is simply a phenomenon affecting the poorest of the world has left the place to a more rounded understanding of migration.

A recent study of IMF (Garrington and Detragiache,1997) proves 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.

Migrants to the US, for example, tend to be better educated than the average person in their home country and the proportion of very highly educated people who migrate is particularly high (Garrington and Detragiache,1999).

In today's global economy, brain gain is of strategic relevance for the growth and wealth of nations in the 21st century, a notion the US has clearly understood and reacted to successfully.

Germany and Europe seem to have adapted more slowly. Instead of adopting a strong policy to foster brain gain, they have so far experienced more of a *brain exchange*, a phenomenon that has being pushed by the 'Europeanisation' of the production system and from a more flexible and integrated labour market.

Evidence suggests Germany and Europe seem not to have identified the way to become a more interesting and challenging place so as to attract the "brains" of the world and move to the forefront of research with a view to become a global leading innovator in services and production.

Geographically, there are areas that attract those who are more skilled and the highly qualified tend to gravitate around these areas fastening economic and social growth of certain regions. The less attractive regions become increasingly 'outsiders' in the overall growth process and amplify the brain drain-brain gain effect.

To simply subsidize the creation of intellectual capital has proved not to be the solution as this can lead to subsidy of other countries who attract these persons. To some extent, this is what we see with Europe supplying the US. Overall, it seems that in order to maintain and accumulate knowledge, Germany has to become more attractive to the highly qualified people searching for a balanced ratio amongst innovation, links between research and industries, multiculturalism, flexible work system and taxes.