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Women's Representation and Progression in Science Careers in Greece

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The paper deals with women's representation and progression in science careers in Greece. We first describe the basic features of the national R&D system and examine women's participation in the system. We then provide information on the institutional setting shaping science careers and mobility and sketch out career paths in science. Finally we turn to the problems women in science face with respect to their careers.

1. THE NATIONAL RESEARCH AND DEVELOPMENT SYSTEM

In this section we describe the national R&D and higher education systems and the position of women in them. We thus provide the reference context against which data on women's participation in science and policy measures to promote their careers can be presented, analysed and assessed in the following sections.

1.1 The basic features of the Greek R&D system: institutions and funding

Scientific research and technological development in Greece takes place in different types of institutions of the public and private sector. The public sector includes the higher education research units and the government research and technology centres and institutes. R&D activities also take place in private firms and research companies as well as in non-profit research institutes.

A major feature of the Greek R&D system is its under-funding and strong dependence on resources from abroad, namely the EU. Gross domestic expenditure on R&D has grown during the 1990s, but still represented only 0.67% of GDP in 1999[1]. This is the lowest rate in the EU-15 and lower than the accession countries' average (Table 1.1.1). Funds from abroad represent 24.7% of total R&D expenditure (Table 1.1.2).

[1] The latest year for which available data exist.

Table 1.1.1 **Gross domestic expenditure on R&D as a percentage of GDP (1999)**

US	2.66	**Spain**	**0.88**	Finland	3.22	**Latvia**	**0.40**
Japan	2.94	France	2.18	Sweden	3.78	**Poland**	**0.75**
EU-15	**1.93**	Ireland	1.21	United Kingdom	1.85	**Romania**	**0.40**
ACC*	**0.83**	Italy	1.04	**Cyprus**	**0.25**	Slovenia	1.51
Belgium	1.96	Luxembourg	1.36**	Czech Republic	1.24	**Slovak Republic**	**0.66**
Denmark	2.09	Netherlands	2.02	**Estonia**	**0.75**	**Turkey**	**0.60**
Germany	2.44	Austria	1.83	**Hungary**	**0.69**	Iceland	2.32
Greece	**0.67**	**Portugal**	**0.76**	**Lithuania**	**0.52**	Norway	1.65

* Acceding countries. ** Data for 2000.
Source: Eurostat - Structural Indicators.

A second important feature of the system is the dominance of the public sector (higher education and government institutions) in the provision of R&D and the very small participation of business in total R&D activity and its funding. The public sector employs 84.6% whereas the business sector only 15.1% of all researchers. Moreover, the business sector provides only 24.1% of total R&D funds (Table 1.1.2 and 1.1.3).

Table 1.1.2 **Percentage of GERD* financed by industry and by abroad (1999)**

EU Member States	Industry	Abroad
Belgium	66.2	7.3
Denmark	57.9	5.2
Germany	65.0	2.1
Greece	***24.2***	***24.7***
Spain	48.9	5.6
France	54.1	7.0
Ireland	64.1	12.4
Italy**	43.0	6.2
Netherlands	49.7	11.2
Austria	40.1	***19.9***
Portugal	***21.3***	5.3
Finland	66.9	3.0
Sweden	67.8	3.5
United Kingdom	48.5	17.3
EU-15	**55.5**	**7.3**

* Gross Expenditure on R&D.
** Data for 1996.
Source: Eurostat - Structural Indicators.

Table 1.1.3 **R&D personnel by sector of employment and occupation (1999)**

	headcount	%	%
Business sector			
Researchers	2235	15.1	48.8
Other support staff	2342		51.2
Total	***4577***	***17.3***	***100***
Government sector			
Researchers	2000	13.6	45.1
Other support staff	2431		54.9
Total	***4431***	***16.8***	***100***
Higher education sector			
Researchers	10471	71.0	60.5
Other support staff	6823		39.5
Total	***17294***	***65.5***	***100***
Private non-profit sector			
Researchers	41	0.3	51.2
Other support staff	39		48.8
Total	80	***0.3***	100
All sectors			
Researchers	14748	100	55.9
Other support staff	11635		44.1
Total	***26382***	***100***	***100***

Source: Ministry of Development, General Secretariat for Research and Technology.

A third important feature of the system is the dominance of higher education within public sector R&D. In 1999 higher education institutions absorbed 49% of total R&D expenditure and 71% of all researchers. In the same year, they employed 10,471 researchers against 2,000 employed by government research institutions (Table 1.1.3).

Last but not least, despite the low participation of the business sector in applied research, the Greek R&D system is highly competitive due to the excellent performance of Greek scientists working in the higher education sector. Over the period 1983-1998 – from ESPRIT 1 until the end of the 4th Framework Research Programme – Greek institutions participated to 4.1% of all competitive industrial research projects funded by the EU and were the leaders of the research joint ventures in 3.1% of all projects (Caloghirou & Vonortas 2000). After controlling for the size of population, Greece occupies the 4th position in the EU with respect to participation in EU funded industrial research, after Denmark, Belgium and the Netherlands (ibid).

1.2 The role of the higher education sector in research

Given the dominant position of the higher education sector in the Greek R&D system, we provide hereafter information on the structure of the Greek higher education system and the teaching/research personnel working in this sector.

The Greek higher education system is made up of two distinctive types of institutions: universities and technological education institutes. There are 21 universities and 14 technological education institutes in Greece. The duration of under-graduate studies is 4-6 years in universities, whereas 3-4 years in Technological education institutes. Universities provide general scientific knowledge in several disciplines as well as interdisciplinary studies, while the technological education institutes are geared to technical knowledge of applied character and studies have a more clear-cut vocational orientation. Post-graduate studies are organized only by universities.

The regular teaching staff of universities is divided into four main ranks: professors, associate professors, assistant professors and lecturers. Apart from their regular personnel, universities employ lecturers and assistant professors on limited duration contracts, which can be renewed up to a total duration of three years. The PhD degree is a common prerequisite for both the regular and temporary teaching staff. Moreover, there is another category of 'auxiliary' teaching staff, including assistant lecturers and external collaborators with or without a PhD degree. Assistant lecturers without PhD is a declining category, since it mainly includes persons that did not possess the qualifications required for a lecturer at the time when the new ranking system was established in 1982 by the higher education reform. Since 1982, many members of this category were able to acquire the required qualifications and join the new system.

The ranks of the teaching staff in the technological education institutes are the same as in universities, with one exception. The 'applications professor' is the lowest rank instead of the lecturer. The majority of the teaching staff has no PhD degree and a great number in the lowest ranks have no Master's degree either. It follows that higher technological education is lower level than university education.

Until recently, technological education institutes were officially classified in the lower tertiary, while universities in the upper tertiary education. Two years ago higher technological education was decreed as equivalent to university education and holding a PhD degree became a prerequisite for the recruitment of the new members of the teaching staff in technological education institutes.

The low qualifications of the teaching staff of the technological education institutes and the legal monopoly of universities in organizing post-graduate studies explain why research in the higher education sector is mainly carried out by universities. Research in universities takes place into the numerous university research centres, institutes and laboratories out of which only 19 possess a separate legal status as well as managerial and financial autonomy from their respective universities. University research units compete with the government and private research institutions in the open market for publicly and privately funded projects of basic and applied research.

Apart from academics, a great number of senior and junior researchers, research assistants and PhD students are involved in research carried out by universities. This research personnel is mostly working on service contracts or on limited duration labour contracts and are paid from the funds of the project they participate in.

1.3 The role of the government sector in research

The second larger provider of R&D in Greece is the government sector. The state runs and funds 26 research and 11 technology centres and institutes. The research and technology centres and institutes occupy different categories of research staff:

a) Researchers belonging to four grades (A, B, C and D);

b) Visiting research fellows, with the qualifications of researchers A and B, employed from 3 to 24 months on limited duration labour contracts to assist the accomplishment of specific research projects;

c) Collaborating research fellows, with the qualifications of researcher D, on post-doc scholarships;

d) Academics employed for specific research projects on annual service contracts;

e) Post-graduate university students on scholarships.

The operational costs and salaries of the personnel of the research centres and institutes of the government sector are covered by the state. However, these centres and institutes also compete with universities and private research institutions in the open market for publicly and privately funded projects of basic and applied research.

1.4 Wages of academics and researchers in public/government institutions

The wages of academics and researchers in government/public institutions are set by law and are adjusted according to the wage increases for the civil servants. On top of minimum wages academics and researchers receive a number of premiums, allowances and bonuses. Allowances are lump sum, while premiums and bonuses are calculated as a percentage of minimum wages. In the tables below we present the minimum monthly wages of academics and researchers from 1.3.2004 onwards.

Table 1.4.1 **Minimum wages of higher education teaching staff and researchers**

Minimum monthly wages of academics (universities)	
Professor	1,537.5 €
Associate professor	1,332.5 €
Assistant professor	1,127.5 €
Lecturer	1,025.0 €
Assistant lecturer	922.5 €
Minimum monthly wages in Technological Education Institutes	
Professor	1,362.0 €
Associate professor	1,180.4 €
Assistant professor	1,044.2 €
Applications professor	908.0 €
Special Teaching Staff	908.0 €
Minimum monthly wages of researchers (government sector)	
Researcher grade A	1,471.5 €
Researcher grade B	1,275.3 €
Researcher grade C	1,079.1 €
Researcher grade D	981.0 €

Academics receive the following premiums and allowances on top of their monthly minimum wages:

- ⊡ Service premium: 4% increase on basic wage every two years up to 60%;
- ⊡ Allowance for preparation of teaching and for non-teaching university activity: 176-587 € depending on grade;
- ⊡ Allowance for library creation and updating and conference participation:88-411 € depending on grade;
- ⊡ Special allowance: 316-426 € depending on grade.

They also receive the following bonuses once a year:

- ⊡ Christmas bonus: 100% of (basic wage + service premium);
- ⊡ Easter bonus: 50% of (basic wage + service premium);
- ⊡ Holiday bonus: 50% of (basic wage + service premium).

The teachers of Technological Education Institutes receive the same premiums, allowances and bonuses as academics, but the amounts of allowances are lower.

Researchers in government research centres and institutes receive the same premiums, allowances and bonuses as academics, except for the allowance for preparation of teaching and for non-teaching university activity. Moreover, the special research allowance is lower: 140-388 €.

2. WOMEN'S PARTICIPATION IN SCIENCE

In this section we analyse quantitative data on women's participation in academia and research. Women's representation among academics has increased during the last decades. The female share of all academics rose from 18.22 in 1982/83 to 30.2% in 2001/02. Though steadily improving, women's participation in the upper ranks is still very low. In 2001/02, only 13.2% of full and 24% of associate professors were women. Women's participation is more important in the lower ranks. In 2001/02, 32.4% of assistant professors and 39.1% of lecturers were women.

Academics are part of the university teaching staff. In 2001/02 women represented 34.7% of the temporary and 44.9% of the auxiliary teaching staff (table 2.1).

Table 2.1 **Female share of university teaching staff by rank and category**

percentages (%)

	1982/83	**2001/02**
Full professors	4.44	13.22
Associate professors	12.32	24.00
Assistant professors	13.47	32.38
Lecturers	25.60	39.09
Temporary personnel	28.16	34.71
Auxiliary personnel	39.59	44.89

Source: Own calculations from official Education Statistics (NSSG).

Women academics seem to fare better in Greece than in several other EU countries, such as the Ireland, Germany, the Netherlands, Austria, Belgium, Denmark and the UK but worse than in Finland, Portugal, Spain, France, Sweden and Italy, which constitute the top scoring Member States (Osborn et al. 2000). The female share of the university teaching staff differs by discipline. It is the highest in humanities (47.1%) and the lowest in engineering and technology sciences (19.28%) (Table 2.2).

Table 2.2 **Female share of university teaching staff by discipline**

	%
Humanities	47.11
Fine arts	31.73
Law	32.09
Social sciences	31.04
Maths, physics, chemistry, biology etc.	23.46
Engineering and technology	19.28
Medicine	24.74
Agronomy, vet and forestry	21.76
Physical education and sports	23.18
All disciplines	**28.78**

Source: Maratou-Alipranti et al. (2002)

Table 2.3 presents data on the female share of R&D personnel by sector and occupation. According to the data, in 1999, women represented 40.9% of all researchers, 44.6% of researchers in private non profit organisations, 44.3% of researchers in the higher education sector, 37.5% of researchers in government research centres and 23.9% of researchers in the business sector. When the number of researchers is measured in full-time equivalents female shares do not change, except for the government sector where it decreases (Maratou-Alipranti et al. 2002). This means that women researchers in government research centres and institutions work on average less hours than their male counterparts.

Table 2.3 **Female share (%) of R&D personnel**

Business sector	
Researchers	23.9
Technicians	17.2
Other support staff	51.4
Total	***28.4***
Government sector	
Researchers	37.5
Technicians	42.6
Other support staff	34.8
Total	***37.2***
Higher education sector	
Researchers	44.3
Technicians	54.8
Other support staff	57.8
Total	***49.6***
Private non-profit sector	
Researchers	44.6
Technicians	44.4
Other support staff	57.7
Total	50.0
All sectors	
Researchers	40.9
Technicians	45.4
Other support staff	51.3
Total	***44.7***

Source: General Secretariat for Research and Technology.

Table 2.4 **Female share of scientific personnel in 37 government research centres and 13 university research institutes**

	Total number	**Female share (%)**
Pemanent researchers (in ranks)	658	28.3
University professors/lecturers	174	14.4
Permanent personnel without Ph.D.	130	40.0
Personnel with unlimited duration labour contracts	522	45.7
Personnel with limited duration labour contracts	317	29.3
Personnel with service contracts	1063	38.0
Ph.D students and trainees	357	33.3
Total	**3,221**	**34.7**

Source: EKKE - Data base 1, Teperoglou et al. (2002).

Greece is among the leading countries in the EU as far as women's participation in research in the public sector. The Third European Report on S&T Indicators shows that Greece has the second highest female share of government employed researchers after Portugal among nine EU Member States (European Commission 2003).

The picture becomes less optimistic as soon as we turn to more detailed data. According to a database created by the National Centre of Social Research (EKKE),

34.7% of the scientific personnel of 37 government research centres and 13 university research institutes in 2000 were women. However, the female share was the highest among the less qualified permanent (without PhD) and the non permanent research personnel (unlimited duration and service contracts) (table 2.4).

Table 2.5 **Researchers and academics by rank in 37 government research centres and 13 university research institutes**

	Total number	***Female share***
Researchers A - Full professors	192	16.1
Researchers B - Associate professors	262	28.6
Researchers C - Assistant professors	277	31.4
Researchers D - Lecturers	104	29.8
Total	***835***	***26.8***

Source: EKKE - Data base 1, Teperoglou et al. (2002).

The female share is very low among higher status researchers (permanent researchers and academics). Table 2.5 shows that the higher the rank the lower the female share, except for the case of researchers D and lecturers among which the female share is lower than among researchers C and assistant professors.

Comparative data are also point to the high performance of Greece as far as women's participation to industrial research is concerned. With a female share rising to 23.9%, Greece – together with Portugal – occupies the second best position after Ireland among ten EU Member States for which data is available. This is 11 percentage points higher than the EU-10 average which is 14.9% (Rübsamen-Waigman et al. 2003).

However, according to another data base created by the National Centre for Social Research (EKKE), only 10% of the scientific coordinators of all the research projects financed by the Operational Programme for Research and Technology under the 3rd Community Support Framework (1994-1999) were women (Teperoglou et al. 2002).

3. SCIENTIFIC CAREERS, INTERNATIONAL MOBILITY AND SCIENCE POLICY

In this section we describe the institutional setting that shapes the pathways and mobility of individuals who choose a career in the field of science.

3.1 Access to higher education and the choice of subject

Access to higher education and choice of subject is the starting point of a science career. Students are admitted to universities and technological education institutes according to their performance at national level examinations taking place at the last two grades of the upper secondary schools. Additionally, students are admitted to the Hellenic Open University upon the completion of the 22 year of age by drawing lots.

Table 3.1.1 **New entrants to higher education by subject (2002/2003)**
shares (%)

Subjects	Universities	Technological Institutes	All
Humanities	17.7	0.0	8.4
Arts	2.0	1.7	1.9
Law	4.5	0.0	2.1
Social Sciences	9.7	0.0	4.7
Communication sciences	1.4	1.7	1.5
Economics and Business	14.6	25.1	20.1
Life sciences	2.0	0.0	0.9
Physics	4.9	0.0	2.3
Earth and environment sciences	2.1	0.0	1.0
Mathematics and statistics	4.4	0.0	2.1
Computer science	8.2	9.7	9.0
Agronomy	3.3	16.3	10.1
Technology and engineering	7.7	24.7	16.6
Architecture and urban planning	1.6	0.5	1.0
Health sciences	4.5	11.3	8.1
Education sciences	8.3	0.8	4.4
Physical education and sports	2.7	0.0	1.3
Welfare and Services	0.1	8.2	4.4
Interdisciplinary subjects	0.3	0.0	0.1
All subjects	**100**	**100**	**100**

Source: Ministry of Education.

Higher education is free of charge for Greek students who do not pay tuition fees. However, only a small minority of students receive a scholarship.

Since 1993 the number of new entrants in higher education has doubled. According to the UNESCO comparative database, the gross enrolment ratio in tertiary education for the year 2000/2001 was 63% and Greece – along with Latvia –

occupied the fourth rank in the world after Norway, Sweden and the Russian Federation. In the same year, the country was the world leader for the male ratio (60%) and displayed the ninth higher female ratio in the world (66%).

According to the data of Table 3.1.1, 31% of all new entrants in higher education in 2002/2003 followed science subjects i.e. physics, mathematics and computer sciences, technology and engineering sciences and life sciences. The respective figures for entrants in university and entrants in technological institutes are 27.2 and 34.4%.

3.2 Post-graduate studies and post-doctoral research: initiation to research

Masters level courses first appeared in Greek universities in the 1970s. Until the beginning of the 1990s they were rather under-developed by comparison to advanced EU countries. Table 3.2.1 below shows that until the mid 1990s the number of taught Master's degrees awarded was smaller than that of PhD degrees.

Table 3.2.1 **Taught Master's Degrees and PhD degrees awarded**

	1972	1977	1982	1995	1999
Master's					
Total		***108***	***110***	***365***	***1304***
Female		11	28	175	708
(Fem share %)		10,2	25,5	47,9	54,3
PhD					
Total	***142***	***351***	***314***	***564***	***827***
Female	30	68	70	180	277
(Fem share %)	21,1	19,4	22,3	31,9	33,5

Source: NSSG, Education Statistics.

Masters programmes increased rapidly during the 1990s; their number passed from 51 in 1993 to 233 in 2002. Most Master programmes of Greek universities do not charge tuition fees to their students. There were 26,078 post-graduate students registered in the Greek universities in 2002; 13,538 were Masters and 12,540 were PhD students.

Only a minority of post-graduate students in Greek universities enjoy a scholarship. Unpublished data we have been able to collect from the State Scholarship Foundation (IKY) show that, in February 2004, the Foundation granted a monthly allowance to 704 such students. Moreover, it has recently announced a programme of 259 scholarships for the academic year 2004/2005. The beneficiaries

will receive a monthly allowance of 450 € for a period of 12 to 24 months in case of Master level studies or for a period of 12 to 36 months in case of doctoral studies.

Since 1996/1997 the State Scholarship Foundation also awards scholarships for post-doctoral research for 12 months. The recently announced programme for the academic year 2004/2005 includes 80 such scholarships. The candidates should not be aged more than 43 years or have obtained their PhD degree more than three years before the date of application. The beneficiaries will receive 600 € per month.

The availability of scholarships for doctoral studies has recently been extended. Since 2003 the Ministry of Education runs the HERAKLITOS programme for promotion of basic research, mainly consisting of scholarships to PhD students, while the Ministry of Development adopted the PENED programme which subsidises the participation of PhD students in research projects run by universities and government research centres and institutes and co-funded by public or private firms. Employment opportunities for post-doc researchers have also been opened up recently by the Ministry of Education, which has prioritized the participation of post-doc researchers in the research groups of the university research projects funded by the PYTHAGORAS programme. More generally, it can be sustained that opening up employment opportunities in research mostly favours young post-doc researchers. This is what is expected from the recent IRON programme of the General Secretariat of Research and Development (Ministry of Development), which subsidizes the employment of new researchers and technicians for 18 to 36 months in research projects of the business sector.

We can consequently deduce that both education policy and research and technology policy are central for encouraging individuals to engage in science careers.

3.3 The career trajectory of academics

The recruitment and promotion system

Academics are elected, after an open call of interest for a post, by other academics of the same or superior rank than that appearing in the call. The electoral bodies have at least eleven members and are composed of all the academics of the Department where the post belongs as well as external members if necessary to fulfill the minimum requirement. Although promotion from the rank of lecturer up to the rank of professor is open to competition, professors and associate professors enjoy tenure.

Lecturers are elected for a seven year term. After the completion of three years of term they have the right to initiate the procedure for their promotion i.e. the publication of an open call of interest for a post of assistant professor. If another candidate is elected for the post their term is automatically ended and they are obliged to quit. Assistant professors are elected for a three year term. At the expiration of their term they have both a right and an obligation to apply for tenure. If their CV is not deemed as appropriate for tenure, their term is automatically ended. After obtaining tenure assistant professors have the right to initiate the procedure for their promotion i.e. the publication of an open call of interest for a post of associate professor. If another candidate is elected for the post their term is automatically ended. In this case, they have the right to ask for a transfer to a vacant post of a public research centre, of public education or of the civil service. After three years of term, associate professors have the right to initiate the procedure for their promotion i.e. the publication of an open call of interest for a post of associate professor. If they are not elected, they have the right to initiate the promotion procedure a second time.

Getting a (temporary) lectureship

The career of an academic can start at any rank of hierarchy, since many academics have a prior professional experience in research centres or institutes. However, most academics start their career as lecturers and many of the latter as temporary lecturers on limited duration contracts, renewable up to 3 years of total cumulative duration. Holding a PhD is a minimum requirement for the recruitment of temporary teaching staff in universities and, since recently, in technological higher education institutes.

Although recruitment to all regular academic posts is open to competition, starting as a temporary lecturer is seen by individuals as an opportunity to obtain more credits than other candidates of equivalent qualifications for election at a regular post of lecturer. It is also one of the rare opportunities to gain teaching experience, which is one of the qualifications required for the regular posts of the teaching staff.

Qualifications for (regular) lectureship and typical progression routes

The minimum qualifications for lectorship are set by law (Act 1268/82):

- A PhD dissertation in scientific field of the post;

- At least two-year teaching experience in a university or two-year experience in research centres or recognized professional experience in a scientific field related to the post;
- At least two publications in scientific journals;
- Ability for independent teaching and research.

It follows that teaching or/and research experience are the necessary links between doctoral research and an academic career. This leads to the following typical progression routes.

Progression route A: doctoral research at home → working as research assistant in university on formal or informal service contract → temporary lecturer on limited duration contract → lecturer → assistant professor → associate professor → professor.

Progression route B: doctoral research abroad → regular researcher in government research centres or institutes or temporary lecturer on limited duration contract → lecturer → assistant professor → associate professor → professor.

Progression route C: doctoral research at home or abroad → post-doctoral contract research position in university or government research centres and institutes → lecturer → assistant professor → associate professor → professor.

Given that the number of available post-doc positions is still very limited in Greece (see above) the main progression routes are the routes A and B. Doctoral studies at home are less prestigious than those abroad but have the advantage of establishing relations between the PhD student and the teaching staff, opening up research assistant positions in university research laboratories, centres and institutes and opportunities for getting a temporary lectureship.

From (regular) lectureship to tenure and professorship

Regular lectureships formally provide job security for seven years maximum. Their main difference from temporary lectureships, apart from the competitive and stricter conditions of admission, is the right and obligation of regular lecturers to promotion. Assistant professors also experience insecurity during their first three years of service, before applying for and obtaining tenure. However, the fact that the

majority of voters for the promotion of lecturers and for the tenure of assistant professors come from the same department as the insider applicant makes it more difficult for outsiders to challenge a post and diminishes the risk of refusal of tenure.

The key for progression to the ranks of assistant, associate and (full) professor is publications of research monographs and articles in scientific journals. The pressure for publications in the first years of the academic career is more deeply felt because it is combined with job insecurity. Lecturers and assistant professors work very long hours to be able to cope with teaching, research and administrative duties.

Additional criteria for progression to the rank of professor are the contribution to the formation and teaching of the subject matter of at least two courses, the teaching in post-graduate programmes, international recognition for contribution in the progress of science etc. The strictness in the application of the criteria differs from department to department, from university to university and from discipline to discipline. Moreover, some universities and disciplines give more emphasis on publication of research monographs whereas others on publication of articles in refereed journals.

The importance of international mobility

Career progression of academics does not depend on the expectation of international mobility. Yet, as the overwhelming majority of Greek academics have carried out their post-graduate studies and have gained research experience abroad (mainly in the US, UK, France and Germany) most of them also spend their **research sabbaticals** abroad. Under-funding of research at home and dependence on EU funds makes it also imperative for Greek academics to cultivate their relationships with their colleagues abroad in order to participate in international research joint ventures. However, the degree of international mobility and participation to transnational research projects differs largely among academics. For instance, those in 'hard' sciences display higher mobility and participation, because of the greater availability of funds and transnational projects in their fields of research.

Greek academics also make a slightly above average use of the fellowships of the **Erasmus** teacher mobility programme for the exchange of teaching experience and methods between European universities. In 2001/2002, 279 Greek academics moved for teaching reasons under the Erasmus programme, which represents 1.48% of all teacher population. The share of teachers of engineering, technology,

mathematics and computer science was 24%. The average duration spent abroad was 6.4 days.[2]

For short visits abroad Greek academics also make use of the fellowships provided by the **bilateral programmes of scientific cooperation** signed between Greece and 16 countries. In 2004 Greece and these countries will cover travel and accommodation expenses for 8 to 15 days of 41 Greek academics who will visit these countries in order to establish cooperation and exchange relationships in teaching and research.[3]

3.4 The career trajectory of researchers in the government sector

Recruitment and progression conditions, qualifications and criteria in government research centres and institutes are set by law (Act 1514/1985). All vacancies are externally advertised and qualification requirements specified. Holding a PhD degree is the minimum requirement for being hired as a researcher of all grades (A, B, C, D).

Although vacancies externally advertised can belong to senior grades, most of them belong to grades D or C. Researchers of grade D, called 'researchers under probation', are appointed for a three year term. A publication of an open call of interest for a post of researcher grade C takes place upon completion of the third year and the researcher can apply for the post. If another candidate is deemed more qualified for the post then the researcher is dismissed. Researchers of grade C, called 'ordained researchers', are also appointed for a three year term. After the completion of the term, their CV is examined for promotion to grade B. If they are not deemed promotable their term can be renewed twice for two years each time. At the end of each term the CV is re-examined. If the researcher is not deemed promotable at the third judgment (s)he is dismissed. Researchers of grade B are called 'main researchers' and enjoy tenure. After four years of service they can apply for promotion. If the researcher is not deemed promotable his CV is reconsidered for promotion every three years. Researchers of grade A enjoy tenure and are called 'research managers'.

The key for progression to grades C, B and A is publications in scientific journals of international reputation along with the proven ability to design, direct, supervise and coordinate research projects and research groups.

[2] Latest data available by the European Commission on the Erasmus teacher mobility programme.
[3] These countries are Azerbaijan, Albania, Belgium, Bulgaria, Germany, Denmark, UK, Jordan, Iran, China, Cuba, Luxembourg, Hungary, Portugal, Syria and Finland.

The progression route of researchers in government research centres and institutes is often interrupted because many researchers voluntarily move to universities to follow an academic career. As mentioned above, research experience is an alternative to teaching experience as requirement for recruitment at all ranks of the regular teaching staff of the universities. It follows that as long as being academic remains more prestigious than being a researcher, there will be a permanent flow of researchers to universities. This will continue to happen in spite of the quasi-equalization of the wages of academics with those of researchers in the centres of the government sector.

3.5 The career trajectory of researchers in the business sector

Unfortunately there is not a single study or survey dealing with the career trajectory of researchers in the business sector. The field research of the MOBISC project is expected to shed light on this issue for the first time.

3.6 International mobility of students, young researchers and academics

Unsatisfied demand for higher education and student out-migration

Since the 1960s Greece has experienced an important out-migration of young people wishing to accomplish their under-graduate and post-graduate studies abroad. Time series data provided by UNESCO (Table 3.6.1) give a good picture of the trend since the early 1960s: a steadily growing number of all Greeks studying abroad and very high numbers in the 1980s and 1990s relative to the size of the relevant youth cohorts. Massive out-migration has been the outcome of excess demand for higher education created by widespread aspirations for upward social mobility, the system of *numerus clausus* that regulated access to higher education until 2000 and the under-development of post-graduate studies until the mid-nineties.

These mobility flows were the outcome of private decisions of investment in human capital based on private calculations of anticipated returns and almost all costs were paid by Greek families, since the Greek State did not provide any scholarships for undergraduate studies abroad and only a small number for post-graduate studies.

Unfortunately the UNESCO database does not distinguish between undergraduate and postgraduate students. Yet, if we combine UNESCO data with

this provided by the Bank of Greece on undergraduate students,[4] we can deduce that the majority of Greek students abroad migrated in order to realize undergraduate studies. However, given the under-development of post-graduate studies in Greece until recently, migration abroad was an imperative for those interested in careers in academia and research.

It is not exaggerated to maintain that, despite the negative phenomenon of brain drain associated with these massive flows abroad, almost all academics and researchers working today in the Greek universities and research centres have obtained their doctoral degrees from the universities of the US, the UK, France and Germany. These countries happen to be international leaders in scientific production and technology.

Table 3.6.1 **Greek students abroad**

Year	*Abs no*	Year	*Abs no*
1963	*7,980*	**1978**	*31,932*
1964	*8,732*	**1979**	*29,539*
1965-66	*9,387*	**1980**	*31,507*
1967-68	*9,703*	**1981**	*30,828*
1969	*12,492*	**1982**	*32,341*
1970	*14,069*	**1983**	*32,220*
1971	*16,934*	**1984-85**	*34,087*
1972	*19,321*	**1986-87**	*31,080*
1973	*20,882*	**1988-89**	*32,183*
1974	*22,587*	**1990-91**	*37,767*
1975	*23,363*	**1992-93**	*40,739*
1976	*31,063*	**1995-96**	*43,941*
1977	*30,849*	**1997-98**	*54,099*

Source: UNESCO database, Magoula (1999).

Scholarships for post-graduate studies abroad

An important number of Greek post-graduate students abroad are on scholarships. In February 2004, the State Scholarship Foundation granted monthly allowances to 460 Greek post-graduate students abroad. The Foundation has recently published its programme for the academic year 2004-2005 including 234 such scholarships. Their duration ranges from 12 to 36 months. Another 90 to 130 scholarships have been announced for the academic year 2004/2005, to be granted by 36 foreign governments to Greeks willing to study in their countries.

[4] For a detailed presentation and analysis of the time series of the Bank of Greece see Karamessini (2003).

European Commission's Mobility Schemes for researchers

The EC has adopted in the 1990s a number of grant schemes to encourage the development and better utilisation of human resources in the EU through the training and mobility of researchers. The *Training and Mobility of Researchers (TMR) Programme* first introduced under the EC's Fourth Framework Research Programme (1994-1998) includes a special scheme for young researchers (Marie Curie Fellowships). The scheme provides grants to doctoral and post-doctoral researchers as well as to established researchers who whish to receive training or specialise in a research institute outside of the country of their nationality. Statistical data provided by a study on the participation of women researchers in the TMR Marie Curie Fellowships (Ackers et al. 2001) illustrate that Greek doctoral students and post-doctoral researchers had a low participation in the scheme between 1994-1998.

Mobility of foreign post-graduate students and researchers to Greece

Data on foreign post-graduate students and researchers working in Greece are not available. Yet we can enumerate two policy measures taken by the Greek government to encourage mobility of foreign post-graduate students and researchers to Greece.

A) Scholarships to foreign citizens for post-graduate studies or research. The Greek government has published its programme for the academic year 2004/2005. It includes 110-120 scholarships that will be granted to nationals of 47 countries who wish to attend post graduate studies in Greek universities or to work on a research project at the universities or research centres of the country. The duration of the scholarships ranges from 3 to 10 months and the monthly allowance rises to 440 €.

B) The ENTER programme of the General Secretariat of Research and Development (Ministry of Development) aims at attracting more than 50 researchers from abroad to work on specific research projects carried out by universities, technological education institutes and government research centres and institutes and co-funded by private or public firms. The programme subsidizes the wages of foreign researchers up to 2,350 € per month (2,935 € for computer scientists) for a duration of 3 to 24 months.

C) The IRON programme of the General Secretariat of Research and Development (Ministry of Development) subsidizes the employment of new researchers and technicians for 18 to 36 months in research projects of the

business sector. The subsidies are granted for the recruitment of either Greek or foreign researchers.

4. CAREER PROGRESSION AND MOBILITY OF WOMEN IN SCIENCE

In this section we first describe gender differences in undergraduate and post-graduate studies as well as gender differences in international mobility for post-graduate studies and post-doctoral research. Then we present the results of a survey on career-related problems of women in research. Finally we analyse the expected impact of flexible working on women's career, progression and international mobility.

4.1 Gender differences in undergraduate and post-graduate studies

According to the most recent official data referring to the academic year 2001/2002 (NSSG, *Education Statistics*), women represented 60.8% of the new entrants in higher education, 59.4% of all undergraduate students, 55.5% of students of Master level courses and 41.4% of PhD students.

The distribution by field of education differs largely among male and female students at both the undergraduate and post-graduate level. Physical science, mathematics and statistics, computing and engineering concentrate 31.6% of male undergraduate, 41.6% of male Master and 43.6% of male doctoral students. The respective rates for female students are 11.7, 19.5 and 17.9%. These are also the fields of education where the feminization rates are the lowest, or among the lowest. On the contrary, female students – both undergraduate and post-graduate – are concentrated much more than men in education science, humanities, social and behavioural science and law. These fields of education concentrate 61.5% of female undergraduate, 54.1% of female Master and 51.9% of female doctoral students. The respective rates for male students are 33.6, 31.9 and 26.1%. These are also the fields of education where the feminization rates are the highest, or among the highest.

Table 4.1.1 **Undergraduate students by sex and field of education (1998)%**

	Field of education (ISCED-97)	Total	Male	Female	*Feminisation rate*
14	Teacher training-education science	9.8	6.3	12.5	71.8
21	Arts	2.3	1.6	2.9	70.3
22	Humanities	18.9	9.4	26.3	78.3
31	Social and behavioural science	13.6	12.3	14.6	60.4
32	Journalism and information	1.1	0.5	1.5	78.8
34	Business and administration	6.6	7.1	6.3	53.1
38	Law	7.0	5.6	8.1	65.0
42	Life science	1.2	1.1	1.2	57.5
44	Physical science	5.4	7.4	3.9	40.3
46	Mathematics and statistics	4.5	5.8	3.4	43.3
48	Computing	1.9	2.7	1.3	38.8
52	Engineering & engineering trades	8.6	15.7	3.1	20.0
58	Architecture and building	5.8	7.7	4.3	41.9
62	Agriculture, forestry and fishery	3.1	4.3	2.3	40.6
64	Veterinary	0.5	0.6	0.4	42.1
72	Health	9.6	11.6	8.0	47.0
	Total	100.0	100.0	100.0	56.4

Source: Calculations by N. Ntermanakis from NSSG, *Education Statistics.*

Table 4.1.2 **Postgraduate students by sex and field of education (1998) %**

	Field of education (ISCED-97)	Master level			Doctoral		
		Total	Male	Female	Total	Male	Female
14	Teacher training-education science	6.3	4.8	7.8	3.6	3.2	4.3
21	Arts	0.0	0.0	0.0	0.8	0.6	1.1
22	Humanities	23.8	17.7	29.8	13.1	7.9	22.8
31	Social and behavioural science	7.6	5.0	10.0	11.5	8.5	17.2
32	Journalism and information	1.1	0.6	1.6	0.0	0.0	0.0
34	Business and administration	8.3	10.9	5.8	0.5	0.7	0.2
38	Law	5.5	4.4	6.5	6.9	6.5	7.6
42	Life science	3.2	2.6	3.6	2.7	2.1	3.8
44	Physical science	22.3	29.3	15.5	8.4	8.7	7.8
46	Mathematics and statistics	1.6	2.1	1.1	1.4	1.7	0.8
48	Computing	1.4	2.4	0.4	0.2	0.3	0.1
52	Engineering and engineering trades	5.1	7.8	2.5	24.6	32.9	9.2
58	Architecture and building	0.9	1.0	0.9	10.1	10.5	9.3
62	Agriculture, forestry and fishery	2.9	3.6	2.2	4.7	5.0	4.1
72	Health	10.0	7.7	12.2	11.6	11.6	11.8
	Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Calculations by N. Ntermanakis from NSSG, *Education Statistics.*

Table 4.1.3 **Postgraduate feminisation rate by field of education (1998) %**

	Field of education (ISCED-97)	Master level studies	Doctoral studies
		Feminisation rate	Feminisation rate
14	Teacher training-education science	63.2	42.0
21	Arts	-	50.0
22	Humanities	63.7	60.8
31	Social and behavioural science	67.4	52.0
32	Journalism and information	73.7	-
34	Business and administration	35.8	11.1
38	Law	60.5	38.6
42	Life science	59.0	48.3
44	Physical science	35.6	32.6
46	Mathematics and statistics	35.8	21.3
48	Computing	15.5	10.0
52	Engineering and engineering trades	24.6	13.0
58	Architecture and building	47.9	32.1
62	Agriculture, forestry and fishery	38.5	30.4
72	Health	62.2	35.3
	Total	51.0	34.9

Source: Calculations by N. Ntermanakis from NSSG, *Education Statistics.*

Table 4.1.4 **Master and doctoral students by sex and age (1998) %**

Age	Master			Doctoral			Master	Doctoral
	Total	Male	Female	Total	Male	Female	Feminisation rate	Feminisation rate
<=22	2.0	2.3	1.7	0.1	0.1	0.2	43.6	50.0
23	5.7	6.1	5.4	0.9	0.9	1.0	48.1	36.0
24	11.7	11.4	11.9	3.2	3.6	2.4	51.9	26.4
25	14.2	12.9	15.4	5.2	5.9	4.0	55.4	26.7
26	13.0	12.0	13.9	6.7	7.5	5.3	54.8	27.6
27	8.8	8.6	8.9	7.1	7.3	6.6	51.9	32.6
28	10.2	11.0	9.5	6.8	7.4	5.8	47.3	29.7
29	5.5	5.4	5.6	7.4	7.2	7.8	52.0	36.7
30	3.9	3.6	4.2	6.9	6.5	7.6	54.5	38.4
31	2.7	2.5	2.8	5.8	5.3	6.8	54.4	40.8
32	2.7	2.6	2.7	5.3	5.1	5.7	52.2	37.2
33	2.1	2.0	2.1	4.3	4.1	4.8	51.9	38.1
34+	17.6	19.5	15.8	40.2	39.1	42.1	45.8	36.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	51.0	34.9

Source: Calculations by N. Ntermanakis from NSSG, *Education Statistics.*

Table 4.1.4 indicates another important gender difference. Although women complete at an earlier age than men their Master studies, the opposite happens with doctoral studies. The larger than the male share of female PhD students above 33 years shows not only that women start their PhD at a later age (on average), but also that they risk more than men to never finish it. A working hypothesis could be that life cycle events, such as giving birth and child rearing, postpone women's decision to start a PhD and, together with the need to find a job and the unavailability of good part-time jobs in the Greek labour market, jeopardize the completion of doctoral research.

Table 4.1.5 **Greek post-graduate students on scholarships granted by the State Scholarship Foundation**
(February 16, 2004)

	Males	Females	Total	Fem share
At home	334	371	705	52.6%
Abroad	248	212	460	46.1%
Total	582	583	1165	50.0%

Finally, according to unpublished data we have able to collect from the State Scholarship Foundation, in February 2004, the female share of post-graduate students of Greek universities receiving a scholarship from the Foundation was 52.6 %.

4.2 Gender differences in the international mobility for post-graduate studies and post-doctoral research

Data on gender differences regarding the international mobility of students and young researchers is very scarce. Unfortunately, the UNESCO database does not deliver data on Greek students abroad by sex. We consequently present in this paragraph the only available data on participants in the major scholarship and grant schemes.

Erasmus Programme for undergraduate students

According to the *Survey into the Socio-economic Background of Erasmus Students* (European Commission 2000), which was carried out in 1997/98 among the students of the Erasmus programme for undergraduate mobility, Greece had the highest female share of participants among 17 countries (70% against an average of 59%).

State Scholarship Foundations' (IKY) scholarships

Unpublished data that we have been able to collect from the State Scholarship Foundation indicate that, in February 2004, the female share of the post-graduate students abroad receiving a scholarship from the Foundation was 46.1%.

Marie Curie grants

As for the EC *Training and Mobility of Researchers Programme*, a study on the part played by female researchers in the **Marie Curie Grant Scheme** (Ackers et al. 2001), has revealed that the female share of the fellowships finally granted to Greek nationals for doctoral and post-doctoral research between 1994 and 1998 was 44% and 30% respectively. Additionally, women represented 37% and 30% of all Greek applicants for doctoral and post-doctoral grants and were over-represented in engineering, mathematics and economics.

4.3 Career problems of women researchers: the results of a survey

We have mentioned in section 2 above the creation by the Greek National Centre for Social Research of two data bases: one for public sector research institutions and another for the scientific coordinators of funded research projects. The same Centre has also carried out a field research among 236 male and female researchers working in the 50 government research centres and university research institutes of the first data base (Teperoglou et al. 2002). Some of the research results are relevant for our study, since they identify women researchers' problems in relation to their careers.

The problems identified by the survey were the following:[5]

1. The incidence of PhD degree is higher among male than female researchers: 81% of men and 64.5% of women researchers are doctors;
2. Women on average complete their post-graduate and doctoral studies at an older age than men - by one and two years respectively - and thus start their career later.
3. Although there is no gender bias in recruitment, discrimination against women appears in relation to the assignment and composition of tasks and promotion.

[5] We present the results selectively and in our own order.

4. The proportion of male researchers occupying posts involving responsibility, initiative and decision-making about the work of other persons is twice the respective proportion of female researchers.
5. The proportion of female researchers occupying posts entailing responsibility and initiative, but where decisions are taken by superiors, is twice the respective proportion of male researchers.
6. In particular, the proportion of women having assumed the responsibility of national, European or international research projects is much lower than that of men;
7. Women researchers have less engagement than their male counterparts in the organisation of scientific activities (e.g. conferences) and reduced participation in administration boards, scientific and counseling committees.
8. Family and childcare responsibilities are serious obstacles to the career progression of women in science, underlined with emphasis by the female respondents.

4.4 Flexible working and women's careers in academia and research

Several general policy measures affect women's representation, career progression and international mobility in science. These measures range from flexible working and sabbaticals in academia and research, to positive discrimination measures actively promoting doctoral studies and research experience among young women.

Flexible working time and sabbaticals: the positive aspect of flexible working

Information on the working conditions of employees involved in the R&D activities of the big companies of the Greek business sector is inexistent. The only information available refers to the public sector, namely researchers and academics working in government research centres and higher education institutions.

A great advantage in the working conditions of academics and permanent researchers of public research centres is **voluntary working-time flexibility** and the right to **paid sabbaticals**. Both academics and researchers of public research centres can vary their working hours and schedules, with the exception of some public research centres where flexibility is more limited and time budget schemes are in practiced. Employee-induced working-time flexibility is especially valued by

parents with caring responsibilities and helps particularly women to combine family life and career.

Both academics and permanent researchers of public research centres are also entitled to a paid sabbatical leave of six months, after having completed three years of service, or of one year, after having completed six years of service in the same institution. If the sabbatical leave is spent abroad then they receive double pay. In addition, academics can choose a **part-time scheme** and be granted an **unpaid leave** of six months maximum per year to teach in a higher education institution abroad. Income loss can be compensated by the host institution.

According to the relevant legislation, sabbatical leaves are meant to enrich and update the scientific knowledge of the applicant and are conditional on his/her participation to the research programme or teaching schedule of other higher education/scientific institutions at home or abroad. They are thus granted after the approval of the plan of scientific activity of the applicant during the leave period. If the beneficiary spends his/her leave abroad and is not remunerated by the host institution, (s) he is entitled to double pay for the whole period of the leave.

Both well-remunerated sabbaticals and unpaid leaves for teaching abroad, encourage short term mobility in science careers and their use is crucial not only for career progression but also for the speed of this progression. Lower female than male take-up rates because of heavier family obligations can prevent/delay women's promotion to higher ranks of the hierarchy, thus reproducing their inferior position in science. Unfortunately, data on take up of leaves are not available.

Greek academics can choose to work part-time for other reasons than teaching abroad. These reasons can be associated with the exercise of other professional activities in the public or private sector or with family obligations. It is extremely rare though that women academics make use of this option to cope with care responsibilities. The income loss partly explains their behaviour. An additional explanation is the strong preference for the full-time work model among Greek women; even more so among highly educated women that invest more than less educated ones in their career.

Precarious employment: the negative aspect of flexible working

Until know we have described the positive aspects of flexible working among academics and researchers. The negative aspect involves the growing importance of **precarious employment**. The data of table 2.4 tell us that 33% of total research staff in the public research institutions is working on service contracts and another 10% on

limited duration labour contracts. This means that precariousness has become a dominant feature in the research profession. Researchers are increasingly employed and paid on a project basis, which is a strong disincentive for young highly educated people who wish to build their careers on expectations of occupational advancement. The other side of the coin is retention problems faced by research institutions for which precariousness jeopardizes the returns of their investments in the training of young researchers.

If we combine employment precariousness with the great gap in unemployment rates between male and female higher education graduates (3 against 8.4% in 2002) and holders of Master's and PhD degrees (4 against 11.5% in 2002), we may infer that young women are discouraged more than young men to invest in doctoral studies and choose science careers. If this is true, then there is a strong structural determinant of the gender gap in science that cannot be overcome without more radical measures.

5. RECENT POLICY CONCERN & INITIATIVES

Recent policy concern is expressed more about equality of access to science careers than about gender differences in progression and mobility in science careers. The thrust for the adoption of policy measures at the national level has come from the EU as a result of gender mainstreaming in European Research Policy. This thrust was mediated through the negotiations over the 3rd Community Support Framework and the EC requirement for applying the principle of gender mainstreaming.

Several policy measures have been taken during recent years to enhance women's participation in science (Rees et al. 2002, http://www.gsrt.gr/site.asp?id=516):

The S&T Indicators Department of the General Secretariat for Research and Technology (GSRT), following recommendations from EUROSTAT, has included since 1999 a gender dimension in the questionnaires of its bi-annual surveys of the research personnel of government research centres, universities, entreprises and private non-profit organisations.

Monitoring women scientists' participation in the labour market and detecting of vacancies in R&D specialties through the National Labour Observatory.

The creation in January 2000 of a ***Women in Science Network*** (called Periktione after Plato's mother who was a keen mathematician and philosopher) with the goal of mainstreaming gender into R&D policy, sensitizing the public and diffusing information.

- Study on the *Enhancement of the Participation of Greek Women in Scientific Research* conducted by the National Centre for Social Research (EKKE) and financed by the GSRT.

Assistance to ***women researcher-entrepreneurs*** to create spin-off companies.

- The GSRT programme PENED for the *Enhancement of the Research Potential*, consisting of ***grants to young researchers to carry out a PhD***. Young female researchers are favoured through a 1.05 bonus awarded to every female candidate upon achieving the final grade following the evaluation of the proposal. 631 proposals have been submitted to the programme until now. They involve 1,903 young researchers out of which 40% are men and 36% are women. The sex of the remaining is yet unknown, since they will be appointed by the responsible of the projects after the approval of proposals.

The most recent policy measures are the following:

- The Ministry of Education programme HERAKLITOS consisting of ***scholarships to PhD students*** and ***grants to research groups*** for publications in scientific journals and secretarial support. Young female researchers are favoured through a 1.05 bonus awarded to every female candidate upon achieving the final grade following the evaluation of the proposal.
- Publication of a "Guide for the Implementation of Equality Policy Measures through the Operational Programmes of the 3rd Community Support Framework" by the Special Coordination Service for the European Social Fund. The Guide proposes an ***indicator to monitor progress of women's participation in science*** and according to which a number of Operational Programmes will be evaluated. This indicator is complemented by three more specific ones: distribution of academics by gender, rank and discipline; female participation into the boards that decide for the allocation of research resources; participation in post-graduate study programmes by gender and scientific area of study.

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