

# **SOCIUS Working Papers**

## **Gender Matters in Scientific and Technological Fields: Time as a Biased Resource**

**Sara Falcão Casaca  
Margarida Chagas Lopes**

***Nº 06/2009***

**SOCIUS - Centro de Investigação em Sociologia Económica e das Organizações  
Instituto Superior de Economia e Gestão  
Universidade Técnica de Lisboa  
R. Miguel Lupi, 20 1249-078 Lisboa  
Tel. 21 3951787 Fax:21 3951783  
E-mail: [socius@iseq.utl.pt](mailto:socius@iseq.utl.pt)  
Web Page: <http://pascal.iseq.utl.pt/~socius/index.htm>**

## **Gender Matters in Scientific and Technological Fields: Time as a Biased Resource\***

Sara Falcão Casaca & Margarida Chagas Lopes (SOCIUS/ISEG-UTL)

### **Introduction**

As in many other European countries, Portuguese women are increasingly choosing scientific occupations. In comparison with women in most OECD countries, they are also narrowing the gap between their performance and that of men in a variety of scientific disciplines, even in the study of Mathematics within the system of compulsory education. Moreover, they are performing increasingly better in most areas of undergraduate and postgraduate study, especially in Master's degrees.

Nevertheless, when data on occupational structure by gender are analysed, it can be seen that most Portuguese women working in Science and Technology (S&T) have jobs in higher education<sup>1</sup> and work as researchers at public agencies, laboratories and research units, with only less than one third of them being employed in economic and business occupations. Furthermore, unlike most scientific areas, technological fields are still considered less attractive by Portuguese women when choosing possible areas of further study. Another more important reason – as highlighted by previous studies - is the nature of firms' innovation policies, work organisation and recruitment strategies: either they are still pursuing quite traditional patterns of specialisation and are therefore not looking for highly skilled workers, or conversely the restructuring of their business requires very specific technological skills. In both situations, a gender-biased recruitment model is to be found most of the time, as is discussed in the theoretical background.

---

\* The authors are grateful to the anonymous referees for their constructive suggestions, to Helena Carvalho (ISCTE, Lisboa) for her helpful comments on the quantitative data analysis and to Tânia Cardoso for her contribution and commitment to the project. This paper was presented in the workshop *Women in Science and Technology*, under the frame of the Research Network Sociology of Science and Technology Network (SSTNET), ESA (European Sociological Association), Zagreb, June 5-6 2008.

In this paper, we argue that higher education has shown itself to be a heavily gender-biased area in Portugal and research careers tend to be insecure, offering limited opportunities for personal and professional development. Therefore, this occupational concentration in higher education and research areas imposes a double burden on women scientists: they almost inevitably have to suffer from job precariousness, at least during a probationary period of some considerable length of time; and, on account of occupational requirements – unlike the present situation in the business sector – they have to achieve both a master's degree (MSc) and a doctorate (PhD), not only in order to overcome instability but also to secure their jobs. Therefore, this paper seeks to highlight the fact that the obstacles and restrictions faced by those seeking to obtain these postgraduate degrees are not gender-neutral. As a result, some of the main gender-biased features affecting the achievement of an MSc or PhD degree are examined. Moreover, success and failure in education and training are intrinsically dynamic processes as they directly affect the time required to complete a given degree. We also raise the hypothesis that the abovementioned gendered features will translate into different time spells required by women and men to complete the same degree, after controlling for other potential sources of inequality. Mainly relying on two projects carried out in Portugal<sup>2</sup>, our analysis will rely upon the individual trajectories of MSc and PhD students, the breakdown of whom by gender will provide the main empirical research material.

Two central questions are explored throughout the paper:

1. In view of the mismatch between the performance of Portuguese women in scientific fields and their common occupational statuses, does the undertaking of postgraduate studies, beginning with a master's degree, amount to a deliberate compensatory strategy, possibly the only one that can offer them job stability and upward mobility, in situations where an MSc or PhD is not a mandatory requirement?

2. In spite of the narrowing gap in educational performances between men and women, and in some scientific fields even the women's higher achievement, is obtaining an

MSc or PhD more difficult and more time-consuming for women than it is for men, especially in careers and occupations where it clearly influences their ability to secure their jobs?

The following sections are organised according to the following structure: firstly, the main theoretical references are presented and discussed in terms of their complementarities, similarities and opposing arguments. Secondly, relying on secondary statistical data, the main aim is to provide a general picture of the performance of Portuguese men and women in higher education and their labour market outcomes. The third section is devoted to the analysis of our primary data and empirically explores the questions previously outlined; here, data description and statistical analysis are developed using Contingency and Discriminant Analyses. Finally, reflecting on the main empirical outcomes, the paper suggests the need for further research.

## **1. Theoretical Background**

Human Resources Economics and the Economics of Education have long criticised the mainstream approach, which considers human capital theories as the most suitable theoretical framework for explaining the demand for education, strategies for further studies and labour market outcomes.

Actually, most hypotheses and results proposed by such theories no longer fit in with present-day life cycles of work and study. It is sufficient to select just a few from amongst such unrealistic traits: the suggestion that more education necessarily implies more and better work opportunities; Mincer's well-known concept of the "overtaking year" (Mincer, 1974), according to which transitions between education and the labour market take place instantaneously and automatically; the assumption that no further education and training are pursued after integration into the labour market; and also – and perhaps the most restrictive assumption – the suggestion of complete homogeneity among individuals in their attitudes towards education.

Besides the very great attractiveness that these theories – together with most other mainstream economic approaches – continue to have for a great number of researchers into

education and the labour market, we believe that statements such as the above should be subject to critical scrutiny. In fact, the homogeneity assumption has been systematically criticised from the standpoint of both equality in terms of education and further labour market opportunities. Nevertheless, inequality can only be assessed in its broader and more diverse dimensions as a dynamic and time-dependent outcome, a feature which calls for the use of longitudinal or panel data capable of depicting life cycle trajectories for the individuals under consideration.

The hypothesis that more education would necessarily imply more and better work opportunities and higher statuses has been successfully proved over time to be a general macroeconomic outcome. Another quite different and frequently opposite result nevertheless arises with the transposition of that outcome to each individual's life cycle, as well as the social representations attached to individual characteristics. As a matter of fact, instead of the linear, well adjusted and automatic transition between school and work, participation in the labour market is increasingly subject to uncertainty, career breaks, time consumption and trial and error processes, frequently leading to poor job-matching, (e.g. Willys, 1986; Bollens & Nicaise, 1994; Alves, 2004).

In addition to this, the argument stating that education and/or training are normally completed before entering the labour market has to be eradicated once and for all: otherwise how would it be possible to go on sustaining the need for lifelong learning (LLL), which most educational and research organisations agree upon? Complying with LLL forces researchers to abandon some of the other conventional assumptions, such as for instance those which support the calculation of the rates of return to education as if work trajectories were continuous, without any breaks of unemployment or inactivity, and as if they were social (and gender) neutral in relation to the upgrading and downgrading of skills. In fact, labour trajectories and lifelong learning opportunities are strongly gender-biased and shaped by the wider social context – dimensions which tend to be undervalued by these theoretical approaches.

Post-Braverman research mostly relies upon dualistic and segmented labour market approaches (SLM), most of the time reinforced by criticism of the ideological genesis of some apparently neutral concepts such as qualification definitions and classification criteria, actually considered to be a source of gendered power (Beechey, 1988). But suspicion about the contribution of SLM approaches has become by no means less prominent, especially with regard to a very important dimension in this study, which is that of considering heterogeneity among women and the evidence that some women have increasingly been joining the primary labour market.

Science and technology are gendered, not neutral, domains – as both Liberal Feminist studies and Human Capital and Human Resource Economics have suggested (for critical accounts of these approaches, see e.g. Cockburn, 1986; Wajcman, 1991; Jenson, 1998; Kergoat, 1998; Faulkner, 2001; Ferreira, 2003; Lopes & Fernandes, 2003; Casaca, 2006). Here we highlight some of the sociological approaches which tend to discard either those deterministic views that are too optimistic or approaches that associate such developments with predetermined directions (heading either towards optimal or highly unfavourable scenarios) and with social change (Kovács, 2005), including gender structures and gender relations. Particular attention is drawn to those perspectives that highlight the influence of cultural norms on women's and men's roles in society, as well as the way in which gendered socialization experiences account for gender-biased choices relating to scientific fields and occupations, where both constraints and opportunities still vary significantly (e.g. Faulkner, 2001; Ferreira, 2003; Casaca, 2005, 2006).

Social Shaping approaches also seem to make supportive contributions to the study as they emphasise that the position of men and women in scientific and technological areas is not independent of the economic, social, historical, political and wider institutional context. Furthermore, the social (and gender) implications of scientific and technological development need to be seen as complex, heterogeneous, ambivalent and contingent (e.g. Cockburn, 1986; Cockburn & Ormrod, 1993; Webster, 1996; Kergoat, 1998; Ferreira, 2003; Casaca, 2005; Kovács, 2005).

Social Constructivist approaches add a complementary view to our analysis: social conceptions about masculinity and femininity are seen as being simultaneously embedded and constructed (and transformed) in the various contexts of social life – economic, social and gender structures, social institutions, culture and social values, political framework, historical development, socialisation processes, individual identities, behaviours, social representations and expectations (e.g. Faulkner, 2001).

This means that our angle of analysis combines both Structuralism and Constructivism and is therefore opposed to Human Capital and SLM theories on the grounds that structural and institutional constraints (including family ones) and individual decisions and actions do actually play a major role in gender-differentiated study choices and labour market outcomes. Thus, it allows us to understand, on the one hand, the gender-biased processes and practices in educational and labour market outcomes and, on the other hand, the resilient symbolic association between masculinity and computing/technological/engineering areas of interest and activity, integrated into strategic, business-oriented and highly competitive market occupations. The opposite is therefore valid for the “durable” connection between the image of femininity and the social areas of activity, associated with public service/administrative occupations. This theoretical reference provides explanations for the gender bias between business (BES) and higher education (HE) occupations, as discussed below.

A recent study carried out in the Information and Communication Technologies (ICT) sector in Portugal stressed the strong correlation between gender and the status of scientific and technological fields and occupations, according to which women tend to be found in those lower-status areas and occupations. The more technical, strategic and analytical are the skills required by a specific job and the less it is associated with women’s attributes, the higher are the value and the status attached to it, with the result that more men tend to be found performing it. On the contrary, the less technical and more relational are the skills and competences associated with a particular job, the less it is associated with men’s attributes, and the more frequently women are to be found performing it. Furthermore, a set of

organisational and cultural practices was seen to reinforce gender asymmetries, such as the widespread culture of long working hours (in some ICT occupations, the average number of hours devoted to paid work is 70), used as an expression of the workers' loyalty, involvement and commitment to their job and the company's goals – a feature which may lead women to distance themselves from such workplaces inasmuch as the onus for domestic/family duties still predominantly falls upon women (despite some signs of modernisation in terms of gender relations) and the public provision of childcare still falls well short of families' needs. Moreover, on the employers' side, gender stereotypes prevent them from recruiting women for the most strategic and demanding occupations based on the assumption that they do not benefit from such a crucial requirement: total availability (Casaca, 2005, 2006). S. F. Casaca therefore stresses that equal opportunities greatly depend not only upon women's improved performance in obtaining technological qualifications, but also upon the reorganisation of firms' work structures, leading to new work organisation models and the modernisation of gender relations. Other authors, representative of the Portuguese research efforts in this area, also stress the role played by gender relations at a number of institutions, such as schools and universities (Pinto & Henriques, 1999; Araújo & Henriques, 2000; Amâncio, 2005).

Underlying this theoretical framework is therefore the view that society shapes the conditions under which women's and men's use of time is mostly allocated to paid work and/or family care (Perista et al., 1999; Torres et al., 2004; Lopes & Medeiros, 2004). But, in doing so, a whole range of different constraints is therefore set in motion, such as gender relations and family dynamics, the industrial structure, employers' and trade unions' strategies, technological and organisational innovation, and the dynamics and regulation of product and labour markets (Rubery et al., 1999; González et al., 2001; Kurtz-Costes et al., 2006). Therefore, diversity is also a major factor in terms of women's qualifications and occupational statuses, family models and the corresponding social representations, perceptions and aims. Likewise, research into education, vocational training and



occupational statuses and patterns not only relies heavily upon macroeconomic and social approaches, but also upon individual's private, educational and occupational trajectories.

## **2. A Glance at the Performance of Men and Women in Higher Education**

This section mainly relies on official secondary data and seeks to provide a general characterisation of the performance of Portuguese men and women in higher education, as well as of their labour market outcomes.

Educational trajectories and performance levels in compulsory schooling have long been presented as one of the main reasons underlying the different school tracks followed by girls and boys, not only in Portugal but in many other European Countries. Nevertheless, the results of PISA 2006 (OECD, 2007) were quite unexpected: despite the poor performances of both girls and boys in Mathematics, Reading Literacy and Science, gender differences in all the above areas are perceived as not statistically meaningful in Portugal. Moreover, data on involvement in the study of Science, again from the PISA 2006 results, show that the "interest in learning science topics" now captures a higher share of girls (571 against 570 average mean points). Even though this is a narrow difference, it does seem to suggest a new trend among Portuguese boys and girls and to depict a gender pattern more akin to that of the Nordic countries.

As one of the paper's main concerns is to compare the numbers of men and women in higher education, particularly those involved in postgraduate studies, let us now consider some of the most recent data made available relating to gender distribution in these areas. It is worth noting that Portuguese women outnumber men in tertiary education, where they amounted to 56.6% of all students in 2005 (slightly above the EU27 average – 54.8%) and 67.2% of the total number of graduates, well above the figures recorded in many European countries (Eurostat, 2008). Actually, this increasing feminisation of tertiary education has been seen as one of the signs of the modernisation taking place in the country. According to the National Institute of Statistics (INE), very high feminisation rates were recorded among students enrolled in the tertiary system, for 2005, especially those involved in Teacher

Training and Educational Sciences (84.6%), Health (74.6%), Journalism and Information Studies (69.5%), Life Sciences (66.8%), Social and Behavioural Sciences (64.5%), Veterinary Sciences (65.6%), Arts (56.5%) and Business Sciences (55.7%). Women are also over-represented even in fields such as Mathematics and Statistics, Environment and Law, among others, the corresponding feminisation rates being 60.9%, 62.7% and 59.1%, respectively. In contrast, the corresponding rates in Engineering and Information Technology are substantially lower: 17.4% and 24.1%, respectively (INE, 2005).

This highlights another specificity of the Portuguese situation. Portuguese female students behave quite differently in relation to the fields of science, engineering and technology: their participation in science is still increasing, while in the latter two areas there seems to be a psychological threshold, with deeply embedded cultural roots, that is difficult to overcome.

As far as postgraduate studies (MSc and PhD) as a whole are concerned, one must again emphasise the growing participation of women, with the overall feminisation rate having reached roughly 67.4% in 2002, according to EUROSTAT 2005. However, when only the PhD degree was considered, women amounted to roughly 52% in 2006 (MCTES 2007), which represents a significant reduction in women's opportunities for taking such a degree.

As most Portuguese postgraduate students rely on scholarships (or on a paid job), the database provided by the Portuguese Foundation for Science and Technology (FCT) on scholarships is statistically meaningful and highlights some relevant features: between 1999 and 2002, the feminisation rate rose from 41.5% to 49.8%. However, when the data are restricted to PhDs taken abroad, it can be seen that the share of women falls drastically to some 38.9%. This evidence might suggest either the fewer opportunities that women have or their lesser availability for undertaking study periods abroad. The same database also reveals that an important percentage of scholarship-holders did not complete their PhDs before the end of the official period: among these, one finds rates of 46% and 42% for female and male candidates, respectively. These figures are particularly elucidative of one of the main differences existing in terms of the studying opportunities available to women and men

applying for postgraduate studies. This is a feature that is central to our study and to which we shall return later.

Does the improved performance of Portuguese women as students in scientific fields result in equal value being attached to their status in the labour market? What is the effective contribution of postgraduate success towards improving women's labour market status? To what extent are postgraduate trajectories affected by gender-biased factors, resulting in positions not being equally accessible to men and women? The next section looks at the links between educational trajectories and further labour market outcomes.

### **2.1. *Educational Trajectories and Labour Market Outcomes***

As a general international trend, women graduates and postgraduates in S&T tend to develop their occupational activity in three different fields: in higher education (HE), as members of teaching and research staff; at firms and other economic organisations (BES), in either manufacturing or services; in government departments (GOV), especially at public agencies and laboratories, where they work mainly as researchers.

The percentage of R&D personnel in FTE (full-time equivalent) terms is relatively low in Portugal (0.86% in 2003<sup>3</sup>, a figure well below the EU27 average of 1.44%) and consists mainly of personnel involved in research activities, 45.5% of whom are women, according to data for 2004 provided by EUROSTAT (Eurostat, 2008). According to the same source, almost half of R&D personnel work in HE (0.42%), as opposed to less than a quarter working in BES (0.19%) and in government occupations (GOV) (0.14%). Therefore, HE remains the main occupational area for both men and women involved in R&D in Portugal, where they almost equally share the proportions of R&D personnel (women account for 49% of the total). Women are over-represented in the government sector, where they account for 58.3% of all researchers (well above the rate of their European female counterparts, as the EU27 average is 41%) and clearly underrepresented in the business sector (29.1%) (Eurostat, 2008). At the same time, despite their lower wages, government occupations are considered

to be more attractive to women because of the greater opportunities provided for reconciling family and work activities (Ferreira, 1995).

When the above outcomes are broken down by gender, it can actually be seen that in 2004 some 56.4% of Portuguese women working in science and technology were employed as human resources in science and technology in education (HRSTE), against only some 32.3% in economic occupations (HRSTO). Again, some idiosyncrasies may be outlined: whereas in the first case the figure is well above the European Union average (46.5%, for the EU25), the opposite holds true for economic occupations, where other European women seem to perform far better – 49.4% for the EU25 (EC, 2006).

The difference between the remuneration paid to a female researcher and that paid to a male researcher is significant in most countries. Thus, the countries with the highest differences (over 35%) are Estonia, the Czech Republic, Israel and Portugal. On average, however, this gap has been significantly reduced as a whole (difference below 15%) (Ackers et al. 2007).

Despite this line of argument, further explanations should be provided at this point. Firstly, the share of government expenditure on R&D is less than the corresponding investment made by the business sector (EC, 2006). Secondly, a distinction is required between science and technology, as it is becoming increasingly clear that, in the case of Portuguese women, both occupational statuses and strategies differ greatly in these two areas. Therefore, we endorse the argument that few women are still to be found in the occupational areas which enterprises value most (such as engineering and technology) (Casaca, 2006). On the contrary, scientific qualifications, in which women are performing better and better, are particularly required by both HE and government departments and laboratories.

A first glance at the data relating to HE personnel, in the year 2002, reveals that women are underrepresented as teachers and researchers even in those tertiary education areas where they outnumber men: this situation was particularly notable in “Sciences”, an area which comprises Mathematics and Statistics, Physics and some fields of Environmental

Studies, where the feminisation rate for teaching staff was already equal to 44.3% (INE, 2007). Less surprisingly, the feminisation rate among teachers in “Engineering fields” amounted to roughly 22% in that same year, nonetheless remaining below the corresponding graduation rate among women.

We are certainly aware of the impact played by the co-existence of two different generations of women teachers in Portuguese tertiary education, with the younger group being more given to scientific fields than those preceding them. But, despite the increased performance of women and their tendency to be involved in science subjects (much more than technical ones, as previously mentioned), HE seems to remain a highly gendered space.<sup>4</sup>

### **3. Empirical Results**

#### ***3.1 Methodological Note***

The question of inequality dynamics in particular is rarely addressed within the framework of gender studies, especially as far as empirical analyses are concerned. A quite fertile research field in this area relates to the identification of the main determinants of individual life cycle trajectories and the duration of time intervals when comparing women’s and men’s paths of development. Therefore, the length of time required to complete a postgraduate degree has been set as the dependent (categorical) variable related with a set of explanatory variables, the impact of which has been systematically debated by the reference bibliography. By separately analysing each sex’s behaviour on the basis of the same independent variables, we will be able to trace the main determinants of the duration of women’s and men’s postgraduate studies and then compare these with each other. For that purpose, and after developing some preliminary tests on the basis of Contingency Analysis, we will apply a Discriminant Analysis (DA) model.

The DA technique reveals the linear combinations of the discriminating (independent) variables that best separate (discriminate) among the several groups of cases. These groups

correspond to the several categories of the dependent variable, namely the different annual time intervals in our analysis. The general form of the DA model can be written as follows:

$$D_{i,k} = b_{0,k} + b_{1k} x_{i,1} + \dots + b_{p,k} x_{i,p} ,$$

With:

$D_{i,k}$  – value for the  $k$ th discriminant function relative to the  $i$ th case;

$p$  - number of discriminating (independent) variables;

$b_{j,k}$  – value for the  $j$ th coefficient of the discriminant function;

$x_{i,j}$  – value for the  $i$ th case of the  $j$ th variable.

Once the normality assumptions have been checked, DA is preferable to other alternative methods, such as logistic regression, because of the robustness of the multiple statistical tests that DA displays, especially in the case of multivariate normality (Sharma 1996; STATSOFT 1984, 2008).

As for the discriminating variables, they are also usable as predictors as, once the best linear combination has been obtained, any further cases can be allocated to the corresponding group of the dependent variable through the selected function. In this research, the following types of predictors have been used:

1. predictors relating to the individual's economic and social status and that of the family of origin: the father's and mother's level of education and their situation with regard to employment and occupation, factors which display both income and human capital effects;
2. predictors representing the individual's own previous educational trajectory: the institution and duration of the respondent's undergraduate studies, the institution and scientific domain of the respondent's master studies;

3. predictors relating to the respondent's present family situation: family characteristics and dimension, civil status, husband's/wife's educational level and his/her situation with regard to employment and occupation; the need to perform paid work while attending the postgraduate course of study;

4. predictors relating to the respondent's own situation with regard to employment and occupation: the nature of the occupational career (academic/other), the corresponding occupation after completion of postgraduate studies, the role played by the employer in the initiative or the demand for completion of the postgraduate degree, employment opportunities;

5. predictors representing the motivation and expectations that each individual associates with postgraduate degrees: the ability to develop studies, to gain further knowledge, to join the scientific community, to find a job, a "well-paid job", to change from previous/current job, to work in the desired occupation, to progress within the academic career, to progress either within the academic or another professional career;

6. obstacles to the completion of postgraduate studies.

In our opinion, the time required to complete a first degree, which is usually taken as another discriminating variable, should instead be considered as a proxy for ability; this was therefore used to compare men's patterns with those of women for the eight fields of undergraduate study included in the sample, before developing statistical adjustments.

Semi-longitudinal life cycle data were obtained for the TELOS II project through a survey directly addressed to MSc and PhD graduates during June and September 2004. The project database comprises data on 145 MSc and PhD degrees (118 and 27, respectively) awarded at four Portuguese state universities: University of Aveiro; Lisbon University – Faculty of Psychology and Education; the New University of Lisbon – Faculty of Sciences and Technology; and the Technical University of Lisbon – School of Economics and Management (ISEG). This sample corresponds to about 33% of the universe, i.e. the total number of MSc and PhD degrees obtained at those institutions in the academic years of

1995-96 and 2000-2001.<sup>5</sup> The feminisation rate of the sample is 52.4 % and the distribution by main undergraduate and postgraduate field of study is as follows:

Table 1. *Sample distribution by undergraduate and postgraduate fields of study (%) and feminisation rate (f.r.)*

	Undergraduates		Master's Degree/MSc		PhD	
	Share (%)	FR (%)	Share (%)	FR (%)	Share (%)	FR (%)
Educational Sciences	0.7	100.0	12.2	76.5	13.5	60.0
Foreign Languages and Literature	4.9	100.0	2.9	75.0	0.0	0.0
Native Language and Literature	4.2	66.6	2.9	75.0	0.0	0.0
Economics	16.7	29.2	12.9	38.9	18.9	28.6
Business Management	6.3	33.3	8.6	8.3	5.4	0.0
Biology/ Biochemistry	5.6	87.5	3.6	100.0	2.7	100.0
Chemistry	11.1	75.0	3.6	60.0	10.8	50.0
Electronics and Automation	6.9	0.0	7.2	0.0	8.1	0.0

Note: The values only report to the main fields of study in both degrees.  
Source: UIED 2005

As shown in Table 1, and confirmed and further developed in the section below, high feminisation rates within the sample are observable among some of the (generally) most feminised areas of undergraduate study.

### **3.2. Reasons for Undertaking an MSc or PhD Degree and Outcomes**

Contingency Analysis (CA) between the area of undergraduate study and gender reveals, as expected from Table 1, an extremely high association between both variables, with a Chi-square  $p=0.012$  and a contingency coefficient (*c.c.*) equal to 56.3; a very strong association pattern is displayed by the contingency between gender and the MSc scientific domain as well ( $p=0.041$  and *c.c.*= 56.5), therefore confirming the pattern of feminisation among the sample's scientific areas that was previously pointed out.

Also according to CA results (cf. Table 2), it is interesting to note that the study fields where women are over-represented are much more diverse than the ones corresponding to men's fields of study for both first degrees and master's degrees, being quite distinct for both levels as well. The women in our sample took their first degrees mostly in Languages, Economics, Biology, Biochemistry and Chemistry; in the case of the MSc, they chose Education Sciences, Humanities, Economics, Biology, Physics, Chemistry and Earth



Sciences. The men, however, graduated mostly in Economics, Management and various Engineering fields and took their MSc in the same areas. These quite distinctive patterns also have implications for the first professional occupation, which is a variable with very meaningful associations. Most women and men began their labour market trajectories as secondary education teachers (232); but, while the next most meaningful first occupations for women were as higher education teachers or technical assistants, the men's next most meaningful first occupations were as engineers or production managers.

Table 2. Crosstabs between Gender and MSc Determinants/Obstacles

	Females (%)	Males (%)
Undergraduate field of study (a)	222; 223; 421; 442	314; 314; 345; 520-523
(Chi-square=50,212, df=30, p=0.012, c.c.=0.563)		
MSc. field of study (a)	142; 229; 421; 440-443	314; 314; 345; 523
(Chi-square= 50,765, df=35, p=0.041, c.c.= 0.565)		
Motivation- improving performance:		
Very High	38.8	29.6
High	38.8	40.7
Fair	10.4	12.9
Weak	12.0	16.8
(Chi-square=12,763, df=4, p=0.012, c.c.= 0.325)		
Motivation-progressing in academic career:		
Very High	36.4	35.8
High	30.0	20.8
Fair	12.1	7.5
Weak	21.5	35.9
(Chi-square=11,258, df=4, p=0.024, c.c.= 0.307)		
Motivation-acquiring further knowledge:		
Very High	74.6	65.5
High	20.9	27.5
Fair	0.0	5.2
Weak	4.5	1.8
(Chi-square=15,620, df=4, p=0.004, c.c.= 0.355)		
Motivation-further studying		
Very High	78.9	58.9
High	16.9	35.7
Fair	0.0	3.6
Weak	4.2	1.8
(Chi-square=13,549, df=4, p=0.009, c.c.= 0.334)		

(To be continued...)

Table 2. Crosstabs between Gender and MSc Determinants/Obstacles (cont.)

	Females (%)	Males (%)
1 <sup>st</sup> . professional occupation (b)	232; 231; 248	122; 214; 232
(Chi-square=45,521, df=28, p=0.020, c.c.= 0.545)		
1 <sup>st</sup> . professional occupation tenure		
< 1 year	29.4	16.4
1 to 5 years	29.4	34.4
6 to 10 years	14.7	27.9
11 to 15 years	5.9	11.5
≥ 16 years	20.6	9.8
(Chi-square=11,655, df=5, p=0.040, c.c.= 0.312)		
Means of obtaining 1 <sup>st</sup> . Occupation		
Publish or answer advertisements	6.9	16.9
Public contest	59.0	24.7
Personal relations	9.6	15.4
Professional relations	6.8	13.8
Job placement office	4.1	12.3
Internship	6.8	4.6
Other	6.8	12.3
(Chi-square=24,842, df=13, p=0.024, c.c.= 0.432)		

Note: (\*) ( $p \leq 0.05$ );

(a) – Study fields with frequencies higher than 0.05: 142 – Education Sciences; 222, 223 - Foreign and Native Languages; 229 – Humanities; 314 – Economics; 345 – Management; 421 – Biology, Biochemistry; 440 – Physics; 442 – Chemistry; 443 – Earth Sciences; 520 – 523 – Engineering: metallurgy; electricity and energy; electronics; chemical technology;

(b)– Professional occupations with frequencies higher than 0.05: 122 – Production Managers; 214 - Engineers; 231 – Higher Education Teachers; 232 – Secondary Education Teachers; 248 – Technical Assistants

Source: UIED 2005.

These highly differentiated patterns are reinforced by two other results which appeared to be quite gender determined as well, namely the means by which the first occupation was obtained and the corresponding tenure. Actually, most women in our sample (59.0%) obtained their first job in response to a public contest.<sup>6</sup> Even though the same pathway proved to be the most frequent for men as well (24.7%), this was more closely followed in importance by advertising and personal/professional relations – two strategies which display almost no meaningful outcomes for women. First job tenure also revealed meaningful gender differences, as a significant number of women held their jobs for less than one year or between one and five years.

All these results relating to gendered school options and labour market integration and opportunities confirm the macro trends previously referred to (see section 2, above). Nevertheless, we must be cautious and avoid any direct inferences about the Portuguese situation because of the limited nature of the data.

Another set of meaningful associations was obtained through variables relating to the motivation to attend and complete an MSc degree course (cf. Table 2). Among these, acquiring further knowledge and further studying are the most meaningful reasons invoked by either gender for engaging in postgraduate study, these features being higher valued by women than by men. It is worth noting that, in contrast to men's occupational patterns, women face narrower occupational outcomes and less career opportunities. Women also seem to value self-development more highly as a reason for enrolling in an MSc degree course than men do. However, extrinsic motivations are as important as these intrinsic ones, particularly in relation to the precariousness experienced in their first job or occupation. This factor does appear to markedly differentiate the women's situation from that of men and possibly motivates more women to enrol in (and complete) these forms of postgraduate study, as part of their strategy for overcoming this precariousness.

Considering the statistical tolerance level with which adjustments were developed, none of the variables relating to the obstacles to the completion of the MSc degree appeared to be meaningful. Indeed, the association between family situation and gender failed to achieve that level ( $p \leq 0,05$ ). Nonetheless, in the light of the aims of this paper, we must check further to see whether or not there are any obstacles associated with the length of time required by each gender to successfully complete their MSc degrees (this will be carried out in the next section).

The results obtained in the case of PhD degrees must be viewed with even more caution, given the limited number of individuals with this degree in our sample (32, 19 of whom are men and 13 of whom are women)<sup>7</sup>. Nevertheless some meaningful associations were found between gender and PhD determinants or obstacles, which deserve to be mentioned:

Table 3. Respondents' answers about PhD determinants/obstacles by gender (in %) with the results of Chi-square tests

	Females (%)	Males (%)
Employer's Initiative		
No	53.3	31.8
Yes	46.7	68.2
(Chi-square= 9,689, df=3, p=0.021)	100.0	100.0
Lack of support by family		
No	80.0	100.0
Yes	20.0	0.0
(Chi-square=4,788, df=1, p=0.029)	100.0	100.0
Satisfaction with present occupation		
Very satisfied	20.0	50.0
Fairly satisfied	66.7	40.9
Not at all	13.3	9.1
(Chi-square=10,329, df=4, p=0.035)	100.0	100.0

Source: UIED 2005.

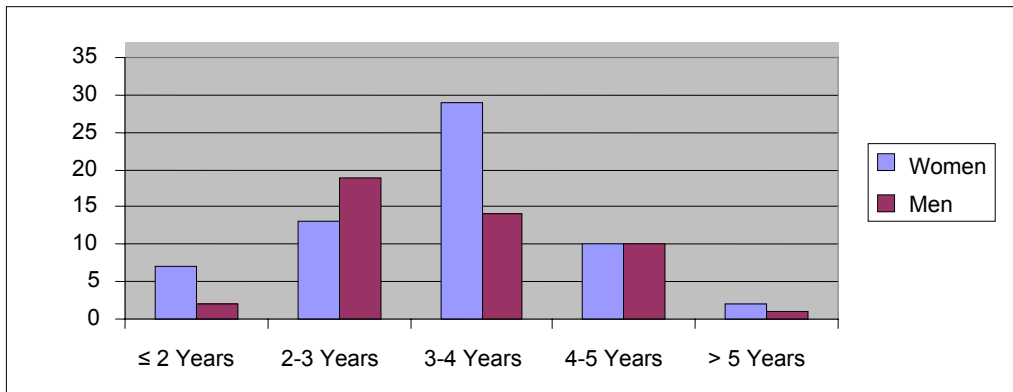
According to Table 3, self-development once again appears as an important motivation, as far as women's attendance of a PhD degree course is concerned. Nevertheless, in spite of the greater obstacles linked to the lack of support provided by the family – an item mentioned by 20.0% of women and no men – their investment in taking a PhD degree appears to provide a much lower return than that enjoyed by men, according to the level of satisfaction they claim to feel in their current (post-PhD) occupation.

On account of the previously mentioned data limitations, no DA model was adjusted for PhD degrees in the next section.

### 3.3. How Long Does it Take to Complete a Master's Degree?

Contingency Analysis provided robust results for the association between gender and the time required to complete an MSc degree ( $p=0.021$ ). Actually, this length of time appears to be highly gender-influenced for the population under analysis, with more women than men in our sample taking longer time to complete an MSc, as shown in Figure 1:

Figure 1. MSc. Duration by Gender



Source: Own calculations from UIED 2005

Meanwhile, no equivalent association was obtained for the time needed to complete a PhD, most probably due to the scarcity of data relating to this postgraduate degree.

In order to further investigate the potential determinants behind the length of time needed to complete an MSc, Discriminant Analysis (DA) was used, as was explained in theoretical terms in the first section. After categorising and computing frequencies on the “time required to complete an MSc” (the discriminant), the variable was then broken down into five subgroups, corresponding to the following time intervals: under two years; two to three years; three to four years; four to five years; five years or above. Some results pointed to heterogeneity among women’s trajectories, with this breakdown proving to be the most suitable one for confirming this impression (which will be developed later on).

The behaviour of the variable proposed as a proxy for ability - “time required to complete first degree” – was first analysed and the normality of its distribution by gender was tested, controlling for possible further differences between women’s and men’s results through DA. As far as the discriminating variables, or predictors, were concerned, the analysis focused on the ones previously presented, together with the DA analytical form. As is usually the case in statistical adjustments concerning gender issues, separate models were developed for women and men<sup>8</sup>.

For women, the best adjustment (with 70.4% of selected original grouped cases and 48.1% of selected cross-validated grouped cases correctly classified) is summarised in the

following tables. Complementary information on adjustment results are displayed in the Appendix.

Table 4. *Discriminant Analysis for Women – Summarised Results*

Test of Functions	% of Variance	Canonical Correlation	Wilks' Lambda	Chi-square	df	p
1 through 4	54.9	.763	.162	82.687	40	.000
2 through 4	22.6	.603	.389	42.971	27	.026
3 through 4	16.7	.546	.612	22.373	16	.132
4	5.8	.359	.871	6.288	7	.507

Source: Own calculations from UIED 2005

Table 5. *Discriminant Analysis for Women-Functions at Group Centroids*

Time to complete an Msc	Function			
	1	2	3	4
≤ 2 years	3,438	-,172	-2,494	,240
> 2 years and < 3 years	-,968	,760	-,179	,405
≥ 3 years and < 4 years	-,189	-,640	,093	-,055
≥ 4 years and < 5 years	2,019	,767	,950	-,045
≥ 5 years	-,983	1,223	-,673	-1,280

Note: Unstandardized canonical discriminant functions evaluated at group means  
Source: Own calculations from UIED 2005

Two discriminant functions – the 1st and the 2nd - were similarly selected for analysis. The relative influence displayed by each variable within each of these functions can be easily observed through the corresponding standardised coefficients:

Table 6. *Discriminant Analysis for Women – Standardised Canonical Discriminant Function Coefficients*

	1	2
Lack of support by family (0-No; 1-Yes)	.787	.051
Wasting some free time (0-No; 1-Yes)	.752	-.365
Mother's educational level (1- Illiterate; ...5-Lower secondary or second stage of Basic; ...10-PhD)	.576	-.229
Civil Status: (1-Single, divorced/widowed; 2-Married)	.236	.627
Demands of professional occupation: (0-No; 1-Yes)	-.258	-.296
Performing a paid job while attending MSc: (0-No; 1- Yes)	.162	.536
Motivation to improve level of intellectual development (0-No; 1-Yes)	.153	.437
Satisfaction with academic skills provided by MSc: (1-Very satisfied; 2- Fairly satisfied; 3- Not at all)	-.111	-.122
Satisfaction with present academic status: (1- Very satisfied; 2- Fairly satisfied; 3- Not at all)	.098	.231
Satisfaction with present occupation: (1-Very satisfied; 2- Fairly satisfied; 3- Not at all)	-.088	.487

Source: Own calculations from UIED 2005

The above table shows what seem to be two different kinds of profile among women: one of them, associated with function 1, represents those for whom the amount of time

needed to complete an MSc degree is mostly positively associated with the lack of support provided by the family. Another factor is the wasting of some free time which they now acknowledge should have been devoted to studying. The mother's educational level, civil status, the need to perform a paid job while attending the MSc course and the motivation to improve intellectual development also display positive meaningful effects. Given the scale ordering of the mother's educational level, we may admit that this variable will mostly intervene within this group through the income effect acting as an extra asset upon which this group's women can rely in order to take more time to complete an MSc. It is worth noting that satisfaction with present academic status has a low influence. On the other hand, satisfaction with the present occupation, with the academic skills provided by the MSc, and in particular the demands of the professional occupation negatively influence the length of time spent studying for an MSc: it seems that, for these women, completing an MSc will become a pre-condition for applying for an alternative and more desirable job, possibly also a more stable one in view of the CA outcomes.

For the second group of women, civil status is much more influential and, together with the performance of a paid job while studying for the MSc degree, the motivation to improve intellectual development, (dis)satisfaction with the present occupation and (dis)satisfaction with present academic status, all display positive meaningful effects: it seems that, for these women, performing an unpleasant occupation – such as an academic one – may discourage them from completing the MSc, while the already mentioned wasting of the free time supposed to be devoted to studies, the demands of the professional occupation (including the academic one), the mother's educational level (viewed here through the human capital effect) and satisfaction with skills promoted by the MSc, are now negatively associated.

To sum up: in either situation being married/living in a couple and having to perform a paid job while studying for the MSc degree both imply that more time will be required to complete this degree, whilst greater professional demands and (dis)satisfaction with skills promoted by the MSc are associated with shorter time intervals.

For men, the best adjustment obtained made it possible to correctly classify 46.5% of original grouped cases and 35.4% of cross-validated grouped cases. Summarised information is presented in Tables 6 and 7 (see Appendix for complementary information):

Table 7. *Discriminant Analysis for Men – Summarised Results*

Test of Functions	% of Variance	Canonical Correlation	Wilks' Lambda	Chi-square	df	p
1 through 4	47.0	.459	.595	47.690	28	.012
2 through 4	28.6	.373	.754	25.966	18	.101
3 through 4	18.8	.310	.876	12.176	10	.273
4	5.6	.175	.969	2.872	4	.580

Source: Own calculations from UIED 2005

Table 8. *Discriminant Analysis for Men-Functions at Group Centroids*

Time to complete na MSc	Function			
	1	2	3	4
≤ 2 years	-1,197	1,277	,811	,438
> 2 years and < 3 years	,354	-,327	,283	,136
≥ 3 years and < 4 years	-,400	-,100	-,094	-,178
≥ 4 years and < 5 years	,833	,694	-,167	-,160
≥ 5 years	-,168	-,006	-,988	,632

Note: Unstandardized canonical discriminant functions evaluated at group means  
Source: Own calculations from UIED 2005

Only the first function was retrieved, reflecting the probable higher homogeneity to be found among the men included in our sample. The relative influence displayed by discriminating variables becomes easy to analyse through the standardised canonical discriminant function coefficients:

Table 9. *Discriminant Analysis for Men – Standardised Canonical Discriminant Function Coefficients*

	1
Civil Status: (1 - Single, divorced/widowed; 2-Married)	.649
Mother's educational level (1- Illiterate; ...5 -Lower secondary or second stage of basic; ...10-PhD)	-.387
Performing a paid job while studying for MSc: (0-No; 1- Yes)	,382
Lack of support by family (0-No; 1-Yes)	-.348
Motivation to improve level of intellectual development: (0-No; 1-Yes)	.321
Satisfaction with present occupation: (1-Very satisfied; 2- Fairly satisfied; 3- Not at all)	.288
Motivation to continue studying: (0-No; 1-Yes)	,227

Source: Own calculations from UIED 2005



The magnitudes of the effects also seem to be more homogeneous among men than among women. Civil status is now by far the variable with the largest influence, being positively associated with the time taken to complete the degree; the following positive influences are displayed by the need to perform a paid job, the motivation to improve the level of intellectual development, (dis)satisfaction with the present occupation and the motivation to continue studying. The mother's educational level and the lack of support provided by the family are the only variables exhibiting negative influences. Therefore, being married, having to contribute to the family budget, being motivated to develop one's knowledge and skills, and dissatisfaction with one's present occupation – not explicitly an academic one – all contribute towards increasing the amount of time that men take to successfully complete an MSc degree. For that purpose, the inter-generational human capital effect represented by the mother's educational level seems to contribute to shorter time spells; nevertheless, the lack of support given by the family displays an unexpected result, as less support coincides with shorter time periods for men. Despite the exploratory nature of the present analysis and the need to further confirm results on the basis of more robust data, this unexpected result may reflect gendered perceptions about objective conditions: men and women might have different understandings and subjective evaluations of family support. Therefore, due to traditional gender representations, women tend to pursue an MSc for the purposes of self-development, while for men this objective is combined with a strategy geared towards the reinforcement of their role as the family's main provider.

Comparison between men and women on the basis of the coincident variables reveals that the male pattern is much closer to that of the women in group two: family constraints seem to go in hand with the aims of self-development and (dis)satisfaction with the present occupation. Nevertheless, even for the second group of women, the lack of support given by the family acts as an obstacle, albeit a modest one, implying longer time spells and never being negatively associated – as happens with men. We should also note that among both groups of women, and especially among the second one, dissatisfaction with an academic career plays a meaningful (positively associated) role, a feature in which

no adjustment proved to be influential for men. The opposite holds true with regard to the motivation to continue studying, a feature which seems to be unrelated to the question of progression in an academic career in the case of men.

## **Conclusions**

As the existing institutional data preclude the possibility of dynamic analyses, this research has relied on results obtained through a specially designed survey providing semi-longitudinal data on roughly one hundred and fifty MSc and PhD trajectories, obtained from four Portuguese universities. This paper highlights the main gender-biased features underlying the reasons for taking an MSc or a PhD degree, as well as the obstacles, constraints and opportunities influenced by gender. In the light of the latter consideration, and according to the Contingency Analysis, it was noted that more women than men did in fact take three or more years to complete their master's degrees. To gain further insight into how the time taken to complete an MSc degree depended on the different features and obstacles involved, a Discriminant Analysis (DA), which followed the model developed in the theoretical framework, was also used to contrast women's and men's situations.

Despite data limitations, some important features clearly appeared. Women in our sample are more heterogeneous concerning the fields of postgraduate study that they follow; nevertheless, once they are in the labour market, their first occupation opportunities are narrower and seem to profoundly restrict their future opportunities, even though they usually obtained their first job via a public contest.

According to CA, women with an MSc seem to be much more restricted than men in situations that are equivalent to an academic career. Moreover, dissatisfaction with the current occupation seems to affect more women than men, especially in terms of occupations that are taken up after completion of a PhD degree.

The support offered by the family shows itself to be one of the most meaningful resources upon which women can rely in order to complete their postgraduate studies. In fact, DA clearly shows the presence of two groups of women: for the first one, the time taken

to complete an MSc mostly depends upon support of this kind, which is also possibly related to the intergenerational human capital transmission effect created by a mother's higher educational level. This may act as an extra resource, allowing for longer time intervals. Dissatisfaction with the professional occupation – including an academic career – seems to speed up the process for the completion of an MSc, provided that the free time supposed to be dedicated to studying is not wasted. Besides, this may possibly be seen as a strategy for obtaining the credentials required to apply for an alternative (and more satisfactory) occupation. Women within the second group tend to give less value to family support as a means of reducing the time taken to complete an MSc: their desire for self development seems to be essentially associated with inherent obstacles, such as those related to their family and income level. Unlike the former group, women within this group seem to be discouraged in their attempts to complete an MSc by their dissatisfaction with their current occupation – even including those cases in which they are pursuing an academic career. Either their present occupation does not provide them with enough free time to pursue their studies or they are not able to envisage the likelihood of any new professional opportunities arising as outcomes of such investment.

The male profiles are similar to those of the women in the second group. Nevertheless, it seems that the need to perform a paid job while attending an MSc course and dissatisfaction with their current occupation affects men less than women as far as the time required to complete an MSc is concerned. Nevertheless, pursuing an academic career did not appear to be a meaningful discriminating variable within the male pattern, and quite surprisingly men seem to get along well without family support.

Empirical outcomes provide meaningful insights into the research hypotheses stated in the introduction: hypothesis 1 seems to be partially confirmed by the motivations and behaviour patterns which characterise women within the first group; as far as hypothesis 2 is concerned, more women than men in our sample took longer periods to complete their degrees, only in the time interval of between two and three years were women quicker. In addition to this, we were also able to form a picture of the main obstacles and driving forces

associated with the above situations. The discouragement perceived by those women within the second group emerges as an important non-hypothesised effect. This leads us to stress the need for taking positive measures to support women's postgraduate trajectories, especially when they are trapped in a vicious circle generated by intense occupational dissatisfaction, severe family and budgetary constraints, and an inherent lack of opportunities, or the assertiveness needed to implement appropriate exit strategies.

Despite the size of the sample, which prevents us from generalizing our outcomes to the whole Portuguese context, the truth is that the results obtained appear to be particularly interesting, calling for further research based on more robust and preferably nationally representative semi-longitudinal data. In further research, special concern should be given to data relating to PhD degrees, for which the present data limitations prevented us from engaging in any further research. Given the perceived differences in terms of occupational satisfaction, analysing gender differences in terms of occupational outcomes and improved statuses after completion of the same postgraduate degree undoubtedly represents one of the most important areas requiring further research.

When searching for the main reasons behind the differences between men and women regarding the time taken to complete an MSc, the DA model reveals that all expectable occupational reasons (such as both first job tenure and type of occupation), and most family constraints (e.g. the need to perform a paid job while studying for an MSc degree, civil status and the family situation) are meaningful. It is worth noting the leading role played by the need to contribute to the family budget while taking a master's degree, a feature that systematically appears as one of the main explanations for the longer time taken by men and women. Together with the above-mentioned family and occupational factors, it seems clear that taking a master's degree should be seen as a suitable strategy (or at least one that is expected to be so) for moving away from job precariousness and lower-status occupations. Nonetheless, according to Table 1 and Figure 1, women have fewer opportunities than men for pursuing such a strategy.

As to PhD degrees, despite the fact that both men and women are mostly driven by career reasons for taking this degree, only women referred to a lack of support by the family when doing so. Furthermore, whereas most men considered themselves to be “fairly satisfied” with their postdoctoral situations in their academic careers, less than one third of the women surveyed expressed a similar opinion, a result that confirms other authors’ findings.

Following the line of reasoning provided by the Social Shaping approaches, such evidence shows that the circumstances under which women and men allocate their time to education and lifelong learning, paid work or family care are socially shaped. Different family backgrounds, however, also provide some explanation for the heterogeneity found among women, in particular regarding family budgetary conditions and the mother’s educational level.

This paper highlights the fact that gender still matters: despite some signs of modernisation, many women still bear the main responsibility of looking after the family, which is further exacerbated by the lack of public childcare facilities; and they also lack favourable employment conditions, such as job stability and satisfactory opportunities for career development.

## References

- Ackers, L. (coord.) et al. (2007). The participation of women researchers in the TMR Marie Curie fellowships, Contract No: ERBFMARCT980006, DG project.
- Alves, M. (2004). A inserção profissional de diplomados de ensino superior numa perspectiva educativa – O caso dos diplomados pela FCT (PhD dissertation, Monte da Caparica, Faculty of Sciences and Technology of the New University of Lisbon).
- Amâncio, L. (2005). Reflections on science as a gendered endeavour: changes and continuities. *Social Science Information* 44 (1), 65-83.
- Araújo, H., & Henriques, F. (2000). Política para a igualdade entre os sexos em educação em Portugal: uma aparência de realidade. *Ex aequo*, 2/3, 141-151.
- Beechey, V. (1988). Rethinking the definition of work – gender and work. In: J. Jenson, E. Hagen & C. Reddy, (Eds.), *Feminization of the labour force – Paradoxes and promises (45-63)*. Cambridge, Polity Press.
- Black, S., Devereux, P. & Salvanes, K. (2003). Why the apple doesn't fall far: Understanding intergenerational transmission of human capital. (Working Paper CWP16/03, Uppsala, CEMMAP/The Institute for Fiscal Studies – Department of Economics).
- Bollens, J. & Nicaise, I. (1994). The medium-term impact of vocational training on employment and unemployment duration. In: *6th EALE Conference Proceedings*, Warsaw, 22-25 September.
- Casaca, S. F. (2005). Flexibilidades de Emprego, Novas Temporalidades de Trabalho e Relações de Género (PhD Thesis in Economic and Organisational Sociology, Lisbon, School of Economics and Management – ISEG).
- Casaca, S. F. (2006). La segregación sexual en el sector de las tecnologías de información y comunicación (TIC) – observando el caso de Portugal. *Sociología del Trabajo*, 57, 95-130.
- Cockburn, C. (1986). Women and technology: opportunity is not enough. In: K. Purcell, S. Wood, A. Waton & A. Scheila (Eds.), *The changing experience of employment – Restructuring and recession (173-187)*. London, MacMillan.
- Cockburn, C. & Ormrod, S. (1993). *Gender and technology in the making*. London, Sage Publications.
- EC. (2006). Science and Technology in Europe (1990-2004). *EUROSTAT*. Retrieved February, 23rd. 2007 from <http://epp.eurostat.ec.europa.eu>
- EUROSTAT. (2005). Statistics on Science and Technology in Europe. *EUROSTAT*. Retrieved March, 24th. 2007 from <http://epp.eurostat.ec.europa.eu/portal>
- EUROSTAT. (2005). Structural Indicators – Education. *EUROSTAT*. Retrieved March, 24th. 2007 from <http://epp.eurostat.ec.europa.eu/portal>
- EUROSTAT. (2008). Science, Technology and Innovation in Europe. *EUROSTAT, Statistical Books*. Retrieved March, 24th. 2007 from <http://epp.eurostat.ec.europa.eu/portal>

- Faulkner, W. (2001). The technology question in feminism: a view from technology studies. *Women's Studies International Forum*, 24 (1), 79-95.
- Ferreira, Virgínia (1995). "Clerical Work, Gender and Technological Change in Portugal", in W. Littek & T. Charles (Eds.), *The New Division of Labour - Emerging Forms of Work Organisation in International Perspective*. Berlin and New York: De Gruyter, Ch. 14.
- Ferreira, V. (2003). *Relações Sociais de Sexo e Segregação do Emprego - Uma Análise da Feminização dos Escritórios em Portugal* (PhD Thesis in Sociology, Coimbra, Faculty of Economics, University of Coimbra).
- GEPE. (2007). Estatísticas da Educação 2005/2006. *Ministério da Educação*. Retrieved May, 13th. 2008 from <http://www.gepe.min-edu.pt>
- GPEARl. (2007). Inquérito ao Potencial Científico e Tecnológico Nacional. *M.C.T.E.S.* Retrieved May, 18th. 2008 from <http://www.estatisticas.gpearl.mctes.pt/?idc=47&idi=203335>
- GIASE. (2006). Recenseamento Escolar Anual 2004/2005 – Inquérito Preliminar. *M.E.* Retrieved October, 5th. 2006 from <http://www.giase.min-edu.pt/>
- Gonzalez P. et al. (2001). Indicators on gender segregation. In: J. Rubery, C. Fagan, D. Grimshaw, H. Figueiredo & M. Smith, (Eds.), *Indicators on gender inequality in the European employment strategy*, (34-70). Manchester, EGGE – EC's Expert Group on Gender and Employment, European Work and Employment Research Centre, Manchester School of Management: UMIST.
- Grácio, S. & Miranda, S. (1977). Insucesso escolar e origem social: resultados de um inquérito-piloto, *Análise Social, vol. XIII*. Lisbon, Instituto de Ciências Sociais da Universidade de Lisboa.
- INE. (2005). Perfil de género. *I.N.E.* Retrieved May, 13th. 2008 from <http://www.ine.pt/PI/genero/Principal.aspx>
- INE. (2006). Perfil de género. *I.N.E.* Retrieved May, 13th. 2008 from <http://www.ine.pt/PI/genero/Principal.aspx>
- INE. (2007). Portal–Estatísticas. *I.N.E.* Retrieved May, 13th. 2008 from <http://www.ine.pt/xportal>
- Jenkins, A. (2006). Women, lifelong learning and transitions into employment. *Work, Employment and Society*, 20(2), (309-328).
- Jenson, J. (1998). The talents of women, the skills of men: flexible specialization and women. In: S. Wood. (Ed.) *The transformation of work? Skill, flexibility and the labour process*, (141-155). London, Routledge.
- Kergoat, D. (1998). La division du travail entre les sexes. In: D. Kergoat (Ed.), *Le Monde du Travail* (319-324). Paris, Éditions La Découverte.
- Kovács, I. (Ed.) (2005). *Flexibilidade de emprego: riscos e oportunidades*. Oeiras, Celta Editora.

- Lopes, M. C. & Fernandes, G.L. (2003). Gender, life cycle trajectories and their determinants in the Portuguese labour market. In: U. Pasero, (Ed.), *Gender – From Costs to Benefits* (101-110), Wiesbaden, Opladen: Westdeutscher Verlag.
- Lopes, M. C. *et al.* (2004). *Trajectórias escolares, inserção profissional e desigualdades laborais: Uma análise de género*. [Electronic Version]. Lisbon, FCT Project PIHM/ECO/49741/2003, [http://www.fct.mces.pt/projectos/pub/2003/\\_especificos/index](http://www.fct.mces.pt/projectos/pub/2003/_especificos/index)
- Lopes, M. C. & Medeiros, J. (2004). School failure and intergenerational «human capital» transmission in Portugal. [Electronic Version]. *Education–Line* <http://www.leeds.ac.uk/educol/documents/00003679.htm>
- Lopes, M. C. (2007). Time to complete a postgraduation: some evidence on “school effect” upon ISCED 6 trajectories. [Electronic Version] (WP/07/2007/DE/CISEP, Lisbon, School of Economics and Management (I.S.E.G.), <http://ideas.repec.org/s/ise/isegwp.html>
- Meri, Th. (2008). Women Employed in Science and Technology. *EUROSTAT-Statistics in Focus* (8).
- Mincer, J. (1974). *Schooling, experience and earnings*. New York, National Bureau of Economic Research.
- OECD. (2004). Learning for tomorrow’s world: First results from PISA 2003. *OECD*. Retrieved October, 21st. 2006 from <http://pisa.oecd.org>
- OECD. (2007). PISA 2006 - science competencies for tomorrow’s world (on-line database). *OECD*. Retrieved May, 13th. 2008 from <http://pisa.oecd.org>
- Perista, H. (Ed) *et al.* (1999). *Os usos do tempo e o valor do trabalho – Uma questão de género*. Lisbon, M.S.S.T.
- Perista, H. & Silva, A. (2004). *Science careers in Portugal*. Brussels, MOBISC-EURODOC, European Community.
- Plug, Erik (2002). How do Parents Raise the Educational Attainment of Future Generations? [Electronic Version]. (IZA DP n° 652, Bonn, [http://www.iza.org/index\\_html](http://www.iza.org/index_html) ).
- Rubery, J. (Ed.) *et al.* (1999). *Women’s employment in Europe: Trends and prospects*. London, Routledge.
- Sharma, S. (1996). *Applied multivariate techniques*. New York, John Wiley.
- STATSOFT (1984, 2008). *Electronic statistics textbook*. Statistica, Retrieved May, 17th. 2008 from <http://www.statsoft.com/textbook/stathome.html?stdiscan.html&1>
- Torres, A. (Ed.) *et al.*, (2004). *Homens e mulheres, entre família e trabalho*. Lisbon, CITE, Estudos 1.
- Thurn, N. *et al.* (2004). Measuring and rewarding excellence of academic careers. (Working Paper no. 17, CSLPE, University of Leeds). Retrieved July, 17th. 2006 from <http://www.peripherie.ac.at/>



UIED. (2005). *Projecto TELOS II – Aprendizagem ao Longo da Vida: Efeitos em Diplomados do Ensino Superior*, POCTI/CED/46747/2002. Lisbon, Portuguese Foundation for Science and Technology.

Wajcman, J. (1991). *Feminism confronts technology*. Cambridge, Polity Press.

Webster, J. (1996). *Shaping women's work – Gender, employment and information technology*. London, Longman.

Willys, R. (1986). The determinants of life cycle earnings: a survey. In: O. Ashenfelter & R. Layard, (Eds.) *Handbook of labour economics (chap. 5)*. Amsterdam, North Holland.

---

## NOTES

<sup>1</sup> These concepts refer to those adopted by Eurostat. Therefore, the higher education sector (HE) includes all universities, institutes of technology and other institutes of post-secondary education, regardless of their source of finance or legal status, as well as all research institutes, experimental stations and laboratories operating under the direct control of, administered by, or associated with, higher education institutions. The government sector (GOV) encompasses all departments, offices and other bodies that provide common services, other than higher education, but which normally do not sell them to the community (hence, public enterprises are included in the business enterprise sector). Finally, the business enterprise sector (BES) includes all firms, organisations and institutions whose primary activity is the market production of goods or services (other than higher education) (cf. Eurostat, 2008).

<sup>2</sup> The data used in this paper were obtained under the framework of the Project *TELOS II – Aprendizagem ao Longo da Vida: Efeitos em Diplomados do Ensino Superior*, POCTI/CED/46747/2002, Lisbon, Portuguese Foundation for Science and Technology – FCT. Part of the paper also results from the project *Gender relations and employment changes: bringing four lenses together (gender, ethnicity, age and social class)* (Project PTDC/SDE/66515/2006), funded by FCT (The Portuguese Foundation for Science and Technology) and developed by researchers from SOCIUS (Research Centre in Economic and Organisational Sociology), School of Economics and Management (ISEG), Lisbon.

<sup>3</sup> No data available for 2004.

<sup>4</sup> In fact, a great deal of research has been undertaken in Portugal into such issues as women's upward mobility in academic careers, gender biases in association and networking opportunities in HE careers (Perista & Silva, 2004; Thurn *et al.*, 2004; Amâncio, 2005), the combination of raising a family with a professional career, hierarchical determinants, career precariousness, and the reputation of the chosen field of work (Perista & Silva, 2004), among others.

<sup>5</sup> For the reasons behind the data used for those two academic years, see UIED (2005).

The corresponding questionnaire's main sections covered the following areas: (1) individual characteristics, such as date and place of birth, sex, educational level, spouse's, father's and mother's educational levels, professional occupation and situation in terms of the labour market; (2) indicators on respondent's own previous educational trajectory, such as the field of study followed during secondary education and first degree, the higher education establishment attended, employment situation during the period of undergraduate study, reasons and motivations for undertaking postgraduate study; (3) characterisation of the employment and/or unemployment situation(s) prior to, and at the time of, the decision being taken to undertake postgraduate study; indicators on paid work and family characteristics (e.g. kind of occupation, sector of activity, contractual situation... and whether or not living in a couple/together with parents, number of children and other dependants...) during postgraduate time intervals; (4) degree of satisfaction and sense of self-fulfilment with the MSc, PhD, or both, curricula, teaching methodologies, and the contribution made to improving skills and knowledge; (5) degree of satisfaction with regard to the respondent's employment and career situation as a consequence of and/or after achievement of the postgraduate qualification.

---

<sup>6</sup> Public contests, or “concurso públicos” – in Portuguese - , is the term used to describe the compulsory form of admission for civil servants in Portugal. The process is very demanding and bureaucratic, in order to (at least theoretically) avoid discretionary decisions.

<sup>7</sup> Actually, only 27 among these 32 had already completed their PhD degrees at the time of the survey; nonetheless, for certain analytical purposes all 32 trajectories were considered whenever they appeared to be meaningful in relation to gender differences.

<sup>8</sup> Given the relatively small dimension of our sample and the diverse nature of the covariates and corresponding scales, DA had to be used with special care and attention being paid to the successive statistical tests. Therefore, we systematically looked at the largest correlations within groups, and, whenever Box's test for equality of group means proved to be meaningful, the separate group covariance procedure was adopted. Abnormally large values for the variables' means and standard deviation also led us to leave them out of the analysis. Finally, we only retrieved adjustments for which we could obtain coincidence between the equality of group means, standardized discriminant function coefficients and structure matrices, as far as the relative influence displayed by the same set of covariates was concerned. As is usually the case in research on social sciences, Wilks' Lambda, F-test and  $p$  ( $p \leq 0.10$ ) were retrieved to decide on the selection of variables and upon the Chi-square value, degrees of freedom ( $df$ ), probability level ( $p \leq 0.05$ ) and percentage of variance in order to select discriminant functions. Percentages of original grouped cases and cross-validated grouped cases correctly classified were also used to confirm the indications provided by previous tests.