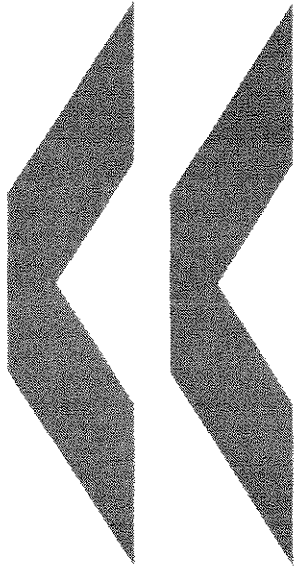


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Labour Market Characteristics and International Mobility of Doctorate Holders

RESULTS FOR SEVEN COUNTRIES

Laudeline Auriol

Senate Standing Committee on Economics
Budget Estimates 2008-09
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**LABOUR MARKET CHARACTERISTICS AND INTERNATIONAL MOBILITY OF DOCTORATE
HOLDERS: RESULTS FOR SEVEN COUNTRIES**

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Statistical Analysis of Science, Technology and Industry

Laudeline Auriol

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**LABOUR MARKET CHARACTERISTICS AND INTERNATIONAL MOBILITY OF
DOCTORATE HOLDERS: RESULTS FOR SEVEN COUNTRIES**LAUDELINÉ AURIOL, OECD (laudeline.auriol@oecd.org)**ABSTRACT**

This paper presents the first results of a project initiated in 2004 by the OECD in collaboration with Eurostat and the UNESCO Institute for Statistics, and aimed at developing a regular and internationally comparable production system of indicators on the careers and mobility of doctorate holders. A first data collection was launched in September 2005, from which the results for seven countries are presented here. These data shed light on the main demographic, educational, labour market and mobility patterns of doctoral graduates. They also mark some progress in the understanding of both the measurement issues and patterns of international mobility, notably by the use of qualitative indicators such as the intentions or reasons for mobility.

The results show in particular that the share of doctorate holders in the population or labour force is two or three times larger in Germany and Switzerland than in Australia, Canada and the United States. In these five countries, women represent only one-quarter to one-third of doctorate holders. The United States has an older population of doctorate holders than the other countries analysed in the paper and this population is still ageing, as is also the case in Canada. Unemployment rates of doctorate holders remain low, but are relatively higher in natural sciences and in engineering. There are important salary differences between men and women and across sectors, especially in the United States. In the United States, as well as in Portugal and Argentina, salary is one of the main reasons why doctoral graduates are dissatisfied with their employment situation. There is a high share of foreign doctorate holders in Switzerland and also a higher share of foreign-born doctorate holders in Canada and Australia than in the United States. Many foreigners, however, come to work to the United States having been trained for research abroad and this trend has grown stronger in recent years. On the other hand, very few doctorate holders from the United States are internationally mobile. Among mobile young Canadian citizens, three-quarters choose the United States as their next destination.

N.B. This working paper also exists in French.

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LABOUR MARKET CHARACTERISTICS AND INTERNATIONAL MOBILITY OF DOCTORATE HOLDERS: THE CASE OF SEVEN COUNTRIES

Introduction

In the past years, many countries around the world have set their R&D spending targets in percentage of GDP: for example, Canada has had a target of 1.94% by 2010, China has one of 2.5% by 2020, the European Union one of 3% by 2010. The formulation of such targets acknowledges the importance of research and innovation in a competitive and globalised economy and implies the availability of a highly skilled workforce. In the case of the European Union, it was estimated that at least 500 000 more researchers would be needed to reach the target of 3% by 2010. Doctoral graduates are at the same time the most qualified people in terms of educational attainment and those who are trained and most predisposed for research careers. They are expected to contribute to the advancement and diffusion of knowledge and technologies. While higher education systems undergo many transformations everywhere, little is known about the current developments in the career paths of doctoral graduates and recent work at the OECD has raised a number of questions about their education-to-work transition, employment and mobility patterns (Auriol, 2004). Do we train too many or too few of them? To what extent are they in competition with other graduates? Are they fully operational when they arrive on the labour market after many years of study? What is the role of postdoctoral positions? How many leave research for other types of jobs? For which reasons? What is their employment pattern in terms of public vs. private sectors? Are they mobile across sectors and internationally? In order to get responses to these questions and better understand the situation of doctorate holders on the labour market, the OECD initiated in 2004 a collaborative project with the UNESCO's Institute for Statistics (UIS) and Eurostat on careers of doctorate holders (CDH). The first results of this project are presented in this paper.

Brief description of the CDH project

As early as 2002, the OECD Secretariat explored the potential of graduate and/or doctorate surveys. A paper on "Entry of Doctorate Recipients into Working Life: Survey Systems of France, the United States and the United Kingdom – Points of Comparison" [DSTI/EAS/STP/NESTI(2002)19] was prepared by a consultant for a workshop on human resources in science and technology organised in 2002. This work was followed by the establishment of an inventory of doctorate recipients' surveys in OECD countries, which was presented at a subsequent workshop in 2003. The inventory on "Availability and Characteristics of Surveys on the Destination of Doctorate Recipients in OECD Countries" [DSTI/DOC(2003)9] has shown that many such surveys existed at national level and that they provided valuable information for the understanding of career patterns and mobility of the most highly educated population and of researchers, who are recruited for a large part among doctorate holders. However, such surveys had been developed to serve national statistical needs and priorities and were not harmonised internationally, therefore limiting international comparison of the results and failing to capture some important characteristics of this cadre of talents, such as their international experience or mobility.

For this reason, the OECD launched in 2004 a collaborative project to improve countries' capability to survey recipients of highly advanced (doctorate level) degrees. The objective is to develop an

internationally comparable production system of indicators on their careers and mobility building on surveys currently existing in some countries (in particular those of the United States and Canada) and on other data sources. An important element of this work is to measure the mobility of doctorate holders both within a country and across borders. Interest in cross-border movements requires surveys to be internationally comparable, and the OECD to partner with other relevant international organisations, *i.e.* UIS and Eurostat.

An expert group was set up at the end of 2004 to develop the different components of the work. Currently, the expert group brings together some 30 countries from a wide variety of regions world-wide and at different stage of development. Large OECD countries such as the United States and Japan are represented, as well as numerous European countries, but also important emerging economies – *e.g.* China and India – and developing countries (*e.g.* Uganda) concerned with their loss of talents. However, the involvement of these countries in the project varies according to the development of their statistical system and the resources they may dedicate to it.

In 2005, the group worked on the development of a three-component package – methodological guidelines, output tabulations and a core model questionnaire – in co-ordination with the three international bodies involved. A first metadata and data collection was launched in Autumn 2005, which provided a first set of results for seven countries: Argentina, Australia, Canada, Germany, Portugal, Switzerland and the United States. It is the aim of this paper to present and analyse these results.

Labour market characteristics and international mobility of doctorate holders: first results for seven OECD countries

Data availability and sources

The project on careers of doctorate holders (CDH) aims at determining the stock of persons having obtained a highly advanced degree across participating countries, as well as their demographic and educational characteristics, their labour market situation and international mobility. In addition, the ambition of the project is to give information on the career development and prospects of doctorate holders. The approach is therefore wide and the project, for this reason, draws on all data sources that may provide information at national level while aiming to report in a harmonised and internationally comparable manner.

Censuses and labour force surveys are widespread and reasonably harmonised data sources at international level. They can provide the basic contextual data on doctorate holders that are needed in addition to the more complex indicators on career path or trajectories emanating from cohort, longitudinal or retrospective surveys. Five of the seven countries that reported data in this first exercise have extensively drawn from their census and/or labour force survey, while sometimes also using other data sources.

The data for Australia and Canada are for the most part generated by the national censuses, while those for Germany and Switzerland originate from the labour force surveys. The data for the United States, on the other hand, come from dedicated surveys – *i.e.* the *National Survey of College Graduates* and the *Survey of Earned Doctorates*. Canada has also conducted a *Survey of Earned Doctorates* in 2003 and 2004 on the model of the one in the United States and also used some of the results for data provision in this exercise.

Argentina and Portugal on the other hand have conducted dedicated surveys using the core model questionnaire developed in the framework of the project. In the case of Portugal, the survey was a pilot test before the first full-scale international survey planned for 2007. For this reason, the data presented here for

Portugal only cover recent doctorate holders, those having received their doctoral degree between 2000 and 2004, while the whole population of doctorate holders is covered in the aforementioned countries. In the case of Argentina, only employed doctorate holders are covered. In addition, those doctorate holders who work exclusively for the business sector (without having any academic activity) are not covered, but it would seem that their number is quite limited. For more details on data availability and sources, see Annex Tables 1 and 2.

Number of doctorate holders in the population

The data collected in the framework of the CDH project helps determine the number of doctorate holders in the population and in the labour force (Table 1) and shows a very contrasted situation between some of the European and non-European countries having participated in this first exercise. The share of doctorate holders in the population or labour force of Germany and Switzerland is two or three times higher than in Australia, Canada and the United States. It is well known that European countries produce a higher share of university and especially doctoral degrees than the United States (OECD, 2005) and graduation rates calculated from official education statistics and shown in Table 1 confirm this. In the case of Germany and Switzerland (but not Portugal), it seems that this also translates into a high percentage of doctorate holders in the population and labour force. However, data are not available for a sufficient number of countries to see if this pattern can be generalised to other European countries. There may also be questions on what is counted as a doctorate in each country and how the ISCED¹ level 6 definition of an advanced research degree is applied. The data for Germany and Switzerland, for instance, comprise doctoral degrees in medicine which are not counted under ISCED 6 in the United States. This, however, is not sufficient to explain the differences in the volume of degrees delivered between these countries.

Table 1. Number of doctorate holders in the population

	Argentina (2005)	Australia (2001)	Canada (2001)	Germany (2003)	Portugal (2004)	Switzerland (2003)	United- States (2003)
Number of doctorate holders per thousand population ¹	0.2	5.9	6.5	15.4	2.1	23.0	8.4
Number of doctorate holders per thousand labour force ¹	0.5	7.8	8.2	20.1	2.6	27.5	10.7
Graduation rates at doctoral level ²		1.3	0.8	2.0	2.5	2.6	1.3
New doctorates per 100 university graduates		2.3	3.9	11.2	7.0	10.1	2.3

1. Doctorate holders and population of 25-64 years old, except for Argentina (total doctorate holders and total population).
2. Graduation rates are for 2002; they are calculated as the number of persons receiving a doctorate level degree as percentage of the population at the typical age of graduation.

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders and OECD Education database.

Demographic characteristics of doctorate holders

The first striking demographic feature of doctorate holders is that of the under-representation of women. With the remarkable exception of Argentina (and Portugal, to a lesser extent), men represent at least two-thirds and sometimes up to three-quarters of doctorate holders in the five other countries. The balance is a bit better in the United States and Germany than it is in Australia and especially Canada and Switzerland. The situation is also improving over time, as can be seen from the two countries (Canada and the United States) that have reported data with an interval of some years (Table 2). This improvement can be attributed to a catching-up phenomenon when looking at the age structure of doctorate holders: except for Argentina, women are in all cases younger than men (Figures 1 to 8).

1. The ISCED (International Standard Classification of Education) is used for classifying educational programmes and degrees at international level.

Table 2. Sex breakdown of doctorate holders

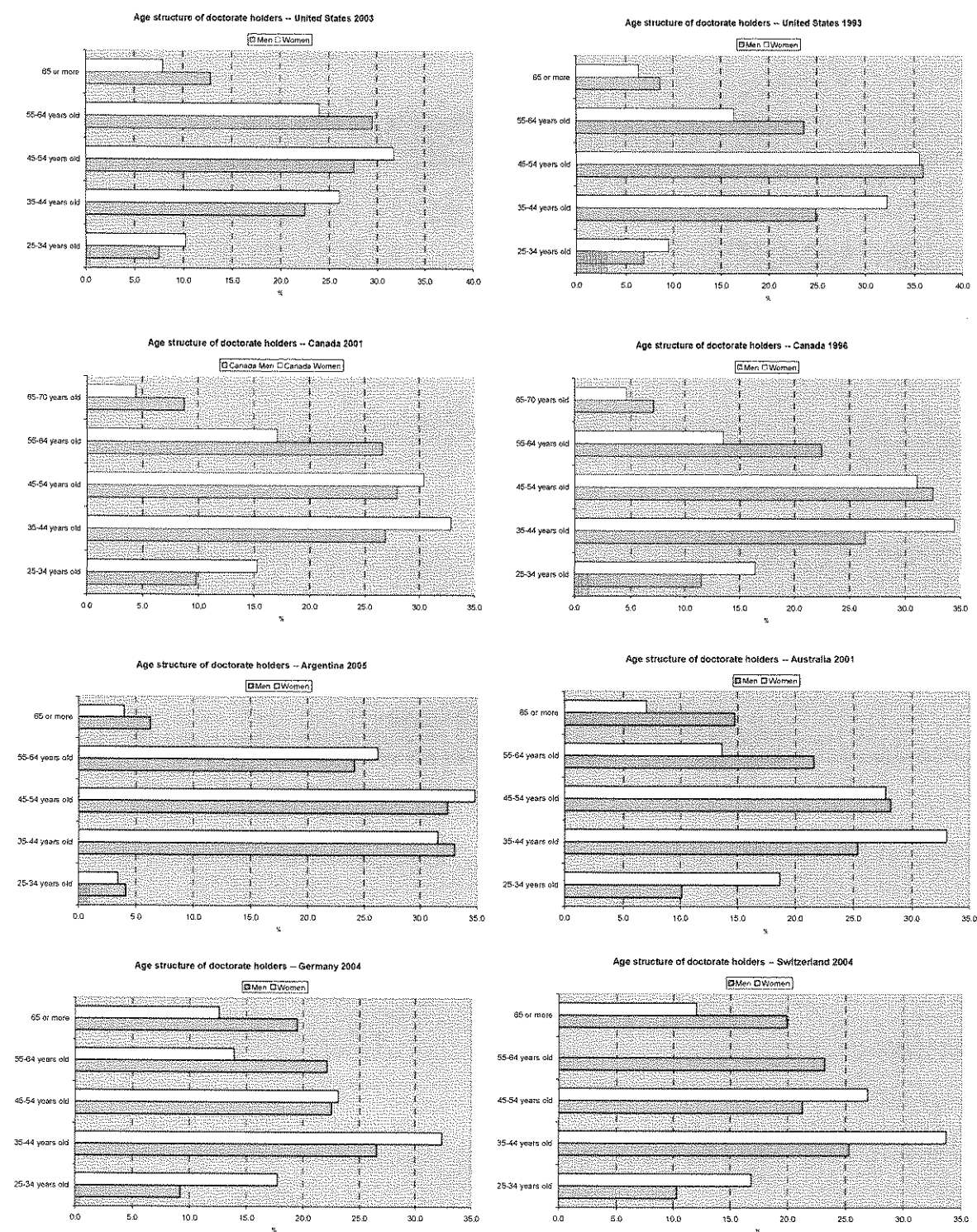
Argentina	2005	Men	56.9
		Women	43.1
		Total	100.0
Australia	2001	Men	71.8
		Women	28.2
		Total	100.0
Canada	1996	Men	76.2
		Women	23.8
		Total	100.0
	2001	Men	73.2
		Women	26.8
		Total	100.0
Germany	2004	Men	67.8
		Women	32.2
		Total	100.0
Portugal	2005	Men	60.8
		Women	39.2
		Total	100.0
Switzerland	2004	Men	73.2
		Women	26.8
		Total	100.0
United States	1993	Men	73.9
		Women	26.1
		Total	100.0
	2003	Men	66.0
		Women	34.0
		Total	100.0

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

The age distribution of doctorate holders varies from one country to another. The youngest population is found in Australia with 40% of doctorate holders under 45 years old and 32% over 55. Germany and Switzerland also have around 40% of their population under 45, but a higher percentage (36.7% and 37.6% respectively) is over 55 years old. The United States has an older population of doctorate holders characterised by both a higher share of people over 55 (38.8%) and a lower share of people under 45 (32.2%). Canada is in an intermediary situation between the two European countries and the United States with 35.6% of persons over 55 and 37.6% under 45. Data for Canada and the United States also show that the population of doctorate holders has aged over five or ten years of interval.

The age distribution of doctorate holders in Argentina is characterised by a very high share (more than 60%) of those between the ages of 35 and 55, and a very low share (around 4%) under 35. Could it be that the young doctorate holders are mainly employed in the business sector (not covered by the survey) or abroad?

Figures 1 to 8: Age structure of doctorate holders in six OECD countries



Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Educational characteristics of doctorate holders

Doctoral degrees are granted at a younger age in Germany and Switzerland (around 32-33 years old) than in Australia, Canada or the United States (35 to 37 years old) or Portugal (37 to 38 years old) as may be seen from Table 3. This may be explained by different factors affecting the organisation of higher education at national level: structure of programmes, public or private funding of institutions, access to doctoral fellowships/scholarships, dependency on loans, or the need to work to finance one's studies.

Table 3. Age at graduation of doctorate holders (in years)

	Australia 2002-2003		Canada 2003-04	Germany 2003-04	Italy 2003		Portugal 2000-04		Switzerland 2004		United States 2003	
	average	median	average	average	average	median	average	median	average	median	average	median
Men												
Natural sciences	33.0	30.0	32.0	32.2			35.0	34.0	31.0	30.0	33.8	30.9
Engineering and technology	34.0	32.0	34.0	34.1			35.8	35.0	31.6	31.0	35.2	31.6
Medical sciences	36.0	35.0	33.0	32.7			40.0	39.0	32.5	31.0	40.2	34.4
Agricultural sciences	37.0	37.0	38.0	34.1			38.6	38.0	32.6	32.0	35.5	33.8
Social sciences	42.0	41.0	39.0	33.4			42.0	41.0	33.8	32.0	40.1	36.4
Humanities	43.0	42.0	37.0	36.9			43.4	41.0	37.1	35.0	39.3	34.7
TOTAL	37.0	35.0	35.0	33.2	31.7	32.0	38.2	37.0	32.6	31.0	36.8	32.9
Women												
Natural sciences	32.0	29.0	32.0	31.5			34.8	34.0	30.7	30.0	32.9	30.5
Engineering and technology	34.0	32.0	33.0	33.5			34.9	34.0	32.8	31.5	34.3	30.5
Medical sciences	36.0	34.0	34.0	31.4			37.5	38.0	31.1	30.0	42.9	39.9
Agricultural sciences	34.0	32.0	35.0	31.8			38.4	38.0	31.1	30.0	34.0	32.9
Social sciences	41.0	40.0	39.0	33.2			41.0	40.0	34.3	32.5	40.2	37.1
Humanities	42.0	41.0	39.0	35.6			41.8	40.5	37.0	35.0	38.9	34.4
TOTAL	37.0	35.0	37.0	32.3	31.6	32.0	37.8	37.0	32.2	31.0	38.1	34.0

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

The time to complete a doctoral degree also appears to be much longer in the United States than in other countries, *i.e.* longer by approximately 30 months (Table 4). This may partly be explained by the fact that the duration in this country is calculated from the start of graduate school since students may join a doctoral programme just after their bachelor degree. Many however will first prepare a master degree. Another reason explaining the longer duration of doctoral degree completion is the lesser access to fellowships or scholarships and the need for students in the United States to work as research or teaching assistants in parallel with the preparation of their thesis (Table 5).

Table 4. Time taken to complete a doctoral degree (in months)

	Australia 2002-2003		Canada 2003-04	Portugal 2000-04		United States 2003	
	average	median	average	average	median	average	median
Men							
Natural sciences	67.0	59.0	63.0	63.5	61.0	92.3	83.0
Engineering and technology	64.0	59.0	63.0	67.2	63.0	88.8	83.0
Medical sciences	64.0	60.0	68.0	63.1	58.0	97.5	90.0
Agricultural sciences	70.0	62.0	70.0	68.3	66.0	96.3	87.0
Social sciences	72.0	70.0	75.0	66.1	61.0	113.5	96.0
Humanities	69.0	60.0	78.0	70.0	66.5	117.4	108.0
TOTAL	68.0	60.0	69.0	66.1	62.0	101.1	89.0
Women							
Natural sciences	66.0	60.0	65.0	65.2	62.0	86.1	80.0
Engineering and technology	64.0	59.0	62.0	66.2	65.0	85.5	80.1
Medical sciences	65.0	60.0	67.0	64.6	63.0	106.9	96.0
Agricultural sciences	69.0	60.0	61.0	69.6	68.5	90.3	84.0
Social sciences	71.0	68.0	73.0	66.1	63.0	109.0	96.0
Humanities	73.0	71.0	85.0	78.3	75.0	118.1	108.0
TOTAL	68.0	62.0	72.0	67.6	65.0	103.5	92.0

Note: In the United States, time to complete is defined as duration between starting and completing graduate school.

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Differences in graduation age and time for completion between men and women are not very significant in four countries out of seven. However, women obtain their doctoral degree on average at the

age of 37 in Canada compared to age 35 for men. Women are also more than one year older than men when they earn their degree in the United States. The opposite is true in Germany.

Table 5. Primary source of funding during completion of doctorate

	Argentina	Canada	Portugal	United States
Primary source of funding				
Fellowship, scholarship from institution	15.3	10.0		
Fellowship, scholarship from government	37.0	34.3	40.8	9.3
Fellowship, scholarship from abroad	8.9			0.3
Teaching assistantship	8.7	9.2	42.5	11.5
Research assistantship	1.9	11.1	2.3	21.5
Other occupation	14.2	10.0	2.0	2.9
Employer's reimbursement/assistance	0.4	4.0		1.3
Loan	0.0	1.7	0.1	2.0
Personal savings	6.8	4.1	9.6	0.2
Spouse's, partner's or family support	2.8	5.5	0.3	5.5
Other	1.0	10.1	2.5	8.6
Unknown	3.0			36.9
Total	100.0	100.0	100.0	100.0

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

There are also differences in graduation age and completion time by field of doctoral degree: it takes longer to prepare a thesis in humanities or social sciences than one in medical sciences, and even longer than one in natural sciences or engineering and technology. This again may be due to a number of different factors. First, field work in humanities or social sciences may take longer than laboratory experiences in natural sciences or technology. Second, the availability of public funding and/or fellowships/scholarships in natural sciences and engineering is probably more substantial than in social sciences or humanities. The data in Annex Tables 3 to 6 confirm this: a higher percentage of students in natural sciences and engineering benefit from fellowships or scholarships and from teaching or research assistantships. Students in social sciences and humanities on the other hand are more dependent on other forms of funding such as other occupations, loans, personal savings or family support.

These results converge with the findings of S. Kergrach and M. Cervantes (2006) who report that "the average duration of PhD programmes is variable across countries from a minimum of 3 years to a maximum of 6 or 7 years. (...) Generally PhD studies are longer in humanities, social sciences or theology. (...) International differences in the duration of PhD studies may be due to a range of factors such as the availability and amount of funding for PhD studies, the structure of academic programmes, the labour force status of PhDs and post-doctorates (i.e. students versus employees)."

Labour force status of doctorate holders

Many studies show that highly educated people have better employment and job prospects than those who were not able to pursue higher education (L. Auriol, 2003). This is indeed the case, as confirmed from the data presented in Table 6. Inactivity rates of university graduates are half of those of the overall population and their unemployment rates also substantially lower. Doctorate holders are also less frequently unemployed than other university graduates. This table also shows that the overall labour market situations may be quite different from one country to another, which also has an impact on the situation of university graduates and doctorate holders.

Table 6. Inactivity and unemployment rates by level of education (per cent)¹
(25 years old and more)

	Inactivity rate			Unemployment rate		
	Total population	University graduates	Doctorate holders	Total population	University graduates	Doctorate holders
Australia (2001)	24.0	12.4	15.6	5.2	2.6	2.3
Canada (2001)	33.7	18.7	19.1	6.1	4.5	3.7
Germany (2003) ²	41.9	21.2	22.7	9.8	4.8	3.2
Portugal (2003)	34.9	9.6	6.6	5.2	4.8	2.5
Switzerland (2003) ²	32.5	16.6	19.0	3.4	3.5	
United States (2003) ³	21.0	14.3	11.1	5.3	3.0	2.9

1. Inactivity rate is defined as the number of inactive people in percentage of the total population; unemployment rate is defined as the number of unemployed people in percentage of the total labour force.

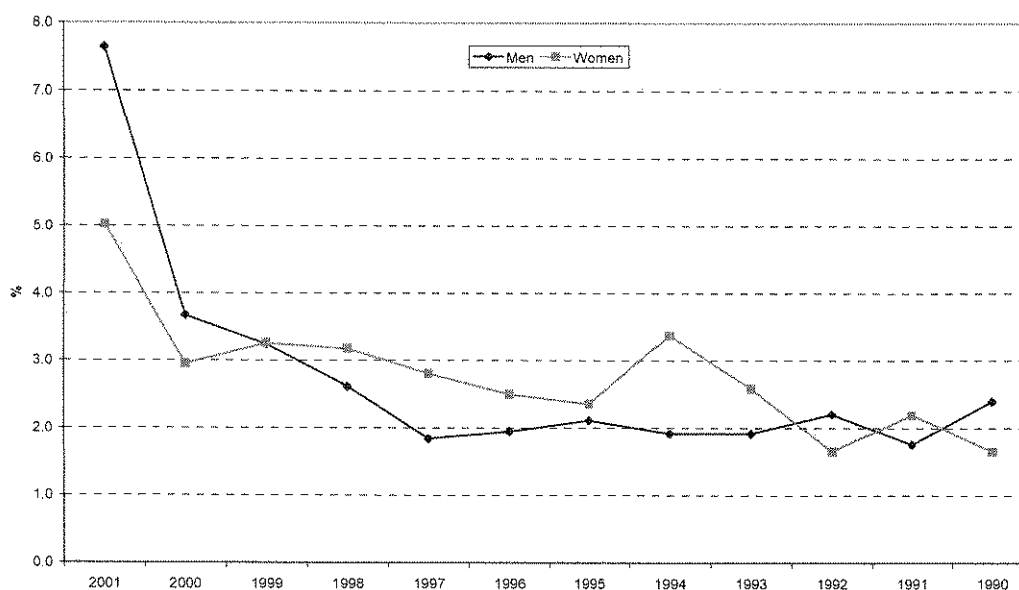
2. Data for doctorate holders are for 2004.

3. Data are for ages 25-70.

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders and OECD Educational Attainment database.

The transition of doctorate holders to employment can take some time, as is the case for all young university graduates. For example, a survey conducted by the CEREQ² in France shows that 7.4% of doctoral degree awardees in 1998 were still unemployed in 2001 (P. Béret, J.-F. Giret, I. Recotillet, 2002). In the same way, the data received in the framework of this CDH exercise show that 4.7% of young Canadians who received their doctoral degree in 1995 were unemployed in 2000. Figure 9 depicts the unemployment rates of doctorate holders by year of doctoral award in Australia.

Figure 9. Unemployment rate of doctorate holders by year of doctoral degree – Australia 2001



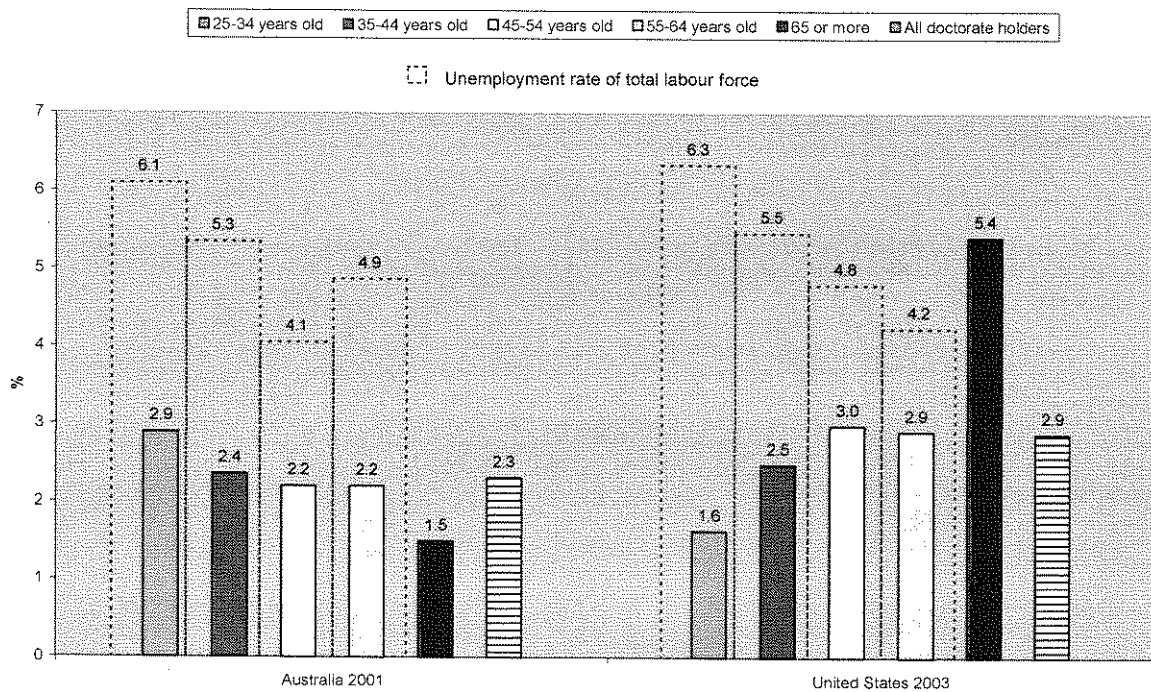
Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

2. Centre d'Étude et de Recherche sur les Qualifications.

The data in this figure reflect not only the time it takes a doctorate holder to enter the labour market but also the evolving labour market conditions over the ten years under review. It shows that although labour market conditions seem to be more favourable to women in the two years following the doctorate award (unless there was a drastic improvement for women in the years 2000 and 2001), it takes longer (two to five more years than for men) until their unemployment rate stabilizes around 2%. Men's unemployment rate drops to 2% after four years compared to after six to nine years for women.

A look at unemployment rates by age category also brings some interesting information. One can see from Figure 10 that while unemployment decreases with age in Australia, it tends on the contrary to increase with age in the United States. This pattern differs somehow from that for the total US labour force and should probably be attributed to the different labour market conditions prevailing for doctorate holders, especially at the beginning of their career.

Figure 10. Unemployment rates of doctorate holders by age category



Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

The unemployment rate for doctorate holders remains nevertheless generally low – between 2% and 4% – as can be seen from Table 7. Among the countries for which we have data, it is higher in Canada and lower in Australia and, with the exception of Canada, higher for women than it is for men.

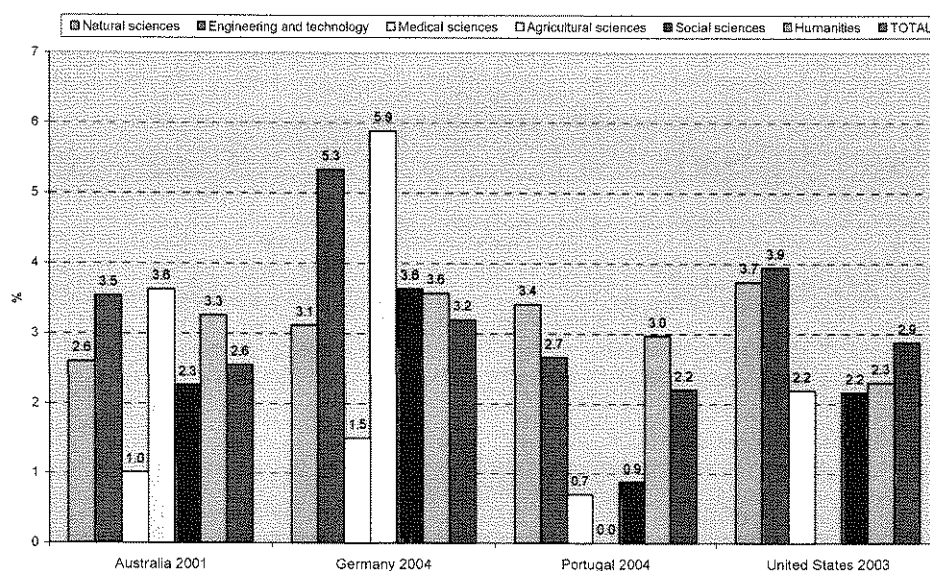
Table 7. Unemployment rates of doctorate holders (per cent)

		Unemployment rate
Australia	Men	2.2
	Women	2.7
	Total	2.3
Canada	Men	4.0
	Women	3.0
	Total	3.7
Germany	Men	2.5
	Women	4.7
	Total	3.2
United States	Men	2.5
	Women	3.7
	Total	2.9

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

There are also informative differences according to field of doctoral degree (Figure 11). For example, unemployment rates for engineering and technology doctorate holders are higher than average doctorate holders' unemployment rates and even higher than those of any other discipline in the United States. In Germany, unemployment rates of engineering doctoral graduates reaches 5.3%. More than 20% of German engineering and technology doctoral graduates are also employed in occupations classified below the managerial and professional levels, part of them possibly in occupations labelled "technicians and associate professionals" (Annex Table 8). In the United States and Portugal, the unemployment rate of natural science doctorate holders is also higher than the average unemployment rate. This is somewhat at odds with the discourse on a possible shortage of natural science and engineering professionals. In contrast, medical science is the discipline with the lowest unemployment rates. Doctoral graduates in social sciences and humanities are also less exposed to unemployment than their counterparts in natural sciences and engineering in the United States. This is also the case in Australia and Portugal for holders of doctorates in social sciences.

Figure 11. Unemployment rates of doctorate holders by field of doctoral degree



Note: Portugal: Doctoral degrees awarded between 2000 and 2004.

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Labour conditions can also be gauged through the type of contract (permanent vs. temporary or part-time vs. full-time) that doctorate recipients hold. Tables 8 and 9 show that, for the countries for which data could be provided, part-time or temporary employment is not negligible, especially for women. Part-time employment reaches 18% in Australia and 28% for women both in Australia and Germany. One should note that part-time employment may to some extent be chosen by women wanting to devote time to their children, but in some cases they may also be compelled by the lack of infrastructure enabling both parents to work. A comparison with general employment figures shows that doctorate holders are, however, less frequently employed on a part-time basis than other employees, especially in the case of women. In Switzerland, 21% of doctorate holders (26% of women) are on temporary contracts. The data for Germany show that the youngest doctorate holders are under such contracts: 33.7% of those aged 25-34 and 14.2% of those aged 35-44. Part of these contracts are most probably for post-doctoral positions. The case of Portugal is particular in that the population covered is restricted to recent doctorate holders having earned their doctoral degree in the last five years and thus probably still in a transitional career period. Included in temporary contracts are also, for this country, all academic staff with five-year working contracts.

Table 8. Percentage of full-time/part-time employment

		Doctorate holders		Total employment		
		Full-time employment	Part-time employment	Full-time employment	Part-time employment	
Argentina	2005	Total	88.4	11.6		
Australia	2001	Men	85.7	14.3	84.2	15.8
		Women	71.7	28.3	58.3	41.7
		Total	81.8	18.2	72.8	27.2
Germany	2004	Men	94.0	6.0	93.7	6.3
		Women	71.7	28.3	63.0	37.0
		Total	87.1	12.9	79.9	20.1
United States	2003	Men	94.8	5.2	92.0	8.0
		Women	86.5	13.5	81.2	18.8
		Total	92.0	8.0	86.8	13.2

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders and OECD Labour market statistics database.

Table 9. Percentage of doctorate holders by type of employment contract

		Permanent employment	Temporary employment	
Argentina	2005	Total	92.6	7.4
Germany	2004	Men	89.7	10.3
		Women	84.3	15.7
		Total	88.0	12.0
Portugal ¹	2004	Men	28.4	71.6
		Women	24.2	75.8
		Total	26.5	73.5
Switzerland	2004	Men	80.7	19.3
		Women	74.1	25.9
		Total	78.9	21.1

1. Doctoral degrees awarded between 2000 and 2004; included is all academic staff with five-year working contracts.

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Occupations of doctorate holders

In Argentina, Canada and Germany, 85% of employed doctorate holders work in managing or professional occupations. This figure rises to over 90% in Portugal and the United States (see Table 10). This also means that up to 15% of them in Canada and Germany, 10% in Argentina and 8% in Portugal and the United States are in occupations below their qualifications. At least one-third of employed doctorate holders in Argentina, Canada and the United States and up to 78% of the recent doctorate holders

in Portugal are teaching professionals, which is their main professional destination. In Germany, it is in life science and health professions that more than one-third of doctorate holders are employed.

It is also important to note that 76% of employed doctorate holders in Canada and 72.5% in the United States are active in research. In the latter country, the breakdown by sex shows that men (74%) work as researchers more frequently than women (70%). Information collected on post-doc occupations in the United States shows that these types of occupations are held by 7.3% of researchers with a doctoral degree in natural science. This percentage reaches 11.3% for women against 6.9% for men. Postdoctoral positions also represent 5.8% of female researchers holding a doctoral degree in medical sciences and 1.3% of male researchers holding a doctoral degree in engineering.

Table 10. Employed doctorate holders by occupation

ISCO-88 code	ISCO-88 title	Argentina 2005	Canada 2001	Germany 2004	Portugal 2000-2004	USA 2003
1	LEGISLATORS, SENIOR OFFICIALS AND MANAGERS	1.0	11.5	4.3	2.8	10.5
2	PROFESSIONALS	84.0	73.8	80.9	88.2	81.2
21	Physical, mathematical and engineering science professionals	20.5	15.9	18.0	6.6	16.2
211	Physicists, chemists and related professionals		6.5	5.0	3.7	5.2
212	Mathematicians, statisticians and related professionals	17.6	0.4		0.1	0.9
213	Computing professionals	0.4	3.9	2.1	0.3	3.8
214	Architects, engineers and related professionals	2.5	5.1	10.8	2.4	6.3
22	Life science and health professionals	21.5	9.4	34.3	2.3	14.2
221	Life science professionals	15.7	3.3	1.9	0.4	6.0
222	Health professionals (except nursing)	5.5	5.9	32.4	1.9	7.2
223	Nursing and midwifery professionals	0.3	0.2		0.0	1.0
23	Teaching professionals	36.4	37.1	13.3	78.3	33.1
231	College, university and higher education teaching professionals	35.4	37.1	6.6	76.4	29.7
232	Secondary education teaching professionals	0.3		5.3	1.5	1.9
233 to 235	Other teaching professionals	0.8		1.4	0.4	1.6
24	Other professionals	5.6	11.4	15.3	1.1	17.6
241	Business professionals	1.2	1.8	3.1	0.1	4.6
242	Legal professionals	1.4	0.8	3.9	0.1	0.4
243	Archivists, librarians and related information professionals	0.0	0.2		0.1	0.5
244	Social science and related professionals	2.8	8.5	3.1	0.9	7.6
245	Writers and creative or performing artists	0.0		2.3	0.0	1.8
	Other professionals			1.9		2.5
Other	Other ISCO-88 groups	10.3	14.7	14.8	8.6	8.4
Unknown		4.7			0.3	
TOTAL	Total	100.0	100.0	100.0	100.0	100.0

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

In Portugal, up to 90% of recent doctorate holders are active in research, 85% of whom work in the higher education sector. A look at the distribution of post-doctoral positions reveals that women are more likely to hold such positions than men in all doctoral degree fields except humanities (Table 11). This raises the question of possible different recruitment procedures prevailing for male and female researchers.

Table 11. Percentage of men and women in post-doctoral positions by field of doctoral degree
Portugal, 2000-2004 doctoral awardees

	Men	Women
Natural sciences	15.8	20.2
Engineering and technology	5.0	18.2
Medical sciences	8.3	12.7
Agricultural sciences	6.3	11.8
Social sciences	2.1	3.0
Humanities	5.7	3.2
TOTAL	7.7	12.1

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Salaries of doctorate holders working as researchers

Canada and the United States provided data on salaries of doctorate holders. Portugal's data cover recent doctoral awardees (Table 12).

Table 12. Median annual basic salary of employed doctorate holders (current PPP dollar)

		Employed as researcher					Not employed as researcher ¹
		Total	Sector of employment			of which: postdocs	
			Business enterprise sector	Government sector	Higher education sector	Private non-profit sector	
Canada (2001)	Total	53 199	49 302	53 878	54 679		51 244
	Men	57 222	54 727	57 093	58 129		54 936
	Women	45 668	40 950	46 739	48 300		43 523
Portugal ² (2004)	Total	39 437	39 437	38 411	39 437	39 437	39 437
	Men	38 194	33 206	37 465	38 451	29 577	37 277
	Women						
United States (2003)	Total	75 000	95 000	85 000	65 000	60 000	85 000
	Men	55 000	71 000	65 000	53 000	50 000	63 000
	Women						

1. Data relate to total employed in research and non research for Canada.
2. Salaries of doctorate holders having received their doctoral degree between 2000 and 2004.

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Although the data given in the table above do not refer to the same year, the salary differences between Canada and the United States cannot merely be attributed to the different years, and salaries of doctorate holders in the United States therefore appear to be much higher than in Canada. The Scientist Salary Survey confirms there are salary differences between these two countries for senior research positions in life sciences, but less so for junior positions (Table 13).

Table 13. Median salaries of scientists in life science in 2003 (current PPP dollar)

Canada		United Kingdom		United States	
Research director	84677	University professor	81270	Distinguished researcher	126000
Senior researcher	49597	Senior researcher	45190	Senior researcher	75350
Intermediate researcher	37097	Intermediate researcher	35224	Intermediate researcher	36366
Postdoc	30645	Postdoc	37337	Postdoc	35000

Source: OECD calculations based on data from "The Scientist 2003 Salary Survey".

One striking feature in Table 12 is that doctoral graduates in the United States are better paid in non-research occupations than in research, which is not the case in Canada. In the United States, the

business sector also offers higher salary levels to researchers than the government sector, and it is in the higher education sector that researchers have the lowest salary levels. In Canada, the salary levels by sector rank the other way around: researchers are better paid in higher education than they are in the government sector and they are the less well paid in the business sector although the salary differentials between sectors are less marked than in the United States. As may be expected, women are less well paid than men and for research positions the differential is larger in the United States (-27%) than in Canada (-20%). The differences are also more pronounced in business and less marked in higher education. There is an exception to this in postdoctoral positions, where women receive higher salaries than men. One should also note that post-doc salary levels are much lower than other research position salary levels and S. Kergrach and M. Cervantes (2006) also report that “salaries for early stage researchers are rather low in many countries relative to per capita GDP”. Sector differences in salaries of recent doctoral recipients in Portugal mainly affect women: they earn significantly less when they work in the business enterprise or private non-profit sectors.

Job-to-job mobility: length of stay with the same employer

One way to gauge job-to-job mobility is to look at length of stay with the same employer. Data have been provided for Germany and in more detail for Argentina the United States (Table 14).

Table 14. Length of stay of doctorate holders with the same employer

		Less than 1 year	1 to 2 years	3 to 4 years	5 to 9 years	10 years and more	TOTAL	
Argentina (2005)	Non researchers	0.3	4.0	6.5	15.1	74.1	100.0	
	Researchers	Total research	0.1	13.9	5.4	14.5	66.1	100.0
		Government sector	0.1	24.9	6.4	15.9	52.7	100.0
		Higher education sector	0.0	5.8	4.9	13.0	76.3	100.0
	Total	0.1	12.1	5.6	14.6	67.5	100.0	
Germany (2004)	Total	10.3	15.3	11.7	17.8	43.9	100.0	
United States (2003)	Non researchers	13.5	18.9	16.8	19.4	31.3	100.0	
	Researchers	Total research	10.8	18.2	15.2	19.8	36.1	100.0
		Business enterprise sector	11.6	21.4	17.0	24.7	25.3	100.0
		Government sector	10.4	19.2	19.7	14.6	36.4	100.0
		Higher education sector	10.8	16.6	13.1	18.3	41.2	100.0
		Private non-profit sector	7.4	17.4	23.4	18.0	33.7	100.0
	Total	11.6	18.4	15.6	19.7	34.8	100.0	

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Firstly, doctorate holders in Argentina are not very mobile: 82% have been with the same employer for more than five years. One-quarter of researchers in the government sector, however, have been with their employer for only one to two years. Secondly, doctorate holders are less mobile in Germany than they are in the United States: 62% of them have been with the same employer for at least five years in Germany against 55% in the United States. Thirdly, doctorate holders who are in research occupations in the United States are less mobile than those in non-research occupations: they are 5% more likely to be with the same employer for at least five years. In addition, a higher percentage of those in non-research positions hold their job for less than one year. Among researchers, it is in higher education that mobility is less frequent: 60% of the employed hold their job for at least five years, against 50% in other sectors.

Satisfaction of doctorate holders with their employment situation

Two types of questions are considered here: whether doctorate holders perceive their job as being related to their doctoral degree, and a ranking of their satisfaction according to a number of criteria (see below). The United States was able to provide data for the whole population of doctorate holders while Canada and Portugal gave responses for recent doctorate holders. The vast majority of doctorate holders consider their job as being related to their doctoral degree. However, 7% of the total US population and of the Canadian 2000 graduates and 8% of the Portuguese 2000-2004 graduates are not in a job related to

their degree. Part of this population is probably the same as that identified in Table 10 as employed in occupations below their qualifications.

Table 15. Satisfaction of doctorate holders with their employment situation — Percentage per criteria

Criteria	Argentina (2005)					Portugal (2004)					United States (2003)			
	Very satisfied	Somewhat satisfied	Somewhat dissatisfied	Very dissatisfied	Empty	Very satisfied	Somewhat satisfied	Somewhat dissatisfied	Very dissatisfied	Non-response	Very satisfied	Somewhat satisfied	Somewhat dissatisfied	Very dissatisfied
Salary	5.8	39.5	35.4	11.5	7.8	3.8	55.6	32.5	7.2	0.9	30.5	46.8	14.2	6.5
Benefits	5.6	32.7	30.1	13.6	18.1	3.1	52.2	33.5	10.2	0.9	38.9	42.6	10.5	6.9
Job security	29.0	43.8	13.5	4.2	9.4	6.6	40.7	29.3	22.4	1.0	49.9	32.4	11.4	6.3
Location	50.5	32.5	4.7	1.2	10.7	36.4	53.2	7.2	2.4	0.9	59.4	28.7	8.9	2.9
Opportunities for advancement	20.9	46.8	18.1	4.5	9.7	5.7	34.0	37.9	21.5	0.9	30.9	42.0	18.7	8.4
Intellectual challenge	72.7	18.6	2.4	0.6	5.8	32.4	49.9	12.8	3.9	0.9	61.7	28.0	7.1	3.2
Level of responsibility	55.1	32.9	3.3	0.4	8.2	18.6	66.7	11.1	2.5	1.0	60.2	30.8	6.9	2.0
Degree of independence	55.9	30.7	5.3	1.0	7.1	22.9	61.7	12.3	3.1	0.9	59.8	24.3	4.2	1.6
Contribution to society	46.4	39.4	6.1	0.8	7.3	22.1	62.9	11.8	2.3	0.9	64.1	29.7	4.8	1.4
Social status	17.2	40.3	17.1	4.5	21.0	9.7	72.7	13.2	3.4	1.1				

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

The vast majority of doctorate holders also express satisfaction with the employment criteria listed in Table 15. However, they feel more satisfied with those criteria linked to the content of the work (intellectual challenge, level of responsibility, degree of independence and contribution to society) than with those related to employment conditions (salary, benefits, job security, location and opportunities for advancement). Dissatisfaction with salary even reaches 20% of doctorate holders in the United States, 40% in Portugal and 55% in Argentina, and the percentages are even higher for women.

Outputs of doctorate holders working as researchers

Argentina and the United States were able to provide data on outputs of doctorate holders working as researchers. For technical reasons, only the data for the United States are shown in Table 16. These data show that in general men are more productive than women. Lower productivity of women has been shown in other studies (M. Bordons, 2005). One reason put forward for this is the fact that women feel more comfortable with other means of knowledge diffusion, such as teaching activities, for example. The average number of articles published diminishes with age in the United States (the reverse is true in Argentina) while the number of books published is higher in the older age categories. Patenting and commercialisation of products or processes reaches its highest intensity among the middle-aged researchers in the United States, *i.e.* between 45 and 54 years old. US citizens are more productive in terms of patenting and commercialising products and processes while foreign citizens, especially those who are permanent residents, publish more. Finally, researchers in social sciences and humanities, with the exception of books, produce less tangible outputs than researchers in other fields. In Argentina, the striking feature is that most outputs come in the form of articles and some books, while patenting or commercialisation of products remain marginal. This may be partly due the fact that doctorate holders working in the business enterprise sector are not covered.

Table 16. Last five-year outputs of doctorate holders working as researchers in the United States

Average number in the last five years:	Articles	Books	Named as inventors in patents	Patents granted	Commercialised products or processes or patents licensed
<i>By sex</i>					
Men	5.7	0.7	5.3	2.7	1.1
Women	3.7	0.7	3.4	1.7	0.6
<i>By age</i>					
25-34 years old	5.4	0.4	3.1	1.0	0.3
35-44 years old	5.3	0.5	4.8	2.4	1.1
45-54 years old	5.3	0.8	6.5	3.4	1.3
55-64 years old	4.9	0.8	4.2	2.6	0.9
65-70 years old	3.2	0.8	2.5	1.2	0.5
<i>By citizenship</i>					
Citizens of the reporting country	4.8	0.6	5.3	2.8	1.1
Foreign citizens who are permanent residents	7.6	0.9	4.0	2.0	0.9
Foreign citizens who are non-permanent residents	5.6	0.4	2.9	0.8	0.3
<i>By field of doctorate degree</i>					
Natural sciences	6.7	0.4	4.5	2.3	0.8
Engineering and technology	4.5	0.3	6.8	3.3	1.6
Medical sciences	7.5	0.9	2.7	1.9	0.5
Agricultural sciences	5.9	0.7	2.4	0.8	0.4
Social sciences	3.5	0.8	3.1	1.1	0.4
Humanities	3.6	1.0	1.8	1.7	0.3
Other	8.0	0.7			
TOTAL	5.1	0.6	5.0	2.5	1.0

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

National origin of doctorate holders and international mobility

An important objective of the CDH project is to get better measures of the international mobility of doctorate holders. To this aim, it was decided to collect data according to various national origin and mobility criteria, and to cross-classify some of them: data on doctorate holders were collected by both place of birth and citizenship (as well as by acquisition of citizenship) and cross-classified with data on residential status, length of stay in the country, previous country of residence and other demographic (sex and age) and educational variables (field and place of doctoral or previous degree). This approach gives some interesting results that are shown below and opens new avenues to better refine the measurement of international mobility.

In a previous paper, J.-C. Dumont and G. Lemaître (2005) illustrated the differences in the stock of persons of foreign origin as measured by those foreign-born and those of foreign nationality. The data collected in the framework of the CDH project confirm these differences, *i.e.* the stock of people foreign-born is larger than that of foreign nationality (Table 17).

Table 17. Doctorate holders by sex and country of origin

			TOTAL	Citizens of the reporting country	Foreign citizens	TOTAL	Born in the reporting country	Foreign born	Unknown
Argentina	2005	Men	100.0	99.6	0.4	100.0	98.6	1.4	
		Women	100.0	100.0	0.0	100.0	99.4	0.6	
		Total	100.0	99.8	0.2	100.0	98.9	1.1	
Australia	2001	Men	100.0	86.6	13.4	100.0	53.3	46.7	
		Women	100.0	84.4	15.6	100.0	54.2	45.8	
		Total	100.0	86.0	14.0	100.0	53.6	46.4	
Canada	1996	Men	100.0	83.4	16.6	100.0	46.3	53.7	
		Women	100.0	82.3	17.7	100.0	51.9	48.1	
		Total	100.0	83.2	16.8	100.0	47.6	52.4	
	2001	Men	100.0	82.0	18.0	100.0	43.4	56.6	
		Women	100.0	81.8	18.2	100.0	52.4	47.6	
		Total	100.0	82.0	18.0	100.0	45.9	54.1	
Germany	2003	Men	100.0	94.4	5.6	100.0	81.2	11.7	7.1
		Women	100.0	90.6	9.4	100.0	78.8	14.4	6.8
		Total	100.0	93.2	6.8	100.0	80.4	12.6	7.0
	2004	Men	100.0	93.6	6.4	100.0	83.3	11.4	5.3
		Women	100.0	90.4	9.6	100.0	80.9	13.3	5.8
		Total	100.0	92.6	7.4	100.0	82.5	12.0	5.5
Portugal	2000	Men	100.0	97.1	2.9	100.0	84.2	15.8	
		Women	100.0	98.3	1.7	100.0	87.0	13.0	
		Total	100.0	97.7	2.3	100.0	85.5	14.5	
	2004	Men	100.0	95.8	4.2	100.0	84.8	15.2	
		Women	100.0	95.0	5.0	100.0	85.9	14.1	
		Total	100.0	95.5	4.5	100.0	85.3	14.7	
Switzerland	2003	Total	100.0	70.0	30.0	100.0	57.7	42.3	
	2004	Total	100.0	69.9	30.1	100.0	58.9	41.1	
United States	1993	Men	100.0	90.2	9.8	100.0	79.0	21.0	
		Women	100.0	92.4	7.6	100.0	83.0	17.0	
		Total	100.0	90.7	9.3	100.0	80.0	20.0	
	2003	Men	100.0	87.2	12.8	100.0	72.2	27.8	
		Women	100.0	90.2	9.8	100.0	78.5	21.5	
		Total	100.0	88.3	11.7	100.0	74.3	25.7	

Note: Portugal: Percentages are for the population of awardees in the reference year.

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

The reason for this is that the foreign-born reflect the cumulative entries of immigrants into the country across the years, a part of whom has acquired the nationality/citizenship of the recipient country. We see from Table 17 that the foreign contingent is very important in Switzerland both in terms of the foreign-born and the foreign citizens. Switzerland is also known for having the highest share of foreign-born doctoral students among OECD countries. The most striking point revealed by the data, however, is that the share of foreign-born doctorate holders is much higher in Canada and Australia than it is in the United States. In Canada, the foreign-born doctorate holders are even more numerous than the native ones. Table 18 confirms that indeed in the so-called settlement countries – Australia, Canada and to a lesser extent the United States – a large share of citizens have acquired the nationality of the country through naturalisation.

Table 18. Doctorate holders who are citizens by nature of citizenship

	Australia (2001)			Canada (2001)			Portugal (2004)			United States (2003)		
	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total
Citizens of the country	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
of which:												
by birth	61.0	63.6	61.7	53.5	64.7	56.6	57.6	89.5	88.5	82.7	87.0	84.2
by naturalisation	38.1	35.4	37.3	46.5	35.3	43.4	42.4	10.5	11.5	17.3	13.0	15.8

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

The data for Canada and the United States also show that the population born in the country is roughly equal to the number holding citizenship of the country by birth, and that the foreign population is

roughly equal to the number of those born abroad, minus the number of people who since acquired the citizenship of the country (the difference being accounted for by nationals born abroad, Box 3 of Chart 1). This is because birth within the territory automatically conveys the citizenship of the country, *i.e. jus soli* applies in their case: Boxes 2 and 5 of Chart 1 are equal to zero. This is not, however, the case in most other countries. In Germany and in Switzerland, for example, legislation governing the granting of citizenship is much more strict, and children and grandchildren born in the country of immigrant parents may not have acquired the citizenship in their country of birth. The data supplied by Germany and Switzerland in the course of this exercise are unfortunately incomplete, and we were not able to include them.

The fact remains, however, that for “immigration countries”, such as Canada and the United States, the number of doctorate holders born abroad who have acquired citizenship (Box 4 of Chart 1) will provide an indicator of definitive or long-term immigration, while those who were born abroad and hold foreign citizenship (Boxes 6 and 7 of Chart 1), with the exception of those who chose to retain their original citizenship even though they have settled permanently in the country, will give an indication of more recent immigration or of temporary mobility toward the country. Information on residential status (temporary or permanent) can refine the data on the timing (recent or earlier) of arrivals in the country. These data show, for example, that the foreign-born population is much more integrated in Canada, either through naturalisation or the granting of permanent residence, while the temporary resident population is more significant in the United States (Table 19).

Chart 1. Distribution of a country's population according to the origin of its inhabitants

	Citizens	Non citizens
Natives	1. Native and citizen by birth	5. Native and non citizen
	2. Native and citizen by naturalisation	
Foreign born	3. Foreign born and citizen by birth	6. Foreign born, non citizen and resident
	4. Foreign born and citizen by naturalisation	7. Foreign born, non citizen and non resident

Source: OECD, Directorate for science, technology and industry.

Table 19. Breakdown of foreign-born doctorate holders in Canada and the United States

	Canada (2001)	United States (2003)
Citizen	66.7	54.3
By birth	1.1	0.0
By naturalisation	65.6	54.3
Foreign citizen	33.3	45.7
Resident	27.4	31.1
Non resident	5.9	14.6
Total	100.0	100.0

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

A look at the regions of origin of alien doctorate holders in the reporting countries also provides some interesting information. In the United States, as well as in Canada and in Australia, the two main regions of origin are Asia and Europe. If we compare the numbers in terms of place of birth and citizenship (Table 20), we see that, in the United States, doctorate holders born in Asia are more than 2.5 times higher than those with Asian citizenship, which indicates that a very large share of the Asian-born have acquired

US citizenship³. The ratio is about two for Europe, Africa and South America and the numbers are of a smaller magnitude. With the exception of those from Asian origin, probably due to the large inflow from China, the number of foreign citizens has however grown faster than the number of foreign born over the period 1993 to 2003, indicating a lesser propensity to acquire US citizenship. Data on residential status also show a lesser propensity to become permanent resident (68% of foreign citizens in 2003 against 80% in 1993). The United States nevertheless remains an important magnet for doctorate holders, who probably come more than in the past for reasons linked to temporary labour market opportunities as opposed to educational or long-term settlement possibilities, as we will see later in this paper.

Table 20. Number of foreign doctorate holders in the United States by region of origin

	2003		1993		1993-2003 growth rate (%)	
	citizens from	born in	citizens from	born in	citizens from	born in
Africa	10 800	23 800	4 900	11 500	120.4	107.0
North America	19 100	32 600	11 700	25 000	63.2	30.4
South America	10 500	20 500	4 400	8 900	138.6	130.3
Asia	73 400	195 600	44 500	99 200	64.9	97.2
Europe	50 400	104 800	27 900	61 800	80.6	69.6
Oceania	4 300	3 800	2 700	3 400	59.3	11.8
Total	168 500	381 100	96 100	209 800	75.3	81.6

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Conversely to the situation in the United States, the percentage of European Union-born doctorate holders (41%) in Australia is higher than the Asian-born (27%) (Table 21).

Table 21. Percentage of foreign doctorate holders by region of birth

	Australia 2001			United States 2003		
	Men	Women	Total	Men	Women	Total
OECD non-EU countries ¹	15.7	18.0	16.4	14.1	13.9	14.0
OECD EU countries ¹	41.1	38.9	40.5	20.5	22.3	21.0
Non-OECD EU countries ¹	0.7	0.7	0.7	0.4		0.4
Africa	1.4	0.8	1.2	6.6	6.2	6.5
Asia (except Japan, Korea and Turkey)	26.9	27.8	27.2	49.4	41.0	47.0
Oceania	7.0	6.7	6.9	0.9	1.2	1.0
Caribbean countries	0.1	0.2	0.2	1.4	3.1	1.9
Central and South America (except Mexico and the Caribbean)	0.8	1.4	0.9	4.5	11.0	6.3
Non-OECD and non-EU Europe ¹	2.9	4.0	3.2	5.9	7.1	6.3
Unknown or not elsewhere classified	2.1	2.7	2.3			

¹ OECD non-EU countries (AUS, CAN, CHE, ISL, JPN, KOR, MEX, NOR, NZL, TUR, USA)
 OECD EU countries (AUT, BEL, CZE, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, IRL, ITA, LUX, NLD, POL, PRT, SVK, SWE)
 Non-OECD EU countries (CYP, EST, LTU, LVA, MLT, SVN)
 Africa
 Asia (except Japan, Korea and Turkey)
 Oceania
 Caribbean countries
 Central and South America (except Mexico and the Caribbean)
 Non-OECD and non-EU Europe (HRV, BIH, YUG, MKD, ALB, BLR, UKR, ROM, BGR, MDA, RUS, small states)
 Unknown or not elsewhere classified

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

More data on the date and place of doctoral and previous university degrees as well as information on intentions to stay or move out of the country can help better understand international mobility patterns of doctorate holders, in particular those who are foreign citizens.

3. There may also be among the Asian-born a small share of US citizens (Box 3 of Chart1) or other non-Asian citizens.

Table 22, on where doctoral degrees are awarded, shows different patterns across countries. First, the share of citizens of the three reporting countries having received their doctorate abroad varies greatly. It is very low as expected in the United States (5%), the double (10%) in Portugal⁴ and reaches 19% in Argentina (there are almost no foreign doctorate holders in Argentina, so the total shown in the table roughly corresponds to citizens from Argentina). Not surprisingly, higher percentages of foreign citizens have earned their doctoral degrees abroad: 15% in Portugal and up to 43% in the United States. This latter figure may be surprising knowing that many foreigners come to the United States to prepare their doctoral degree, and hence reveals that there are also many foreigners that come to work in the United States having been trained for research abroad.

Table 22. Place of doctoral degree award by citizenship

	Argentina	Portugal		United States	
	Total	Citizens	Foreign citizens	Citizens	Foreign citizens
Total	100.0	100.0	100.0	100.0	100.0
Have received their doctorate degree in the country	81.1	89.8	84.8	94.8	56.8
Have received their doctorate degree abroad	18.9	10.2	15.2	5.2	43.2

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

This is confirmed by the reasons given by foreign doctorate holders for coming to the United States. Beyond keeping count of cross-border movements, policymakers are interested in the reasons or motives for these movements. The project on doctorate holders' careers is thus seeking to collect qualitative information on mobility intentions and motivations. These data are for the moment only available for the United States, but they offer some evidence as to how mobility motivation has evolved over time, and how this relates to the residential status of migrants in the country. The data in Table 23 show that over the last five years, educational opportunities in the United States have become less prominent as a reason for moving to the United States than job or economic opportunities, compared to the previous five years. Reasons relating to scientific or professional infrastructures also became more important. These trends are particularly marked among doctorate holders with permanent resident status. For those who have acquired US citizenship, family-related reasons also play an important role, although less so in the last five years compared to the prior five-year period.

Table 23. Reasons given by doctorate holders for coming to the United States over the last 10 years (2003 data)

Entered the country in the last five years	Citizens of the country (by naturalisation)	Foreign citizens		Total
		Permanent residents	Non-permanent residents	
Educational opportunities in the United States	28.1	14.4	26.0	23.1
Family-related reasons	20.3		6.0	8.9
Job or economic opportunities	25.0	45.6	28.5	31.7
Scientific or professional infrastructure in my field	26.6	40.0	39.5	36.4
All reasons	100.0	100.0	100.0	100.0
Entered the country five to ten years ago	Citizens of the country (by naturalisation)	Foreign citizens		Total
		Permanent residents	Non-permanent residents	
Educational opportunities in the United States	19.9	27.4	38.1	31.0
Family-related reasons	32.5	10.7	4.2	10.7
Job or economic opportunities	21.7	29.2	21.3	25.0
Scientific or professional infrastructure in my field	21.1	30.1	35.6	31.3
Other reasons	4.8	2.6	0.7	2.1
All reasons	100.0	100.0	100.0	100.0

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

4. In addition, 31% of all doctorate holders having received their doctoral degree abroad had also earned their earlier degree abroad (and 8% of those having received their doctoral degree in Portugal).

Data on intentions to move out of the country are also collected on an optional basis in the CDH project. Data in Table 24 confirm that US citizens are not very internationally mobile: only 5% of recent doctorate holders declare their intentions to move out of the country, but this figure rises to around 15% among Canadian and Portuguese citizens. Forty percent of foreign citizens in both Canada and the United States intend to leave the country in the next year, whereas only 25% intend to do so in Portugal.

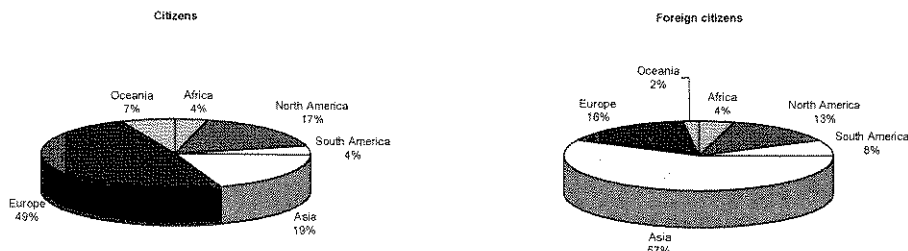
Table 24. Percentage of recent doctorate holders having declared intentions to move out of the country in the next year

	Canada (2003-2004)	Portugal (2000-2004)	United-States (2003)
Citizens	16.6	14.6	5.0
Foreign citizens	39.2	25.0	40.1

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

A look at intended destinations provides more information. Among Portuguese doctorate holders intending to move, 60% plan to go elsewhere in Europe (of which half to the United Kingdom or Spain) and 30% to America (of which 66% to the United States). Three-quarters of the Canadian citizens intending to move plan to go to the United States and 18% to Europe. In the United States, doctorate holders' chosen destinations vary greatly depending on whether they are citizens or not. About half of US citizens will choose Europe as their next destination and 20% will choose Asia. Among foreign doctorate holders in the United States, destination choices probably reflect their origin to some extent: 57% will choose Asia and 16% Europe (Figures 12 and 13).

Figures 12 to 13. Intended destination of 2003 doctorate recipients wishing to leave the United States



Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

The Portuguese survey provides additional information about reasons behind these intentions to move, and their analysis reveals that: "the main reasons are the conclusion of post-doc in a foreign country for the Portuguese recent doctorates (60%) and family or personal reasons for the foreign recent doctorates (57%)" (OCES, 2006).

Conclusion

The first OECD/Eurostat/UIS data collection on careers of doctorate holders helps to better understand what the main demographic, educational, labour market and mobility patterns of doctoral graduates are. Their share in the population and in the labour force varies widely from one country to another: it is two or three times larger in Germany and Switzerland than in Australia, Canada and the United States. In these five countries, women represent only one-quarter to one-third of doctorate holders.

The United States has an older population of doctorate holders than the other countries analysed in this paper and the data show that this population is still ageing, as is also the case in Canada. In the United States, age at graduation is higher and completion time for doctorates is also longer. In all countries, it also takes longer to prepare a doctorate in social sciences and humanities than in natural sciences and engineering. Not surprisingly, unemployment rates of doctorate holders remain low, but are relatively higher in natural sciences and engineering. Furthermore, a significant share of the population seems to be overqualified for their current occupations. A non-negligible share works on temporary contracts or part time, especially women. Amongst young researchers, women also seem to be more likely to hold post-doctoral positions than men. In addition, there are important salary differences between men and women and across sectors, especially in the United States. In the United States, as well as in Portugal and Argentina, salary is one of the main reasons why doctoral graduates are dissatisfied with their employment situation.

This first data collection also brings some progress in the measurement of international mobility by cross-classifying place of birth and citizenship with residential status and other variables. It shows a high share of foreign doctorate holders in Switzerland and also a higher share of foreign-born doctorate holders in Canada and Australia than in the United States, a younger population of foreign doctorate holders than those of the country, and confirms the importance of Asia and Europe as the two main regions of origin of foreign doctorate holders in Australia, Canada and the United States. Data on place of doctoral degree reveals that there are many foreigners coming to work to the United States having been trained for research abroad, and that this pattern has grown stronger in recent years. Data on intentions to move abroad confirm the low propensity of US citizens to be mobile. Among mobile young Canadian citizens, three-quarters choose the United States as their next destination. Mobile young Portuguese doctorate holders move abroad to join a post-doctoral position.

These qualitative indicators on mobility intentions and motivations are extremely useful to help understand the complex patterns of international mobility that cannot only be gauged through quantitative data because of, *inter alia*, the heterogeneity of migration systems across countries. It is only in the light of data on intentions or reasons for moving abroad that some of the quantitative indicators can be interpreted. All efforts should therefore be conducted to collect and refine such information. The CDH project also brings important added value by introducing the collection of information on doctoral graduates' perceptions of their employment situation. Data on doctorate holders' satisfaction with their salaries, working conditions or other criteria are for instance of great value for the steering of research systems. It is important that a larger number of countries be able to collect such data, more of which should become available in the future.

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ANNEX TABLES

Annex Table 1. First OECD/Eurostat/IUIS data collection on careers of doctorate holders: data availability

	Argentina	Australia	Canada	Germany	Italy	Portugal ¹	Switzerland	USA
Table P1	2005	2001	1996, 2001	2003, 2004	(1987-2003)	2004	2003, 2004	1993, 2003
Table P2	2005	2001	1996, 2001	2003, 2004	(2001-2003)	2004	2003, 2004	1993, 2003
Table P3	2005	2001	(1996, 2001)	2003, 2004		2004	2003, 2004	1993, 2003
Table P4	2005	2001	(1996, 2001)	2003, 2004		2004	2003, 2004	1993, 2003
Table P5	2005	2001	1996, 2001	2003, 2004		2004	2003, 2004	1993, 2003
Table P6	2005	2001	1996, 2001	2003, 2004		2004	2003, 2004	1993, 2003
Table P7	2005	2001	(1996, 2001)	2003, 2004		2004	2003, 2004	1993, 2003
Table ED1	2005					2004		2003
Table ED2	2005					2004		2003
Table ED3	2005					2004		2003
Table ED4	2005	2002-2003	2003-2004	Under calculation	2003	2004	2004	2003
Table ED5	2005		2003-2004			2004		2003
Table EMP1	(2005)	2001	2001+	2004		2004	2003, 2004	2003
Table EMP2	(2005)	2001	2001+	2004		2004	from 2006	2003
Table EMP3	(2005)					2004		2003
Table EMP4	2005	2001	~ 1996, 2001	2004		2004	from 2006	2003
Table EMP5	2005	2001	~ 1996, 2001			2004		2003
Table EMP6	2005	2001	~ 1996, 2001			2004		2003
Table EMP7						2004		2003
Table EMP8	2005			Under calculation		2004		2003
Table PERC1	2005					2004		2003
Table PERC2	2005					2004		2003
Table IMOB1	2005		1996, 2001	2004		2004	2003, 2004	2003
Table IMOB2						2004		
Table IMOB3						(2004)		2003
Table OMOB1						2004		2003
Table OMOB2						2004		2003
Table OMOB3			2003-2004			2004		
Table OMOB4						2004		
Table OUTP1	2005					2004		2003
Table OUTP2	2005					2004		2003

1. Data also available for "higher degree" 1991 and 1996 for tables P1, P2, P4, P5.

2. This pilot survey covers doctorate holders who received their degree between 2000 and 2004. The entire population of doctorate holders should be covered as from 2006.

Source: First OECD/Eurostat/IUIS data collection on careers of doctorate holders.

Annex Table 2. First OECD/Eurostat/UIS data collection on careers of doctorate holders: data sources

	Argentina	Australia	Canada	Germany	Italy	Portugal	Switzerland	United States
Table P1	Dedicated online survey	2001 Census of Population and Housing	1996 and 2001 censuses	Federal Statistical Office, Microcensus 2003, 2004	MUR	Dedicated online survey (SIFES) 2003, 2004	Swiss Labour Force Survey (SIFES) 2003, 2004	NSF/SRS National Survey of College Graduates, 1983 and 2003
Table P2	id.	id.	id.	id.	id.	id.	id.	id.
Table P3	id.	id.	id.	id.	id.	id.	id.	id.
Table P4	id.	id.	id.	id.	id.	id.	id.	id.
Table P5	id.	id.	id.	id.	id.	id.	id.	id.
Table P6	id.	id.	id.	id.	id.	id.	id.	id.
Table E.D1	id.	id.	id.	id.	id.	id.	id.	id.
Table E.D2	id.	id.	id.	id.	id.	id.	id.	id.
Table E.D3	id.	id.	id.	id.	id.	id.	id.	id.
Table E.D4	id.	id.	id.	id.	id.	id.	id.	id.
Table E.D5	id.	id.	id.	id.	id.	id.	id.	id.
Table E.MP1	id.	id.	id.	id.	id.	id.	id.	id.
Table E.MP2	id.	id.	id.	id.	id.	id.	id.	id.
Table E.MP3	id.	id.	id.	id.	id.	id.	id.	id.
Table E.MP4	id.	id.	id.	id.	id.	id.	id.	id.
Table E.MP5	id.	id.	id.	id.	id.	id.	id.	id.
Table E.MP6	id.	id.	id.	id.	id.	id.	id.	id.
Table E.MP7	id.	id.	id.	id.	id.	id.	id.	id.
Table E.MP8	id.	id.	id.	id.	id.	id.	id.	id.
Table PERC1	id.	id.	id.	id.	id.	id.	id.	id.
Table PERC2	id.	id.	id.	id.	id.	id.	id.	id.
Table IMCB1	id.	id.	id.	id.	id.	id.	id.	id.
Table IMCB2	id.	id.	id.	id.	id.	id.	id.	id.
Table IMCB3	id.	id.	id.	id.	id.	id.	id.	id.
Table OMCB1	id.	id.	id.	id.	id.	id.	id.	id.
Table OMCB2	id.	id.	id.	id.	id.	id.	id.	id.
Table OMCB3	id.	id.	id.	id.	id.	id.	id.	id.
Table OUP1	id.	id.	id.	id.	id.	id.	id.	id.
Table OUP2	id.	id.	id.	id.	id.	id.	id.	id.

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Annex Tables 3 and 4. Primary sources of funding during completion of doctorate in Argentina and Canada

	Argentina						TOTAL
	Natural sciences	Engineering and technology	Medical sciences	Agricultural sciences	Social sciences	Humanities	
Primary source of funding	16.4	14.8	16.7	31.4	10.4	13.6	15.3
Fellowship, scholarship from institution	47.3	54.3	26.7	29.4	11.2	29.8	37.0
Fellowship, scholarship from government	5.9	9.5	3.5	11.8	17.4	14.9	8.9
Fellowship, scholarship from abroad	12.8	5.8	9.7	5.9	3.1	2.1	8.7
Teaching assistantship	2.3	2.1	1.6	2.0	1.7	0.8	1.9
Research assistantship	7.1	6.2	9.4	3.9	18.5	15.7	10.1
Other occupation (full time)	1.3	1.2	9.1	3.9	8.4	5.8	4.2
Other occupation (part time)	0.2	0.4	0.9	2.0	0.6	0.0	0.4
Employer's reimbursement/assistance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan	1.9	1.2	11.9	3.9	19.7	7.9	6.8
Personal savings	2.6	1.6	5.3	2.0	2.2	2.5	2.8
Spouse's, partner's or family support	0.6	2.1	1.6	0.0	1.1	0.8	1.0
Other	1.5	0.8	3.5	3.9	5.6	6.2	3.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Canada							
	Natural sciences	Engineering and technology	Medical sciences	Agricultural sciences	Social sciences	Humanities	TOTAL
Primary source of funding	10.6	12.7	10.7			12.6	10.0
Fellowship, scholarship from institution	42.4	31.4	45.8	31.6	25.9	28.7	34.3
Fellowship, scholarship from government							
Fellowship, scholarship from abroad							
Teaching assistantship	16.7	8.5	3.6		9.8	14.9	9.2
Research assistantship	16.7	23.7	10.1	31.6	5.2		11.1
Other occupation (full time) ¹		6.8	4.8		19.2	13.8	10.0
Other occupation (part time)							
Employer's reimbursement/assistance			1.8		6.2	9.2	4.0
Loan					2.6		1.7
Personal savings			1.8		8.8	5.7	4.1
Spouse's, partner's or family support		2.5	6.0		7.3	6.9	5.5
Spouse's, partner's or family support from abroad							
Other	12.1	10.2	14.3	21.1	7.8	4.6	10.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1. Includes part-time employment.

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Annex Tables 5 and 6. Primary sources of funding during completion of doctorate in Portugal and the United States

	Portugal						TOTAL
	Natural sciences	Engineering and technology	Medical sciences	Agricultural sciences	Social sciences	Humanities	
Primary source of funding	52.6	40.7	41.8	34.5	33.5	30.0	40.8
Fellowship, scholarship	37.8	50.1	28.2	44.3	43.8	45.0	42.5
Teaching assistantship	3.3	2.3	2.1	8.6	0.4	1.4	2.3
Research assistantship	0.8	0.8	4.5	0.6	2.2	1.8	1.6
Other occupation (part time)	0.3		1.0	0.6	0.6	0.2	0.4
Employer's reimbursement/assistance							
Loan		0.1	0.3		0.1	0.2	0.1
Personal savings	3.0	3.3	16.7	6.9	16.3	19.8	9.6
Spouse's, partner's or family support	0.1		1.4		0.7		0.3
Spouse's, partner's or family support from abroad							
Other	2.0	2.8	3.8	4.6	2.2	1.6	2.5
Number of respondents	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	United States						TOTAL
	Natural sciences	Engineering and technology	Medical sciences	Agricultural sciences	Social sciences	Humanities	
Primary source of funding	9.6	8.3	9.7	6.0	9.7		9.3
Fellowship, scholarship from institution	0.2	0.7	0.2	0.5	0.2	0.2	0.3
Fellowship, scholarship from government	13.4	6.2	6.7	3.6	13.3		11.5
Fellowship, scholarship from abroad	24.5	33.6	10.9	38.5	8.5		21.5
Teaching assistantship	4.5	0.6	4.9	0.2	1.7		2.9
Research assistantship	0.9	2.7	3.4	0.8	0.9		1.3
Other occupation	0.5	0.5	3.9	1.1	5.5		2.0
Employer's reimbursement/assistance							
Loan	0.1	0.1	0.8		0.4		0.2
Personal savings	3.8	3.1	10.2	6.1	9.0		5.5
Spouse's, partner's or family support	4.6	6.8	21.1	7.6	14.9		8.6
Other	37.9	37.5	28.1	35.4	36.1		36.9
Unknown							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Annex Tables 7 and 8. Employed doctorate holders by occupation and field of doctorate in Argentina and Germany¹

ISCO-88 code	Argentina	Natural sciences	Engineering and technology	Medical sciences	Agricultural sciences	Social sciences	Humanities	Empty	TOTAL
1	LEGISLATORS, SENIOR OFFICIALS AND MANAGERS	1.0	1.0	0.3	5.8	0.8	0.0	0.0	1.0
2	PROFESSIONALS	90.8	86.4	83.6	86.2	76.1	66.6	71.1	84.0
211-212	Physical, mathematical engineering science professionals	35.5	35.0	1.9	0.0	0.0	1.4	14.2	20.5
213	Physicists, chemists, mathematicians, statisticians and related professions	33.9	18.1	1.6	0.0	0.0	0.0	0.0	17.6
214	Computing professionals	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.4
22	Architects, engineers and related professionals	0.7	16.9	0.3	0.0	0.0	1.7	0.0	2.5
221	Life science and health professionals	30.2	11.1	38.0	31.3	2.2	0.8	14.2	21.5
222	Life science professionals	28.4	9.5	6.6	31.3	0.3	0.8	14.2	15.7
223	Health professionals (except nursing)	1.4	0.8	31.1	0.0	2.0	0.0	0.0	5.5
23	Nursing and midwifery professionals	0.4	0.8	0.3	0.0	0.0	0.0	0.0	0.3
231	Teaching professionals	24.8	40.3	43.7	50.9	45.8	54.2	42.7	36.4
232	College, university and higher education teaching professionals	24.4	39.9	42.1	49.0	43.8	51.7	42.7	35.4
233-235	Secondary education teaching professionals	0.0	0.0	0.9	2.0	0.3	0.8	0.0	0.3
24	Other teaching professionals	0.3	0.4	0.6	2.0	1.7	1.7	0.0	0.8
241-242	Other professionals	0.2	0.0	0.0	3.9	26.7	9.9	0.0	5.6
242	Business and legal professionals	0.1	0.0	0.0	3.8	5.3	1.7	0.0	1.2
243	Legal professionals	0.0	0.0	0.0	0.0	8.4	0.8	0.0	1.4
244	Archivists, librarians and related information professionals	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
245	Social science and related professionals	0.1	0.0	0.0	0.0	12.9	6.6	0.0	2.8
246	Writers and creative or performing artists	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
Other (ISCO-88 groups)		5.7	7.0	8.1	5.9	14.9	28.5	0.0	10.3
(empty)		2.7	4.9	6.9	2.0	8.1	5.0	28.4	4.7
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

ISCO-88 code	Germany	Natural sciences	Engineering and technology	Medical sciences	Agricultural sciences	Social sciences	Humanities	Other/ unknown	Total
1	LEGISLATORS, SENIOR OFFICIALS AND MANAGERS	6.2	73.8	6.9	73.2	6.9	6.9	8.4	4.3
2	PROFESSIONALS	79.7	73.8	87.0	75.7	75.7	82.6	61.2	80.9
21	Physical, mathematical and engineering science professionals	46.5	60.6	4.5	4.5	4.5	16.3	16.3	18.0
212	Mathematicians, statisticians and related professionals	23.4							5.0
213	Computing professionals	7.3							2.1
214	Architects, engineers and related professionals	14.8	52.5					8.9	10.8
22	Life science and health professionals	8.1		93.8	54.8			26.2	34.3
221	Life science professionals	6.1						1.9	1.9
222	Health professionals (except nursing)			93.4	44.0			23.6	32.4
223	Nursing and midwifery professionals								
23	Teaching professionals	17.2	7.6			26.5	31.3	9.9	13.3
231	College, university and higher education teaching professionals	12.3				3.5	17.2	7.6	6.6
232	Other teaching professionals					15.4			5.3
24	Other professionals	7.9	6.3			5.5	43.1	8.8	1.4
241	Business professionals					8.9			3.1
242	Legal professionals					17.2			3.9
243	Archivists, librarians and related information professionals					9.5			3.1
244	Social science and related professionals					9.5			3.1
245	Writers and creative or performing artists						15.1		2.3
246	Religious professionals								
247	Public service administrative professionals								
Other (ISCO-88 groups)		14.8	21.6	4.7	10.0	4.7	15.3	90.4	14.8
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1. The sum does not add to 100.0 because of the suppression of data cells for confidentiality reasons.

Source: First OECD/Eurostat/IUIS data collection on careers of doctorate holders.

Annex Tables 9 and 10. Employed doctorate holders by occupation and field of doctorate in Portugal and the United States¹

ISCO-88 code	Portugal	Natural sciences	Engineering and technology	Medical sciences	Agricultural sciences	Social sciences	Humanities	TOTAL
1	LEGISLATORS, SENIOR OFFICIALS AND MANAGERS	3.0	1.7	1.3	4.9	3.8	3.1	2.8
2	PROFESSIONALS	82.6	80.0	89.1	78.2	82.8	83.6	86.2
21	Physical, mathematical and engineering science professionals	12.2	10.9	1.1	8.0	0.9	0.7	6.6
211	Physicists, chemists and related professionals	10.8	2.5	1.1	1.1	0.0	0.0	3.7
212	Mathematicians, statisticians and related professionals	0.3	0.3	0.0	0.0	0.0	0.0	0.1
213	Computing professionals	0.2	1.0	0.0	0.0	0.1	0.0	0.3
214	Architects, engineers and related professionals	1.9	7.2	0.0	6.9	0.4	0.7	2.4
22	Life science and health professionals	1.1	0.1	17.6	0.6	0.4	0.7	2.3
221	Life science professionals (except nursing)	0.9	0.1	0.0	0.6	0.0	0.4	0.4
222	Health professionals (except nursing)	0.8	0.0	17.6	0.0	0.4	0.5	1.9
223	Nursing and midwifery professionals	0.0	0.0	0.0	0.0	0.0	0.2	0.0
23	Teaching professionals	67.7	78.9	70.4	68.5	83.1	88.9	78.3
231	College, university and higher education teaching professionals	66.5	78.1	70.1	68.5	86.6	83.3	76.4
232	Secondary education teaching professionals	1.0	0.5	0.4	0.0	1.8	5.2	1.5
233 to 235	Other teaching professionals	0.2	0.3	0.0	0.0	0.5	0.0	0.4
24	Other professionals	0.1	0.0	0.0	0.0	2.8	3.3	1.1
241	Business professionals	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	Legal professionals	0.0	0.0	0.0	0.0	0.0	0.0	0.0
243	Archivists, librarians and related information professionals	0.0	0.0	0.0	0.0	0.0	0.0	0.0
244	Social science and related professionals	0.0	0.0	0.0	0.0	0.0	0.5	0.1
245	Writers and creative or performing artists	0.0	0.0	0.0	0.0	0.0	2.8	0.9
Other	Other ISCO-88 groups	14.0	8.1	9.8	17.2	2.9	3.1	8.8
D/NP		0.4	0.3	0.0	0.0	0.5	0.2	0.3
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0	100.0

ISCO-88 code	United States	Natural sciences	Engineering and technology	Medical sciences	Agricultural sciences	Social sciences	Humanities	Other/unknown	Total
1	LEGISLATORS, SENIOR OFFICIALS AND MANAGERS	8.9	0.8	8.7	8.8	15.7	7.2		10.5
2	PROFESSIONALS	86.2	85.3	81.8	81.3	74.9	83.8	58.0	81.2
21	Physical, mathematical and engineering science professionals	25.6	64.1	3.0	14.1	2.4	1.2		16.2
211	Physicists, chemists and related professionals	14.1	4.0	1.0	6.2	0.4	0.4		5.2
212	Mathematicians, statisticians and related professionals	2.1	0.7	0.0	0.0	0.0	0.0		0.9
213	Computing professionals	6.2	10.6	1.6	4.6	1.1	1.2		3.8
214	Architects, engineers and related professionals	3.3	48.9	0.0	0.0	0.7	0.0		6.3
22	Life science and health professionals	28.4	0.8	48.0	39.4	2.5	1.3		14.2
221	Life science professionals (except nursing)	13.0	0.0	5.2	35.7	0.3	0.0		6.0
222	Health professionals (except nursing)	13.9	1.5	36.1	3.7	1.5	0.3		7.2
223	Nursing and midwifery professionals	0.5	0.0	7.6	0.0	0.8	1.0		1.0
23	Teaching professionals	25.5	17.8	33.1	26.1	38.5	52.9	64.0	33.1
231	College, university and higher education teaching professionals	24.7	17.5	22.4	22.8	32.5	46.5	60.0	29.7
232	Secondary education teaching professionals	0.7	0.0	0.0	0.0	2.5	4.9		1.9
233 to 235	Other teaching professionals	0.0	0.0	0.0	0.0	0.0	0.0		1.6
24	Other professionals	5.7	2.6	6.3	2.1	31.0	28.3		17.6
241	Business professionals	3.5	2.1	4.9	0.0	6.1	5.7		4.6
242	Legal professionals	0.2	0.0	0.0	0.0	0.0	0.0		0.4
243	Archivists, librarians and related information professionals	0.0	0.0	0.0	0.0	0.0	0.0		0.5
244	Social science and related professionals	0.6	0.2	1.5	19.9	0.3	2.5		0.5
245	Writers and creative or performing artists	1.2	0.0	0.0	0.0	1.2	4.2		7.6
Other	Other ISCO-88 groups	8.0	8.7	11.6	12.0	10.0	14.4		2.5
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1. The sum does not add to 100.0 because of the suppression of data cells for confidentiality reasons.

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.

Annex Table 11. Number of doctorate holders by sex and country of origin (thousands)

			TOTAL	Citizens of the reporting country	Of which by birth	Of which by naturalisation	Foreign citizens	TOTAL	Born in the reporting country	Foreign born	Unknown
Argentina	2005	Men	4.8	4.8	4.8	0.0	0.0	4.8	4.8	0.1	
		Women	3.7	3.7	3.6	0.0	0.0	3.7	3.6	0.0	
		Total	8.5	8.5	8.4	0.1	0.0	8.5	8.4	0.1	
Australia	2001	Men	48.8	42.3	25.8	16.1	6.5	48.6	25.9	22.7	
		Women	19.2	16.2	10.3	5.7	3.0	19.1	10.3	8.7	
		Total	68.0	58.5	36.1	21.8	9.5	67.7	36.3	31.4	
Canada	1996	Men	74.1	61.8	34.6	27.3	12.3	74.1	34.3	39.8	
		Women	23.2	19.1	12.2	6.9	4.1	23.2	12.0	11.1	
		Total	97.3	80.9	46.8	34.2	16.4	97.3	46.4	51.0	
2001	Men	85.5	70.1	37.5	32.6	15.4	15.4	85.5	37.1	48.4	
	Women	32.9	26.9	17.4	9.5	6.0	6.0	32.9	17.2	15.6	
	Total	118.4	97.0	54.9	42.1	21.3	21.3	118.4	54.3	64.1	
2003	Men	587.5	554.4			33.1	33.1	587.5	476.8	69.0	41.7
	Women	261.9	237.4			24.5	24.5	261.9	206.4	37.7	17.8
	Total	849.4	791.7			57.7	57.7	849.4	683.2	106.7	59.5
2004	Men	563.8	527.8			36.0	36.0	563.8	469.4	64.3	30.1
	Women	267.8	242.1			25.7	25.7	267.8	216.7	35.5	15.6
	Total	831.6	769.9			61.8	61.8	831.6	686.1	99.8	45.7
2003	Men	117.3	82.1			35.2	35.2	117.0	67.6	49.5	
	Women	114.6	80.1			34.6	34.6	114.6	67.4	47.1	
	Total	231.9	162.2			69.8	69.8	231.6	135.0	96.6	
1993	Men	767.0	691.6	605.7	85.9	75.5	75.5	767.0	605.7	161.3	
	Women	270.6	249.9	224.5	25.4	20.7	20.7	270.6	224.5	46.1	
	Total	1037.6	941.5	830.2	111.3	96.1	96.1	1037.6	830.2	207.3	
2003	Men	948.1	827.2	684.1	143.1	120.9	120.9	948.1	684.1	264.0	
	Women	487.8	440.2	382.9	57.3	47.6	47.6	487.8	382.9	104.9	
	Total	1435.9	1267.4	1067.0	200.3	168.5	168.5	1435.9	1067.0	368.8	

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders.