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(Endogenous) occupational choices and job satisfaction among recent PhD recipients: evidence from Catalonia

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Abstract:

Drawing on data from two successive cohorts of PhD graduates, this paper analyses differences in overall job satisfaction and specific job domain satisfaction among PhDs employed in different sectors four years after completing their doctorate degrees. Covariate-adjusted job satisfaction differentials suggest that, compared to faculty members, PhD holders employed outside traditional academic and research jobs are more satisfied with the pecuniary facets of their work (principally, because of higher earnings), but significantly less satisfied with the content of their job and with how well the job matches their skills (and, in the case of public sector workers, with their prospects of promotion). The evidence regarding the overall job satisfaction of the PhD holders indicates that working in the public or private sectors is associated with less work well-being, which cannot be fully compensated by the better pecuniary facets of the job. It also appears that being employed in academia or in research centres provides almost the same perceived degree of satisfaction with the job and with its four specific domains. We also take into account the endogenous sorting of PhD holders into different occupations based on latent personal traits that might be related to job satisfaction. The selectivity-corrected job satisfaction differentials reveal the importance of self-selection based on unobservable traits, and confirm the existence of a certain penalisation for working in occupations other than academia or research, which is especially marked in the case of satisfaction with job content and job-skills match. The paper presents additional interesting evidence about the determinants of occupational choice among PhD holders, highlighting the relevance of certain academic attributes (especially PhD funding and pre-and-post-doc research mobility) in affecting the likelihood of being employed in academia, in a research centre or in other public or private sector job four years after completing their doctorate programme.

JEL classifications: J24, J28, J45, C31, C35

Keywords: Job Satisfaction, Job Domain Satisfaction, Occupational Choices, Self-Selection, PhD Holders, Catalonia

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1) Introduction

Holders of Doctor of Philosophy degrees (PhDs) are a key element in the innovation and generation of new knowledge in an economy (Auriol 2010). Indeed, many European countries have recorded a huge expansion in the provision of doctoral education in recent decades, although it seems that the creation of new jobs that require a PhD (be it as an official or a practical requirement) has not kept pace with the increasing supply of PhD graduates. In several countries, including Spain, doctoral education has traditionally been associated with a candidate's intention of pursuing an academic career, especially given the insufficient "absorptive capacity" of private firms and the shortage of appropriate jobs for PhD holders in government, public administration and other areas of the public sphere. However, existing evidence indicates that — even if academia remains

the main sector of employment for doctorate recipients¹ — a significant proportion of PhD holders are employed outside the university. Moreover, this share seems set to increase in forthcoming years, given the shortage of academic positions and the progressive contraction of public recruitment due to spending cuts resulting from the current economic crisis.

Given this general background, the main purpose of this paper is to analyse the well-being of recent PhD graduates employed in a range of occupations. The paper draws on data from two successive cohorts of PhD recipients from the seven Catalan public universities, which were interviewed four years after the completion of their doctoral degrees in order to obtain information about their academic attributes, their current working situation and their satisfaction with the job and with respect to four specific work domains, which can be taken as proxies of work well-being. More specifically, we aim to estimate job satisfaction and job domain satisfaction differentials among PhD holders employed in four specific sectors: academia, research centres, the public sector (other occupations) and the private sector (other occupations). We first consider covariate-adjusted job satisfaction differentials, conditional on a progressively increasing set of individual characteristics, academic attributes and job-related variables. Moreover, in this study, we explicitly consider the possibility of self-selection into occupations by the PhD holders and, as such, this represents the paper's main contribution to the existing literature about job satisfaction among doctorate recipients — in which the issue of occupational selectivity has been usually neglected. Indeed, as for any other worker, the observed occupational choices of PhD holders are likely to depend on unobserved personal traits that might also affect their job satisfaction. Therefore, we simultaneously estimate job satisfaction and the endogenous multinomial treatment (i.e. sector choice), in order to rule out the non-random allocation of workers into employment sectors and obtain a consistent estimate of job satisfaction differentials among PhD holders employed in different types of occupation. Additionally, we also present estimates of the determinants of occupational choices, which provide an insight into the way in which individual and academic attributes affect the observed occupational choices of recent PhD graduates.

The current paper is organised as follows: the next section reviews existing research in the field. Section 3 describes the data used in the empirical analysis and presents some preliminary statistical evidence. Section 4 presents the covariate-adjusted job satisfaction differentials. Section 5 illustrates the empirical strategy adopted to deal with the issue of self-selection into occupations and the results obtained for the multinomial model of sector choice and the selectivity-corrected job

¹ See OECD, 2009, OECD/UNESCO Institute for Statistics/Eurostat data collection on Careers of Doctorate Holders.

satisfaction differentials. Finally, Section 6 summarises the conclusions that can be drawn from the current work.

2) Related research

Following the seminal studies of Hamermesh (1977), Freeman (1978) and Clark (1996), job satisfaction is now widely considered an informative economic variable, which has gained significant importance in the economics literature. However, the debate as to whether job satisfaction constitutes a good representation of worker utility derived from a job remains ongoing. Yet, the empirical regularity is that job satisfaction is a strong predictor of labour market behaviour, including future job quits, absenteeism and work productivity (see Ferrer-i-Carbonell, 2012, for a recent general discussion).

A growing number of papers focus their attention on job satisfaction among specific groups of highly educated workers – i.e. academics or PhD recipients in general. For example, the pioneering study by Lillydahl & Singell (1993) seeks to disentangle the complex relationship between union membership, wages and job satisfaction among faculty members using U.S. data. They find that although being unionised has a positive effect on earnings, union members are significantly less satisfied than other academics. Hagedorn (1996) identifies the negative impact of gender wage differentials on job satisfaction among female faculty members using a structural equation model setup. Ward & Sloane (2000) also focus on gender differences, in this instance among Scottish academics, considering not only overall job satisfaction, but also perceived degrees of satisfaction with several specific domains of the job (i.e. job domain satisfaction). Their results indicate that while there are no significant gender differences in terms of overall job satisfaction, female academics assign more importance to job security and less to their prospects of promotion than their male counterparts. The authors also report significant gender differences in the determinants of job satisfaction and of job domain satisfaction. Using the same dataset, another paper by Sloane & Ward (2001) shows that the insignificant gender differential in overall job satisfaction is substantially confounded by cohort effects. Indeed, it appears that while young male academics are more satisfied than their young female counterparts, the gender differential is reversed among the older cohorts of academics. Stevens (2005) examines the determinants of UK academics' perceived satisfaction of several job domains, as well as the effect of pecuniary and non-pecuniary job facets on the intention to quit the university. He reports that both aspects of the job are significant

predictors of the likelihood of quitting, although the impact of the former is slightly higher than that of the latter.

Other studies – based primarily on U.S. data from the Survey of Doctoral Recipients (SDR) – aim to examine job satisfaction among general samples of PhD holders employed either in academia or in other occupations. For example, Sabharwal & Corley (2009) examine gender disparities in job satisfaction across disciplines, finding that male PhD holders are significantly less satisfied than their female counterparts within the hard science and health fields, whereas there are no significant gender disparities in other disciplines. Again drawing on SDR data, Sabharwal (2011) examined differences in the relationship between individual, academic and job-related characteristics and job satisfaction² of U.S. born and foreign-born PhD holders in Science and Engineering employed in academia, finding lower levels of satisfaction among the latter and also substantial differences in the determinants of job satisfaction between native-born and foreign faculty members. Given the specific aims of this current study, we paid particular attention to papers that highlight the importance of the sector of employment for the job satisfaction of PhD holders. The evidence reported by Moguérou (2002) – also obtained from SDR data – suggests that PhD graduates employed in the education sector or engaged in research are significantly more satisfied with their job than those employed in other sectors. Bender & Heywood (2006), again employing SDR data, divide their sample according to occupation and examine three groups of PhD holders employed in academia, government jobs and the business sector. They report differences in job satisfaction by gender that are strongly dependent on the sector of employment and find that tenured faculty members are significantly more satisfied than PhD holders employed outside academia, although the relative difference also varies by gender. In a subsequent paper, Bender & Heywood (2009) considered the issue of educational mismatch among PhD holders, reporting (among other findings) considerably lower job satisfaction for PhD graduates employed in occupations that are not directly related to their academic skills. They also find that the negative impact of mismatch on job satisfaction does not appear to vary between PhD holders employed in academic or non-academic jobs.

Overall, existing research into the job satisfaction of PhD holders provides a fairly informative picture as to which factors might affect their well-being at work; indeed, these findings are often consistent with the large body of evidence reported for more general samples of workers. However, as regards the role played by occupation, the papers discussed above largely neglect the fact that the employment sector in which the PhD holder works represents a choice variable, which may well be

² Notice that both Sabharwal & Corley (2009) and Sabharwal (2011) constructed a composite measure of job satisfaction based on the combination of several job domains satisfaction variables.

affected by unobserved personal traits that, in turn, are quite likely related to perceived job satisfaction. In other words, the sorting of PhD holders into different occupations based on unobservable characteristics might generate a problem of self-selection bias in the estimated relationship between employment sector and job satisfaction. The effects of self-selection into occupation have been explicitly considered in the general literature examining job satisfaction. For example, Heywood, Siebert and Wei (2002), Clark & Senik (2006) and Demoussis & Giannakopoulos (2007) seek to accommodate the endogenous sorting of workers into economic sectors using individual fixed effects models, which are based on the assumption that workers do not sort into occupation because of idiosyncratic benefits derived from being employed in a given sector. Other papers rely on endogenous switching models that account for selection on unobservable characteristics. Luechinger et al. (2006), for example, use a simultaneous model for sector choice and job satisfaction among a sample of European workers in estimating the welfare gains derived from the matching of the workers into economic sectors based on comparative advantage. In general, the paper highlights the relevance of self-selection models for estimating job satisfaction differentials across sectors in the presence of the endogenous sorting of workers. Luechinger et al. (2010) present a general discussion about the use of self-selection models for the estimation of public/private job satisfaction differentials, and also provide a novel empirical application of copula functions in this framework. Most recently, to the best of our knowledge, Danzer (2011) estimates differences in job satisfaction between public and private workers in Ukraine. She applies an IV strategy to solve the self-selection of workers into specific economic sectors, exploiting the huge post-Soviet privatisation process as a source of exogenous variation in the sector allocation of workers. In line with the above papers, we also consider endogenous occupational sorting to be of relevance among highly educated workers, which should be taken into account to obtain a consistent estimate of job satisfaction differentials across sectors. Therefore, as we explain below, in this current paper we deal with the problem of self-selection of PhD holders into economic sectors by adopting a multinomial endogenous treatment framework.

3) Data and descriptive evidence

The data employed in the empirical analysis are taken from two successive waves of the survey conducted by the *Agència per la Qualitat del Sistema Universitari de Catalunya*³ (Quality Assurance Agency for the University System in Catalonia, AQU). The AQU surveys were carried

³ See http://www.aqu.cat/insercio/estudi_2008_doctors.html for additional details about the AQU survey.

out in 2008 and 2011 respectively, with the aim of monitoring the labour market situation of PhD holders four years after being awarded their doctorate degree. The target population comprises all the Spanish-born individuals who were awarded their PhD by the seven Catalan public universities during the 2003-2004 academic year for the first wave and the 2006-2007 academic year for the second⁴. The populations of the two graduating cohorts numbered 1,612 and 1,824 individuals respectively, and the questionnaire was completed by 934 in 2008 (response rate of 58%) and by 1,225 in 2011 (response rate of 67%). We restricted the sample to those individuals that had a regular, full-time job when the survey was conducted and who were under the age of 50 when they completed their PhD⁵. After eliminating individuals because of missing observations for our main variables of interest, we end up with a pooled sample of about 1,700 individuals.

The dataset contains basic socio-demographic information, several specific items related to the individual's academic attributes and their PhD programme, and detailed information about the current job of the PhD holders, as here we are particularly interested in the types of occupation being performed. The survey classifies the employment sectors into four main categories, namely: 1) University, 2) Research Institutes, 3) Public Sector (other occupations), and 4) Private Sector (other occupations). As expected, employment in the academic sector is the most common occupation (37% of the pooled sample) while the remaining observations are almost uniformly distributed among the other three categories. This preliminary descriptive evidence suggests that, four years after graduation, a non-trivial proportion of recent PhD recipients from Catalan universities are employed outside the traditional academic sector. Interestingly, the distribution of observations across sectors is virtually identical in the two cohorts (more details available upon request).

The interviewees were asked to report their degree of satisfaction with four specific facets of their current job and with their job as a whole, using a Likert scale ranging from 1 (very unsatisfied) to 7 (very satisfied). Table 1 displays the distribution of these job satisfaction variables as well as their average values for the whole sample and for each type of occupation separately. In the case of overall job satisfaction, it emerges that those employed in academia and — to a slightly lesser degree — in research institutes are more satisfied with their occupation than those employed in the other two sectors, being more highly represented in the highest categories of job satisfaction and

⁴ The Catalan Public Education System comprises seven universities: University of Barcelona (UB), Autonomous University of Barcelona (UAB), Polytechnic University of Catalonia (UPC) and Pompeu Fabra University (UPF) — all in the province of Barcelona — University of Lleida (UdL), University of Girona (UdG) and Rovira i Virgili University (URV, in the province of Tarragona). See García-Quevedo et al. (2010) for a comprehensive overview of the Catalan Higher Education System.

⁵ Given the aims of this paper, this restriction was made to avoid including observations of individuals who were already at an advanced point in their professional careers when they received their PhD. Moreover, the fact that the AQU survey only includes Spanish-born PhD holders does not constitute a drawback for our purposes, since this serves as an implicit reduction in the degree of labour market-related heterogeneity in the sample.

less so in the lowest. The differences with respect to public and private sector workers are even more marked in terms of the two domains that capture most closely the intrinsic quality of the job — i.e. satisfaction with the job content and, more especially, with how well this content matches the skills acquired as PhD students (job-skills match). By contrast, the raw differentials in the perceived degree of satisfaction with pecuniary aspects of the job — i.e. satisfaction with earnings and with promotion opportunities — are significantly smaller. Moreover, PhD holders that work in the private sector are clearly more satisfied than their counterparts working in other sectors with these last two facets of the job.

[TABLE 1 ABOUT HERE]

However, these raw differentials are likely to be confounded by the relationship between the perceived degree of job satisfaction and other relevant observed characteristics of the individual and of the job itself, the distribution of which might also differ across the sectors. Therefore, in what follows we present covariate-adjusted job satisfaction differentials across sectors, exploiting the relevant details in the AQU survey regarding socio-demographic characteristics, academic information and job-related variables. Table 1A in the Appendix contains the entire list of variables employed in the empirical analysis (the meanings of which are self-explanatory), together with basic descriptive statistics for the pooled sample and each sector of employment.

4) Employment sector and job satisfaction

In this section we present the covariate-adjusted job satisfaction differentials among PhD holders employed in different sectors. In order to simplify the interpretation of these results, we adopt a Probit-adapted Ordinary Least Squares (POLS) specification for the job satisfaction equations, as suggested by van Praag et al. (2003) and van Praag & Ferrer-i-Carbonell (2008). This methodology consists in replacing the ordinal job satisfaction variables with normalised variables that vary on the real axis⁶, which enables the job satisfaction differentials to be estimated by OLS using the transformed LHS variables. Here, we focus on the coefficients (see Table 2) referring to the indicators of each employment sector (taking the University as the base category). The estimates

⁶ More specifically, our categorical observed job satisfaction variables are transformed into a linear score such as: $JS^* = E(JS | \theta_{m-1} < JS \leq \theta_m) = [\varphi(\theta_{m-1}) - \varphi(\theta_m)] / [\Phi(\theta_m) - \Phi(\theta_{m-1})]$, where θ_m are the normal quintile values of the original job satisfaction variables (defined on the basis of m categories) and φ and Φ represent the normal density and distribution functions respectively. The empirical results are qualitatively the same when using OLS with the original ordinal variables as when employing an ordered probit/logit technique.

for the rest of the control variables are largely standard and are not reported here for reasons of space (detailed results are available upon request).

Our starting point is the baseline specification (model (1) in Table 2), in which the covariate-adjusted job satisfaction differentials are estimated conditioning only on individual socio-demographic characteristics, academic variables and job location. Our results suggest that, compared to faculty members, PhD recipients employed in the public and — especially — in the private sectors are substantially more satisfied with their earnings. Moreover, it appears that the latter are also significantly more satisfied with the future prospects offered by their professional career. By contrast, working outside traditional academic or research-oriented jobs seems to have a detrimental impact on satisfaction with job content and with the job-skills match, this negative effect being more pronounced among those employed in the public sector. Our findings regarding overall job satisfaction also reveal a negative differential for PhD holders employed in other private and — even more — public jobs. Since overall job satisfaction constitutes an aggregate measure of satisfaction for all relevant facets of a job, our findings in this respect suggest that even though PhD holders employed in the public and private sectors are more satisfied with their earnings and with their promotion opportunities than those employed in more “traditional” areas for PhD recipients, the pecuniary domains of the job do not fully compensate them for the shortfall in other facets, including job content, job-skills match and other intrinsic job domains that are not observed in the data. Finally, after conditioning for the initial set of covariates, it emerges that there are no significant differences in job satisfaction between PhD holders employed in universities and those employed in research institutes.

[TABLE 2 ABOUT HERE]

In subsequent steps we add different sets of job-related controls to the job satisfaction equations (models (2)-(5)). The explanatory power of the estimated models tends to increase with the progressive inclusion of these additional job characteristics, which might covariate with job satisfaction. Claims might be made that the inclusion of job-related controls would make it more difficult to interpret the conditional job satisfaction differentials — i.e. job characteristics are likely to depend on the sector of employment⁷. However, we consider the estimates from these augmented models to be informative anyway, since they help us identify those factors that actually generate the observed job satisfaction differentials.

⁷ This could be taken as a case of “bad control problem”, as described in Angrist & Pischke (2009), in which the estimation of the treatment effect’s parameter is confounded by the inclusion of controls that depend on the treatment itself.

First of all, we notice that, in the case of PhD holders employed in the public sector, the positive earnings satisfaction differential disappears when we control for job-tenure, type of contract and firm size (model (2)), while in the case of those employed in the private sector the differential loses statistical significance when we control for annual earnings (model (3)). This evidence suggests that, in general, public sector workers tend to be more satisfied than faculty members because of the pecuniary compensations associated with a greater likelihood of their having a permanent contract and a more secure tenure. However, in the case of private sector workers the differential observed in earnings satisfaction is almost fully explained by the higher salaries they receive than those paid to their academic counterparts. Second, the PhD holders who work in the private sector are no more satisfied than workers in the other occupations as regards their prospects of promotion once other job characteristics are kept fixed. By contrast, public sector workers report low levels of satisfaction with their promotion opportunities when we condition on job-related variables. Moreover, model (5) reveals a negative effect of not being employed by the university (now significant also in the case of research institutes), which means that the “average” PhD holder employed in sectors other than academia is less satisfied with his/her prospects of promotion, while those who fulfil some specific role or task in their job tend to be — at least to some extent — compensated for this negative differential⁸.

Third, the negative conditional difference in satisfaction with job content reported by PhD holders employed in the public and private sectors persists with the inclusion of job-tenure, type of contract, firm size and earnings, although it is slightly attenuated — albeit not to a statistically significant degree for the private sector — when we control for job-entry degree requirements (model (4)). Similarly, in the case of job content satisfaction, controlling for the main tasks performed in the workplace serves to emphasise the negative effect of working outside the University, being significant also for those employed by research institutes. Fourth, the job-skills match satisfaction differentials appear to present a fairly similar pattern to that observed for job content satisfaction, although the estimated coefficient is higher in absolute terms. Finally, the estimated differentials for overall job satisfaction remain roughly stable after the progressive inclusion of job-related variables, suggesting the existence of a certain penalization for working in the public or private sector after obtaining a PhD. Nevertheless, the actual extent of the overall job dissatisfaction of public and private sector workers seems likely to depend on the specific activity being performed at work, given the stronger negative impact estimated in model (5). Additionally, it

⁸ For example, PhD holders who have a managerial role, are engaged in R&D or in health-related activities are likely to be more satisfied than the average PhD holder employed outside the university (notice that academics were not asked about their main activity). We also found a positive effect of these activities on satisfaction with job content and overall job satisfaction. Moreover, PhDs working in R&D activities are significantly more satisfied than others with their job-skills match, and those performing teaching tasks in sectors than the University are more satisfied with their job as a whole.

seems that PhD holders employed in research institutes tend to obtain the same degree of satisfaction with their job as university workers if engaged in specific activities that are most likely to generate higher levels of job satisfaction.

Yet, as discussed above, these estimated job satisfaction differentials probably do not represent the true impact of sector choice on the job satisfaction of our sample of PhD holders. This would seem to be particularly true in the case that unobserved characteristics determining the chances of being employed in a given sector are also conditioning the perceived degree of satisfaction with the job. In other words, the presence of unobserved latent traits affecting both sector choice and job satisfaction would generate some selection bias in the above estimates. Therefore, in the section that follows we present the empirical methodology adopted in order to eliminate potential selection bias from our job satisfaction differentials.

5) Endogenous occupational choices and job satisfaction

5.1 Empirical strategy

The empirical strategy adopted to provide consistent estimates of job satisfaction differentials involves the joint estimation of the endogenous multinomial treatment (i.e. sector choice) and an outcome equation (i.e. overall job satisfaction and job domain satisfaction), following the methodology proposed by Deb & Trivedi (2006a, 2006b). Specifically, we consider that the choice of sector follows a mixed multinomial distribution, which means that the probability of observing individual i in sector j (i.e. $s_{ij} = s_{i1}, s_{i2} \dots s_{iJ}$) can be described as

$$\Pr(s_{ij} | z_i, l_i) = \frac{\exp(z_i' \alpha_j + \delta_j l_{ij})}{1 + \sum_{k=1}^J \exp(z_i' \alpha_k + \delta_j l_{ik})} \quad (1)$$

Here, the likelihood of being assigned to sector s_j depends on pre-determined characteristics z_i (mainly socio-demographic and academic attributes) and latent factors l_{ij} with their respective factor loadings (δ), which represent the unobserved individual heterogeneity affecting the utility of working in a given sector.

The expected value of the final outcome (i.e. job satisfaction) can be expressed as,

$$E(y_i | s_i, x_i, l_i) = x_i' \beta + \sum_j \gamma_j s_{ij} + \sum_j \lambda_j l_{ij} \quad (2)$$

which is considered to be a linear function of a vector of control variables x_i with the associated parameters β , a set of dummies denoting sector choice relative to the control group ($s = University$) and the latent factors l_{ij} , capturing the unobserved factors determining sector choice that also affect

the final outcome. The associated factor loadings λ_j can be interpreted as selection terms, which reflect the correlation between the unobservable determinants of sector choice (relative to the base category) and job satisfaction. Assuming that the latent factors follow a standard normal distribution, the estimation of this joint model for sector choice and job satisfaction can be carried out using maximum simulated likelihood based on Halton Sequences, using the STATA routine “MTREATREG”⁹.

Given the nonlinear functional form of the multinomial equation, the parameters of this joint model for sector choice and job satisfaction can, in principle, be identified even if the variables that appear in the two equations are identical (i.e. $x_i = z_i$). However, to avoid this somewhat tedious method of identification, exclusion restrictions can be incorporated into the model. These are variables that predict the choice of sector by the PhD holders, but — conditional on the large set of explanatory variables included in the outcome equation(s) — they assumed to be uncorrelated to unobserved determinants of job satisfaction(s). Specifically, we consider that the (logged) elapsed time between the completion of the undergraduate degree and PhD enrolment affects occupational choices, but not job satisfaction directly (once the relevant academic attributes and job features are controlled for). Indeed, each additional year between completion of the undergraduate degree and enrolment on a PhD programme represents more exposure to the labour market, increasing the chances of finding employment outside academia (during and) after the doctorate programme. Moreover, we assume that having carried out a research stay in another university/research institution either before or after completing the doctorate determines the likelihood of that worker finding employment in a given sector, although again this is not directly related to job satisfaction four years after being awarded a doctorate degree. The underlying hypothesis here is that the propensity to undertake a research visiting in another institution is greater among those who express a stronger preference for research-oriented jobs — especially in academia — while research mobility has a low or even null value in other professional occupations in the public or private sectors. Moreover, it can reasonably be assumed that, controlling for actual occupational choice and all its relevant features, the fact of an individual having completed either a pre-doctoral or a post-doctoral visiting stay is unlikely to be correlated with current job satisfaction.

The relevance of the exclusion restrictions in terms of their predictive power of sector choice can be directly tested from the model estimates. However, no formal overidentification test has been developed for this specific framework. We are aware of the fact that, as usual, the validity of our

⁹ See Deb (2009) for more details about “MTREATREG”. As the author suggests, the number of simulation draws should be higher than the square root of the number of observations in order to remove the simulation bias. Here, we performed the estimations using 100 draws, which is more than sufficient for a sample of about 1,700 observations. Notice also that in order to identify the factor loading parameters in the outcome equation, some restrictions should be imposed on the factor loadings for sector choice, i.e. $\delta_0=0$ and $\delta_1=\delta_2=\delta_3=1$.

exclusion restrictions is debateable, because it can be argued that the selected variables might be related to unobserved determinants of job satisfaction. This would be especially true in the case that the list of control variables in the job satisfaction equation(s) does not include all the relevant features of the current job. Nevertheless, in the Appendix we provide an informal means of testing both for the relevance of the exclusion restrictions and for the excludability of the aforementioned variables from the outcome equation(s).

5.2 Occupational choices among PhD holders

Table 2 reports the estimates of the multinomial equation for sector choice described in the previous section; with the aim of facilitating their interpretation we also computed the average marginal effects (see Table 2A in the Appendix)¹⁰. These estimates are of independent interests, given that they provide some insight as to whether and how individual characteristics and academic attributes affect occupational choices among recent PhD recipients.

The results indicate that, conditional on individual and academic characteristics, PhD holders belonging to the second cohort (i.e. those that graduated in 2006/2007) are somewhat less likely to work in research institutes. Relative to males, female PhD holders are more likely to join a research institute and less likely to be employed in a university, while age does not appear to be a relevant factor in determining occupational choices of recent PhD graduates. Parental education has a positive effect on the probability of a PhD holder being a faculty member four years after completion of their doctorate and a negative impact on their likelihood of holding a public sector post. The time elapsed between the completion of the undergraduate degree and enrolment on the doctorate programme increases an individual's chances of working in a research institute after being awarded a PhD, which might be picking up those individuals that began working at the research institute as undergraduate technicians and prepared their doctoral thesis within the same institution. PhD funding represents an important determinant of sector choice. As expected, compared to PhD holders working in a job unrelated to their field of study, recipients of research fellowships are more likely to join a research institute and — to a slightly lesser extent — to find employment at university, and less likely to take up a position in the public sector. Moreover, having had the opportunity to teach or undertake research at the university increases the individual's chances of

¹⁰ We performed five separate estimations (see model (1)-model (5) in Table 3) for each measure of job satisfaction, obtaining virtually the same parameter estimates of equation (1). Notice that the point estimates are almost identical to those obtained from a standard Multinomial Logit. For this reason, and given that the routine "MTREATREG" does not provide marginal effects for the multinomial treatment equation, average marginal effects are obtained from a standard Multinomial Logit model. Notice also that the job-related variables included in specifications (2) to (5) were not included in the sector choice equation in order to avoid reverse causality problems (i.e. job-related variables are likely to depend on the employment sector).

remaining in academia, while making it less likely for them to take up employment in the public or private sectors. Finally, working outside academia while completing the PhD but in a job related to their field of study has a negative impact on the individual's probability of working in the private sector and a positive effect on the likelihood of obtaining a public sector job. Conditional on other characteristics, the time taken to complete a PhD does not affect the occupational choices of the two cohorts of doctorate recipients. By contrast, being awarded the highest grade for the PhD (*summa cum laude*) increases the recipient's probability of working in academia and reduces their likelihood of obtaining a public sector job, while those who wrote their thesis in English (as opposed to Spanish or Catalan) and/or undertook their doctoral research within a research group are more likely to enter a research institute and less likely to work in the public sector.

The results obtained from the multinomial model of sector choice identify the relevance of pre- and post-doctoral research mobility in accounting for observed occupational choices among recent PhD graduates from Catalan Universities. Compared to those who did not undertake a research visiting at another centre during their doctorate studies, experiencing a research stay in a national centre reduces the probability of being employed by a university and augments the chances of obtaining a public sector job after completing the PhD. However, participating in a mobility programme outside Spain reduces the chances of eventual employment in the public sector and, in the case of visiting centres outside Europe, increases the likelihood of working in academia. The conditional impact of post-doctoral mobility is even more significant and is in the expected direction. Indeed, PhD holders who experienced a visiting stay at another institution after completing their doctoral studies are significantly more likely to be employed in academia and — to a lesser extent — in research institutes, while the probability of being employed in either a non-academic or non-research oriented job is significantly reduced. Interestingly, the estimated impact of research mobility on sector choice is conditional on the geographical location of the individual's current job; moreover, the estimates are completely unaffected by the exclusion of job-location indicators from the model. Overall, this evidence suggests that the impact of undertaking a post-doctoral research visiting on occupational choices among PhD holders is not driven by the potential relationship between research mobility and (current) job location. On a related matter, moving away from Barcelona but remaining within Catalonia appears to reduce the probability of working in research institutes and increases the likelihood of being employed as a faculty member. Moreover, those working in the provinces of Girona and Lleida are less likely to have a private sector job, while the former are also less likely to work in the public sector. Finally, those who work in another Spanish region are more likely to have a public sector occupation, while those who moved outside Europe have a reduced likelihood of being employed in this sector.

The estimated model of occupational choice also contains PhD-type and university fixed effects as additional control variables, thus identifying factors that are common among doctorate holders with similar PhDs across the seven Catalan public universities. The estimates of PhD-type FEs suggest that, compared to PhDs in Biology (the largest group), those who have a PhD in the Humanities or Social Science are more likely to work at the university and less likely to be employed in research institutes and in the private sector. Moreover, having a PhD in History, Philosophy and Arts or in Language, Linguistic and Literature increases the chances of working in the public sector. Within the area of Hard Sciences, a PhD in Chemistry — compared to one in Biology — raises the likelihood of employment in the private sector and reduces the likelihood of being employed in a research institute, whereas PhD holders in Environmental Studies are more likely to obtain public sector occupations and PhDs in Maths and Physics have greater probabilities of entering the university and fewer of entering the private sector. As expected, PhDs in Medicine tend to concentrate more in the public sector and less in other occupations. Finally, again in comparison with PhDs in Biology, those who have doctorates in Production Engineering and Computer and Information Engineering are more likely to work in academia, while the latter have fewer probabilities of working in research institutes. After conditioning on the basis of PhD-type, there are few differences across universities. Compared to those obtaining PhDs at the University of Barcelona (UB), the largest and oldest of Catalonia's universities, doctors who have been awarded PhDs by the Polytechnic University of Catalonia (UPC) or the University of Lleida (UdL) are less likely to find employment in the public sector, while in the case of the latter there is a greater likelihood of being employed in a research institute four years after completing the PhD.

5.3 Selectivity-corrected job satisfaction differentials

The selectivity-corrected job satisfaction differentials resulting from the joint estimation of equations (1) and (2) are shown in Table 3, together with the factor loading estimates associated with the latent factors affecting both sector choice and job satisfaction¹¹. As before, we start with a baseline specification that includes only individual characteristics and academic attributes as control variables (model (1)), and then we progressively add job-related variables in order to highlight the channels through which overall job satisfaction and specific job domain satisfaction differentials are generated (model (2)-model (5)).

¹¹ See the Appendix for evidence regarding the validity of the exclusion restrictions needed to identify the selectivity-corrected job satisfaction differentials without having to rely on functional form assumptions.

The results about earnings satisfaction indicate that, after controlling for selection on unobservable traits, PhD holders employed in research institutes are significantly more satisfied with their pecuniary remuneration than is the case of academics. The associated lambda parameter is consistently negative, suggesting that the PhD holders that are most likely to find employment in research institutes are less likely to be happy with their earnings than a random worker. The positive differential found in favour of public sector workers, estimated without accounting for the endogenous sorting of workers, is due in the main to positive selection, given the negative (but statistically insignificant) selection-corrected differential with respect to faculty members and the positive (and significant) selection coefficient. By contrast, the positive effect of working in the private sector on the degree of satisfaction with the level of earnings is even more marked once the endogenous selection is controlled for, since this sector is likely to attract PhD holders that are “intrinsicly” less satisfied with their earnings (i.e. negative selection).

In general, PhD holders’ satisfaction with promotion prospects seems not to be so strongly affected by endogenous selection into employment sectors. In fact, here again there is no statistically significant difference in the degree of satisfaction with regards to promotion between PhD holders employed in research institutes and those working at the university, and the point estimate for private sector PhD workers is almost identical to the non-corrected estimate (albeit that it is now no longer significant due to a loss in precision). However, the case of the public sector is a clear exception, in the light of the negative and significant selectivity-corrected differential and the positive selection coefficient, which once again indicates that the PhD holders that are most likely to express greater degrees of satisfaction with their promotion opportunities tend to self-select into the public sector.

Even when taking into account the endogenous selection of recent PhD recipients into employment sectors, the estimates of degrees of job content and job-skills match satisfaction are still consistent with the idea that not being employed in academic or research-based occupations generates more dissatisfaction with these two facets of the job. Indeed, the estimated differentials for both domains are somewhat higher than the non-corrected estimates. This is especially true for the former domain, for which we also obtain a positive and significant selection coefficient.

Finally, the evidence concerning overall job satisfaction confirms that, even when controlling for observed and unobserved individual characteristics, PhD holders employed in academia and in research institutes do not differ significantly in terms of their perceived degree of satisfaction with the job as a whole. However, private and, more especially, public sector workers are significantly less satisfied with their job overall than their faculty counterparts. Moreover, the resulting differentials are now markedly higher than with the non-corrected models, in which the estimated

differences in job satisfaction are confounded by the strong positive selection of more satisfied PhD holders into the public and private sectors.

The selectivity-corrected job satisfaction differentials are, in general, less sensitive to the inclusion of job-related variables as additional controls. The positive earnings satisfaction gap between PhD holders employed in research institutes and those working at university remains stable across the different specifications, while the negative impact on PhD holders of working in the public sector rises somewhat when controlling for job-tenure, type of contract and firm size (model (2)) and for earnings (model (3)). In the case of private sector PhD employees the positive differential decreases slightly, especially when we include annual earnings, but it still remains sizable and significant. Our promotion satisfaction differentials across sectors are mostly unchanged when job characteristics are included in the satisfaction equation, except for the case of PhD holders employed in the public sector, for whom we obtain a stronger negative satisfaction gap with respect to their counterparts working in academia once annual earnings are controlled for. Interestingly, when the individuals' earnings categories are maintained constant, the negative differential in job content satisfaction among private workers tends to lose importance. This result might be due to the fact that, for a PhD holder, obtaining a highly paid job in the private sector is likely to be synonymous with finding a good quality job, which provides roughly the same level of well-being as an — equally well-paid — job in academia. Moreover, the rise in the negative satisfaction differential for PhD holders employed in the public and private sectors after controlling for the main job activities suggests once again that, to some extent, the existing disparities in job content satisfaction across sectors are likely to depend on the main tasks undertaken in the workplace. With respect to the job-skills match, the dissatisfaction expressed by public and private sector workers is only slightly affected by the inclusion of these educational certification requirements (model (4)), although the estimated coefficient is still sizable and strongly significant. Finally, the estimates for overall job satisfaction confirm the similarity between academia and research institutes in terms of the overall job quality they afford, but also the existence of a significant disparity between PhD holders employed in the private and public sectors and their academic counterparts. Only in the case of the public sector is the estimated gap subject to a modest reduction after controlling for job-tenure, type of contract and firm size (model (2)) and academic requirements on job entry (model (4)).

6) Conclusions

This paper has examined differences in the degree of job satisfaction reported by recent PhD recipients employed in different job sectors. We draw on data from two successive cohorts of PhD graduates from the seven Catalan public universities, who were interviewed about four years after receiving their PhD degrees. We consider different models for overall job satisfaction and specific job domain satisfaction, starting from a baseline equation containing only individual and academic attributes, which we progressively augment with additional job-related controls. Overall, the results from a POLS specification with employment sector indicators reveal the existence of significant differences in job satisfaction between PhD holders employed in academia and those working in other sectors. In general, PhD holders working in the public and private sectors are less satisfied than their academic counterparts with the non-pecuniary aspects of their work — i.e. job content and job-skills match, while the former are also less satisfied with their promotion opportunities. However, these public and private sector workers tend to be more satisfied with the pecuniary aspects of their jobs, tending to earn more than faculty members and to enjoy better employment conditions (e.g. type of contract and more secure job-tenure in the case of public sector workers). On average, when controlling for individual, academic and job characteristics, it appears that PhD holders working in universities and research institutes are almost equally satisfied with their jobs and with the four main job domains. Finally, our results highlight the importance of the main activities engaged in at work in accounting for the job satisfaction differentials between sectors. This is especially relevant in the case of PhD holders employed in research institutes.

The paper also considers the non-random allocation of PhD holders into different occupations, based on unobserved characteristics and latent personal traits that are also likely to affect job satisfaction. Based on the simultaneous estimation of job satisfaction and the endogenous multinomial treatment (i.e. sector choice), we obtained a quite distinct but consistent picture that makes evident the importance of self-selection based on unobservable traits. The selectivity-corrected job satisfaction differentials indicate that PhD holders employed in research institutes and in the private sector are significantly more satisfied with their earnings than is the case of their faculty counterparts, while public sector workers are likely to be less satisfied with both their earnings and their promotion prospects. The negative impact in terms of job content satisfaction and job-skills match satisfaction for PhD holders that work outside academia or research institutes is even more marked when the endogenous sorting of workers is taken into account (especially as regards the first of these two domains). Moreover, our evidence regarding overall job satisfaction confirms that working in a university or in a research institute provides almost the same degree of

well-being to recent PhD recipients, while being employed in other types of occupation generates a certain degree of dissatisfaction with the job that is not fully offset by such pecuniary facets as earnings or promotion prospects. Finally, the paper provides additional evidence about the determinants of sector choice among recent PhD recipients, highlighting the relevance of certain academic attributes — especially PhD funding and pre-and-post-doc research mobility — in affecting the likelihood of being employed in academia, in a research centres or in another public or private sector occupation.

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TABLES

Table 1: Job satisfaction by sector of occupation (%)

| | University | Research Institutes | Public Sector | Private Sector | Total |
|--|-------------------|----------------------------|----------------------|-----------------------|--------------|
| Satisfaction with Earnings | | | | | |
| 1 (very unsatisfied) | 2.37 | 3.06 | 3.83 | 1.07 | 2.52 |
| 2 | 5.85 | 7.50 | 5.01 | 2.14 | 5.22 |
| 3 | 11.22 | 11.94 | 10.91 | 10.16 | 11.08 |
| 4 | 22.91 | 17.50 | 23.30 | 14.44 | 19.99 |
| 5 | 29.86 | 26.94 | 28.61 | 35.83 | 30.30 |
| 6 | 20.70 | 23.06 | 19.76 | 27.01 | 22.39 |
| 7 (very satisfied) | 7.11 | 10.00 | 8.55 | 9.36 | 8.50 |
| Average | 4.63 | 4.67 | 4.61 | 5.00 | 4.72 |
| Satisfaction with Promotion Opportunities | | | | | |
| 1 (very unsatisfied) | 3.46 | 7.20 | 7.96 | 2.67 | 4.97 |
| 2 | 4.41 | 8.03 | 5.90 | 5.08 | 5.62 |
| 3 | 10.87 | 9.14 | 9.14 | 7.22 | 9.36 |
| 4 | 16.54 | 18.01 | 16.22 | 12.57 | 15.92 |
| 5 | 26.30 | 24.10 | 24.48 | 29.68 | 26.21 |
| 6 | 25.51 | 21.05 | 25.66 | 26.74 | 24.87 |
| 7 (very satisfied) | 12.91 | 12.47 | 10.62 | 16.04 | 13.05 |
| Average | 4.86 | 4.57 | 4.63 | 5.06 | 4.80 |
| Satisfaction with Job Content | | | | | |
| 1 (very unsatisfied) | 0.16 | 0.28 | 1.18 | 0.00 | 0.35 |
| 2 | 0.31 | 0.83 | 1.18 | 1.34 | 0.82 |
| 3 | 0.94 | 0.83 | 4.14 | 1.34 | 1.64 |
| 4 | 3.78 | 5.26 | 7.40 | 6.15 | 5.33 |
| 5 | 16.22 | 16.07 | 20.12 | 21.93 | 18.21 |
| 6 | 42.52 | 42.38 | 37.57 | 43.32 | 41.69 |
| 7 (very satisfied) | 36.06 | 34.35 | 28.40 | 25.94 | 31.97 |
| Average | 6.07 | 6.01 | 5.70 | 5.82 | 5.93 |
| Satisfaction with Job-Skills Match | | | | | |
| 1 (very unsatisfied) | 1.10 | 2.22 | 13.61 | 8.29 | 5.39 |
| 2 | 0.95 | 0.83 | 10.06 | 10.70 | 4.86 |
| 3 | 3.31 | 3.60 | 11.83 | 8.29 | 6.15 |
| 4 | 9.78 | 7.76 | 15.98 | 15.78 | 11.89 |
| 5 | 21.45 | 21.61 | 21.30 | 19.79 | 21.09 |
| 6 | 36.12 | 36.84 | 18.05 | 24.33 | 30.11 |
| 7 (very satisfied) | 27.29 | 27.15 | 9.17 | 12.83 | 20.50 |
| Average | 5.67 | 5.65 | 4.12 | 4.52 | 5.11 |
| Overall Job Satisfaction | | | | | |
| 1 (very unsatisfied) | 0.47 | 0.83 | 1.77 | 0.27 | 0.76 |
| 2 | 0.47 | 0.28 | 2.06 | 0.27 | 0.70 |
| 3 | 1.89 | 2.49 | 3.24 | 4.55 | 2.87 |
| 4 | 7.56 | 7.48 | 11.21 | 9.63 | 8.72 |
| 5 | 20.00 | 26.87 | 26.55 | 27.54 | 24.40 |
| 6 | 49.29 | 44.88 | 41.30 | 44.12 | 45.64 |
| 7 (very satisfied) | 20.31 | 17.17 | 13.86 | 13.64 | 16.91 |
| Average | 5.75 | 5.63 | 5.38 | 5.51 | 5.60 |
| % Selected Sample | 37.16% | 21.12% | 19.84% | 22.88 | 100% |

Table 2: Covariate-Adjusted Job Satisfaction Differentials (POLS)

| | MODEL | | | | |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) |
| Satisfaction with Earnings | | | | | |
| <i>reference category</i> | | | | | |
| University | | | | | |
| Research Institutes | 0.092 (0.071) | 0.080 (0.081) | 0.052 (0.078) | 0.054 (0.078) | 0.128 (0.100) |
| Public Sector | 0.164 (0.077)** | 0.104 (0.086) | 0.024 (0.083) | 0.013 (0.085) | 0.060 (0.100) |
| Private Sector | 0.351 (0.066)*** | 0.280 (0.092)*** | 0.113 (0.089) | 0.108 (0.090) | 0.151 (0.102) |
| R ² | 0.083 | 0.088 | 0.169 | 0.170 | 0.175 |
| Satisfaction with Promotion Opportunities | | | | | |
| <i>reference category</i> | | | | | |
| University | | | | | |
| Research Institutes | -0.062 (0.072) | -0.113 (0.080) | -0.124 (0.078) | -0.123 (0.078) | -0.329 (0.105)*** |
| Public Sector | -0.092 (0.077) | -0.179 (0.086)** | -0.221 (0.084)*** | -0.223 (0.086)*** | -0.445 (0.105)*** |
| Private Sector | 0.240 (0.067)*** | 0.010 (0.093) | -0.013 (0.092) | -0.011 (0.093) | -0.202 (0.110)* |
| R ² | 0.072 | 0.088 | 0.134 | 0.134 | 0.145 |
| Satisfaction with Job Content | | | | | |
| <i>reference category</i> | | | | | |
| University | | | | | |
| Research Institutes | 0.001 (0.066) | 0.040 (0.075) | 0.028 (0.075) | 0.031 (0.075) | -0.226 (0.104)** |
| Public Sector | -0.367 (0.078)*** | -0.361 (0.086)*** | -0.383 (0.086)*** | -0.297 (0.087)*** | -0.517 (0.107)*** |
| Private Sector | -0.184 (0.064)*** | -0.155 (0.088)* | -0.206 (0.090)** | -0.146 (0.090) | -0.349 (0.107)*** |
| R ² | 0.063 | 0.064 | 0.073 | 0.088 | 0.102 |
| Satisfaction with Job-Skills Match | | | | | |
| <i>reference category</i> | | | | | |
| University | | | | | |
| Research Institutes | -0.039 (0.061) | 0.027 (0.068) | 0.019 (0.069) | 0.017 (0.068) | -0.493 (0.096)*** |
| Public Sector | -0.766 (0.076)*** | -0.691 (0.082)*** | -0.715 (0.082)*** | -0.570 (0.085)*** | -0.814 (0.102)*** |
| Private Sector | -0.608 (0.065)*** | -0.504 (0.087)*** | -0.556 (0.088)*** | -0.458 (0.088)*** | -0.779 (0.100)*** |
| R ² | 0.184 | 0.190 | 0.196 | 0.225 | 0.257 |
| Overall Job Satisfaction | | | | | |
| <i>reference category</i> | | | | | |
| University | | | | | |
| Research Institutes | -0.071 (0.067) | -0.061 (0.075) | -0.072 (0.075) | -0.069 (0.075) | -0.279 (0.103)*** |
| Public Sector | -0.278 (0.077)*** | -0.271 (0.084)*** | -0.302 (0.084)*** | -0.227 (0.087)*** | -0.452 (0.107)*** |
| Private Sector | -0.171 (0.066)*** | -0.174 (0.088)** | -0.238 (0.090)*** | -0.186 (0.091)** | -0.371 (0.106)*** |
| R ² | 0.056 | 0.059 | 0.070 | 0.080 | 0.096 |

Note: model (1) includes controls for the year of the survey, gender, log-age, parental education, PhD-funding, log-PhD duration, PhD thesis in English, PhD thesis developed within a research group, extraordinary PhD thesis prize, PhD type FEs, university FEs and job location indicators. Model (2) contains additional controls for log-job tenure, permanent contract, firm size. Model (3) contains additional controls for annual earnings categories. Model (4) contains additional controls for academic requirements to enter the current job. Model (5) contains additional controls for the main activity at the current job

(non-excluding categories). Robust standard errors within parenthesis. * Significant at 0.1%, **significant at 0.05%, *** significant at 0.01%.

Table 3: Mixed Multinomial Logit for Sector Choice

| | <i>Research Institutes vs University</i> | | <i>Public Sector vs University</i> | | <i>Private Sector vs University</i> | |
|--|--|-------------|--|-------------|---|-------------|
| CONTROLS | Coef. | S.E. | Coef. | S.E. | Coef. | S.E. |
| Intercept | -2.099 | 4.392 | 1.735 | 4.254 | 6.934 | 4.066 * |
| Cohort 2011 | -0.387 | 0.205 * | 0.302 | 0.229 | 0.191 | 0.198 |
| SOCIODEMOGRAPHIC VARIABLES | | | | | | |
| Female | 0.57 | 0.183 *** | 0.293 | 0.209 | 0.107 | 0.182 |
| Log(Age) | 0.6 | 1.232 | -0.111 | 1.201 | -1.133 | 1.165 |
| Parental education = primary or less | <i>reference category</i> | | <i>reference category</i> | | <i>reference category</i> | |
| Parental education = secondary | -0.443 | 0.224 ** | -0.619 | 0.255 ** | -0.225 | 0.221 |
| Parental education = tertiary | -0.237 | 0.202 | -0.441 | 0.228 * | -0.263 | 0.207 |
| ACADEMIC VARIABLES | | | | | | |
| Log(Elapsed time between degree and PhD) | 0.258 | 0.141 * | 0.153 | 0.154 | -0.098 | 0.140 |
| Research fellowship during the PhD | 0.374 | 0.565 | -1.033 | 0.43 ** | -1.347 | 0.398 *** |
| Teaching/research contract during the PhD | -1.379 | 0.584 ** | -2.902 | 0.516 *** | -2.859 | 0.429 *** |
| Work related to the PhD | -0.06 | 0.55 | 0.405 | 0.373 | -0.813 | 0.386 ** |
| Work not related to the PhD or others | <i>reference category</i> | | <i>reference category</i> | | <i>reference category</i> | |
| Log(PhD duration) | -0.044 | 0.226 | -0.115 | 0.234 | -0.128 | 0.225 |
| Extraordinary PhD prize | -0.339 | 0.251 | -0.625 | 0.305 ** | -0.813 | 0.274 *** |
| PhD thesis in English | 0.249 | 0.248 | -0.69 | 0.351 ** | -0.238 | 0.243 |
| PhD thesis within a research group | 0.457 | 0.275 * | -0.554 | 0.259 ** | -0.179 | 0.231 |
| PRE & POST DOCTORAL MOBILITY | | | | | | |
| No pre-doctoral mobility | <i>reference category</i> | | <i>reference category</i> | | <i>reference category</i> | |
| Pre-doctoral mobility in national centres | 0.673 | 0.453 | 0.827 | 0.411 ** | 0.724 | 0.447 |
| Pre-doctoral mobility in European centres | -0.118 | 0.23 | -0.599 | 0.271 ** | -0.157 | 0.217 |
| Pre-doctoral mobility in U.S. centres | -0.085 | 0.288 | -0.865 | 0.333 *** | -0.501 | 0.289 * |
| Pre-doctoral mobility in other countries | -0.757 | 0.398 * | -1.614 | 0.503 *** | -0.433 | 0.329 |
| No post-doctoral mobility | <i>reference category</i> | | <i>reference category</i> | | <i>reference category</i> | |
| Post-doctoral mobility in national centres | 0.062 | 0.364 | -2.431 | 0.556 *** | -1.156 | 0.409 *** |
| Post-doctoral mobility in European centres | 0.326 | 0.231 | -2.371 | 0.37 *** | -2.027 | 0.283 *** |
| Post-doctoral mobility in U.S. centres | -0.256 | 0.307 | -1.581 | 0.446 *** | -2.583 | 0.486 *** |
| Post-doctoral mobility in other countries | -0.153 | 0.425 | -2.296 | 0.545 *** | -1.859 | 0.453 *** |
| WORKING REGION | | | | | | |
| Working in Barcelona province | <i>reference category</i> | | <i>reference category</i> | | <i>reference category</i> | |
| Working in Tarragona province | -1.378 | 0.494 *** | 0.144 | 0.546 | -0.738 | 0.388 * |
| Working in Girona province | -2.731 | 0.664 *** | 0.289 | 0.448 | -0.999 | 0.483 ** |
| Working in Lleida province | -1.301 | 0.529 ** | -0.393 | 0.653 | -2.403 | 0.801 *** |
| Working in the rest of Spain | 0.072 | 0.307 | 0.405 | 0.355 | -0.196 | 0.347 |
| Working in the EU | -0.103 | 0.39 | 0.634 | 0.675 | -0.342 | 0.473 |
| Working outside the EU | -0.132 | 0.435 | -1.171 | 1.168 | 0.609 | 0.529 |

Robust standard errors in italic. * Significant at 0.1%, **significant at 0.05%, *** significant at 0.01%.

Table 3: Mixed Multinomial Logit for Sector Choice (continued)

| CONTROLS | <i>Research Institutes vs University</i> | | | <i>Public Sector vs University</i> | | | <i>Private Sector vs University</i> | | |
|---|--|--------------|-----|--|--------------|-----|---|--------------|-----|
| | Coef. | <i>S.E.</i> | | Coef. | <i>S.E.</i> | | Coef. | <i>S.E.</i> | |
| PHD TYPE | | | | | | | | | |
| Geography and Demography | -0.993 | <i>0.736</i> | | -1.19 | <i>0.82</i> | | -1.881 | <i>0.787</i> | ** |
| History, Philosophy and Arts | -1.674 | <i>0.47</i> | *** | 0.158 | <i>0.458</i> | | -1.319 | <i>0.437</i> | *** |
| Language, Linguistics and Literature | -2.572 | <i>0.593</i> | *** | 0.233 | <i>0.49</i> | | -1.464 | <i>0.512</i> | *** |
| Economics, Business and Related Fields | -4.442 | <i>0.99</i> | *** | -1.124 | <i>0.604</i> | * | -1.822 | <i>0.467</i> | *** |
| Pedagogy and Psychology | -3.196 | <i>0.726</i> | *** | -0.63 | <i>0.511</i> | | -2.584 | <i>0.557</i> | *** |
| Other Social Sciences | -3.044 | <i>0.566</i> | *** | -0.661 | <i>0.451</i> | | -2.039 | <i>0.450</i> | *** |
| Chemistry | -0.453 | <i>0.321</i> | | 0.189 | <i>0.462</i> | | 0.609 | <i>0.321</i> | * |
| Biology | <i>reference category</i> | | | <i>reference category</i> | | | <i>reference category</i> | | |
| Environmental Studies | -0.143 | <i>0.393</i> | | 1.135 | <i>0.494</i> | ** | -0.186 | <i>0.424</i> | |
| Maths and Physics | -0.928 | <i>0.386</i> | ** | -0.266 | <i>0.613</i> | | -1.434 | <i>0.457</i> | *** |
| Medicine | 0.064 | <i>0.39</i> | | 2.446 | <i>0.415</i> | *** | 0.351 | <i>0.407</i> | |
| Other Health-Related Fields | -0.588 | <i>0.403</i> | | -0.199 | <i>0.516</i> | | 0.196 | <i>0.415</i> | |
| Architecture and Civil Engineering | -1.025 | <i>0.664</i> | | -0.229 | <i>1.516</i> | | -0.302 | <i>0.672</i> | |
| Production Engineering | -0.75 | <i>0.431</i> | * | -0.856 | <i>0.653</i> | | -0.625 | <i>0.458</i> | |
| Computers and Information Engineering | -2.024 | <i>0.445</i> | *** | -0.983 | <i>0.664</i> | | -1.231 | <i>0.436</i> | *** |
| UNIVERSITY | | | | | | | | | |
| University of Barcelona UB | <i>reference category</i> | | | <i>reference category</i> | | | <i>reference category</i> | | |
| Autonomous University of Barcelona UAB | 0.027 | <i>0.217</i> | | -0.276 | <i>0.235</i> | | -0.082 | <i>0.211</i> | |
| Polytechnic University of Catalonia UPC | -0.247 | <i>0.381</i> | | -1.248 | <i>0.552</i> | ** | -0.312 | <i>0.379</i> | |
| Pompeu Fabra University UPF | 0.341 | <i>0.47</i> | | -0.372 | <i>0.572</i> | | 0.339 | <i>0.501</i> | |
| University of Lleida UdL | 1.526 | <i>0.666</i> | ** | -0.338 | <i>0.599</i> | | 0.193 | <i>0.566</i> | |
| University of Girona UdG | 0.71 | <i>0.55</i> | | 1.175 | <i>0.629</i> | * | -0.038 | <i>0.681</i> | |
| Rovira i Virgili University URV | 0.641 | <i>0.55</i> | | 0.258 | <i>0.693</i> | | 0.41 | <i>0.469</i> | |

*Robust standard errors in italic. * Significant at 0.1%, **significant at 0.05%, *** significant at 0.01%.*

Table 4: Selectivity-Corrected Job Satisfaction Differentials

| | MODEL | | | | |
|----------------------------|--|----------------------|----------------------|----------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) |
| | Satisfaction with Earnings | | | | |
| University | <i>reference category</i> | | | | |
| Research Institutes | 0.397 (0.160)** | 0.362 (0.158)** | 0.320 (0.123)*** | 0.323 (0.123)*** | 0.388 (0.134)*** |
| Public Sector | -0.148 (0.143) | -0.217 (0.136) | -0.273 (0.120)** | -0.284 (0.122)** | -0.263 (0.122)** |
| Private Sector | 0.844 (0.259)*** | 0.766 (0.198)*** | 0.559 (0.127)*** | 0.548 (0.137)*** | 0.564 (0.163)*** |
| Lambda _{research} | -0.353 (0.199)* | -0.345 (0.164)** | -0.322 (0.133)** | -0.324 (0.133)** | -0.293 (0.133)** |
| Lambda _{public} | 0.437 (0.166)*** | 0.440 (0.169)*** | 0.418 (0.084)*** | 0.421 (0.081)*** | 0.442 (0.079)*** |
| Lambda _{private} | -0.635 (0.370)* | -0.648 (0.341)* | -0.546 (0.140)*** | -0.537 (0.154)*** | -0.490 (0.196)** |
| | Satisfaction with Promotion Opportunities | | | | |
| University | <i>reference category</i> | | | | |
| Research Institutes | -0.157 (0.142) | -0.226 (0.155) | -0.145 (0.183) | -0.143 (0.186) | 0.408 (0.431) |
| Public Sector | -0.552 (0.157)*** | -0.587 (0.155)*** | -0.637 (0.130)*** | -0.643 (0.130)*** | -0.706 (0.309)** |
| Private Sector | 0.247 (0.185) | 0.074 (0.240) | -0.059 (0.285) | -0.069 (0.299) | 0.213 (0.461) |
| Lambda _{research} | 0.110 (0.147) | 0.128 (0.164) | 0.009 (0.199) | 0.007 (0.202) | 0.105 (0.488) |
| Lambda _{public} | 0.609 (0.189)*** | 0.534 (0.183)*** | 0.546 (0.130)*** | 0.547 (0.128)*** | 0.340 (0.386) |
| Lambda _{private} | -0.002 (0.215) | 0.032 (0.265) | 0.063 (0.320) | 0.072 (0.334) | 0.015 (0.539) |

Note: model (1) includes controls for the year of the survey, gender, log-age, parental education, PhD-funding, log-PhD duration, PhD thesis in English, PhD thesis developed within a research group, extraordinary PhD thesis prize, type FEs, university FEs and job location indicators. Model (2) contains additional controls for log-job tenure, permanent contract, firm size. Model (3) contains additional controls for annual earnings categories. Model (4) contains additional controls for academic requirements to enter the current job. Model (5) contains additional controls for the main activity at the current job (non-excluding categories). Robust standard errors within parenthesis. * Significant at 0.1%, **significant at 0.05%, *** significant at 0.01%.

Table 4 (Continued): Selectivity-Corrected Job Satisfaction Differentials

| | MODEL | | | | |
|----------------------------|---|----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) |
| | Satisfaction with Job Content | | | | |
| University | <i>reference category</i> | | | | |
| Research Institutes | -0.097 (0.216) | -0.063 (0.198) | 0.160 (0.162) | -0.149 (0.186) | -0.164 (0.441) |
| Public Sector | -0.778 (0.110)*** | -0.785 (0.112)*** | -0.767 (0.217)*** | -0.735 (0.130)*** | -0.994 (0.243)*** |
| Private Sector | -0.554 (0.105)*** | -0.561 (0.133)*** | -0.120 (0.217) | -0.361 (0.271) | -0.629 (0.332)* |
| Lambda _{research} | 0.096 (0.273) | 0.094 (0.258) | -0.181 (0.140) | 0.196 (0.208) | -0.123 (0.517) |
| Lambda _{public} | 0.550 (0.100)*** | 0.546 (0.096)*** | 0.504 (0.158)*** | 0.553 (0.118)*** | 0.602 (0.266)** |
| Lambda _{private} | 0.487 (0.110)*** | 0.509 (0.114)*** | -0.097 (0.218) | 0.265 (0.316) | 0.327 (0.342) |
| | Satisfaction with Job-Skills Match | | | | |
| University | <i>reference category</i> | | | | |
| Research Institutes | -0.030 (0.232) | 0.005 (0.186) | -0.001 (0.204) | -0.080 (0.752) | -0.440 (0.991) |
| Public Sector | -0.917 (0.150)*** | -0.849 (0.140)*** | -0.885 (0.162)*** | -0.697 (0.156)*** | -0.885 (0.170)*** |
| Private Sector | -0.897 (0.146)*** | -0.777 (0.152)*** | -0.821 (0.159)** | -0.621 (0.252)** | -0.961 (0.304)*** |
| Lambda _{research} | -0.032 (0.267) | 0.002 (0.209) | -0.012 (0.230) | -0.094 (0.909) | -0.077 (1.200) |
| Lambda _{public} | 0.200 (0.160) | 0.196 (0.148) | 0.212 (0.179) | 0.161 (0.131) | -0.090 (0.145) |
| Lambda _{private} | 0.375 (0.152)** | 0.336 (0.146)** | 0.326 (0.154)** | 0.200 (0.254) | 0.230 (0.307) |
| | Overall Job Satisfaction | | | | |
| University | <i>reference category</i> | | | | |
| Research Institutes | -0.091 (0.097) | -0.029 (0.218) | -0.006 (0.188) | -0.096 (0.244) | -0.293 (0.268) |
| Public Sector | -0.788 (0.106)*** | -0.564 (0.227)** | -0.583 (0.149)*** | -0.502 (0.164)*** | -0.708 (0.174)*** |
| Private Sector | -0.609 (0.086)*** | -0.559 (0.198)*** | -0.603 (0.158)*** | -0.598 (0.236)** | -0.645 (0.219)*** |
| Lambda _{research} | 0.000 (0.094) | -0.074 (0.266) | -0.115 (0.220) | 0.000 (0.299) | 0.008 (0.306) |
| Lambda _{public} | 0.663 (0.079)*** | 0.372 (0.263) | 0.358 (0.148)** | 0.338 (0.165)** | 0.328 (0.163)** |
| Lambda _{private} | 0.582 (0.064)*** | 0.473 (0.222)** | 0.447 (0.158)*** | 0.497 (0.269)* | 0.340 (0.239) |

Note: model (1) includes controls for the year of the survey, gender, log-age, parental education, PhD-funding, log-PhD duration, PhD thesis in English, PhD thesis developed within a research group, extraordinary PhD thesis prize, type FEs, university FEs and job location indicators. Model (2) contains additional controls for log-job tenure, permanent contract, firm size. Model (3) contains additional controls for annual earnings categories. Model (4) contains additional controls for academic requirements to enter the current job. Model (5) contains additional controls for the main activity at the current job (non-excluding categories). Robust standard errors within parenthesis. * Significant at 0.1%, **significant at 0.05%, *** significant at 0.01%.

APPENDIX

Table 1A: Descriptive Statistics

| | University | | Research Institutes | | Public Sector | | Private Sector | |
|---|------------|-------|---------------------|-------|---------------|-------|----------------|-------|
| | Mean | S.D. | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| CONTROLS | | | | | | | | |
| Cohort 2011 | 0.550 | 0.498 | 0.551 | 0.498 | 0.560 | 0.497 | 0.586 | 0.493 |
| SOCIODEMOGRAPHIC VARIABLES | | | | | | | | |
| Female | 0.376 | 0.485 | 0.554 | 0.498 | 0.493 | 0.501 | 0.492 | 0.501 |
| Age (survey year) | 37.23 | 5.32 | 35.73 | 4.17 | 41.13 | 6.05 | 36.71 | 5.51 |
| Parental education = primary or less | 0.386 | 0.487 | 0.380 | 0.486 | 0.481 | 0.500 | 0.409 | 0.492 |
| Parental education = secondary | 0.250 | 0.434 | 0.233 | 0.423 | 0.218 | 0.414 | 0.246 | 0.431 |
| Parental education = tertiary | 0.364 | 0.481 | 0.388 | 0.488 | 0.301 | 0.459 | 0.345 | 0.476 |
| ACADEMIC VARIABLES | | | | | | | | |
| Research fellowship during the PhD | 0.528 | 0.500 | 0.814 | 0.389 | 0.298 | 0.458 | 0.639 | 0.481 |
| Teaching/research contract during the PhD | 0.306 | 0.461 | 0.069 | 0.254 | 0.035 | 0.185 | 0.080 | 0.272 |
| Work related to the PhD | 0.123 | 0.329 | 0.091 | 0.289 | 0.546 | 0.499 | 0.179 | 0.384 |
| Work not related to the PhD or others | 0.044 | 0.205 | 0.025 | 0.156 | 0.121 | 0.327 | 0.102 | 0.303 |
| PhD duration (in years) | 5.728 | 3.020 | 4.601 | 2.349 | 6.327 | 3.929 | 5.286 | 3.227 |
| Extraordinary PhD prize | 0.170 | 0.376 | 0.147 | 0.354 | 0.097 | 0.297 | 0.091 | 0.288 |
| PhD thesis in English | 0.304 | 0.460 | 0.271 | 0.445 | 0.056 | 0.230 | 0.184 | 0.388 |
| PhD thesis within a research group | 0.687 | 0.464 | 0.878 | 0.328 | 0.472 | 0.500 | 0.741 | 0.439 |
| PRE & POST DOCTORAL MOBILITY | | | | | | | | |
| No pre-doctoral mobility | 0.359 | 0.480 | 0.341 | 0.475 | 0.676 | 0.469 | 0.460 | 0.499 |
| Pre-doctoral mobility in national centres | 0.030 | 0.171 | 0.055 | 0.229 | 0.083 | 0.276 | 0.067 | 0.250 |
| Pre-doctoral mobility in European centres | 0.380 | 0.486 | 0.385 | 0.487 | 0.145 | 0.352 | 0.307 | 0.462 |
| Pre-doctoral mobility in U.S. centres | 0.140 | 0.347 | 0.166 | 0.373 | 0.071 | 0.257 | 0.099 | 0.299 |
| Pre-doctoral mobility in other countries | 0.091 | 0.288 | 0.053 | 0.224 | 0.027 | 0.161 | 0.067 | 0.250 |
| No post-doctoral mobility | 0.491 | 0.500 | 0.460 | 0.499 | 0.876 | 0.330 | 0.826 | 0.379 |
| Post-doctoral mobility in national centres | 0.061 | 0.240 | 0.078 | 0.268 | 0.018 | 0.132 | 0.043 | 0.203 |
| Post-doctoral mobility in European centres | 0.249 | 0.433 | 0.296 | 0.457 | 0.053 | 0.225 | 0.075 | 0.264 |
| Post-doctoral mobility in U.S. centres | 0.123 | 0.329 | 0.119 | 0.324 | 0.041 | 0.199 | 0.032 | 0.176 |
| Post-doctoral mobility in other countries | 0.076 | 0.265 | 0.047 | 0.212 | 0.012 | 0.108 | 0.024 | 0.153 |
| Elapsed time between the degree and the PhD | 2.75 | 3.53 | 2.90 | 3.19 | 5.40 | 5.07 | 3.13 | 4.12 |
| WORKING REGION | | | | | | | | |
| Working in Barcelona province | 0.628 | 0.484 | 0.670 | 0.471 | 0.684 | 0.465 | 0.759 | 0.428 |
| Working in Tarragona province | 0.065 | 0.246 | 0.033 | 0.180 | 0.083 | 0.276 | 0.059 | 0.236 |
| Working in Girona province | 0.080 | 0.272 | 0.028 | 0.164 | 0.068 | 0.252 | 0.048 | 0.214 |
| Working in Lleida province | 0.041 | 0.198 | 0.025 | 0.156 | 0.062 | 0.241 | 0.008 | 0.089 |
| Working in the rest of Spain | 0.077 | 0.267 | 0.094 | 0.292 | 0.077 | 0.267 | 0.059 | 0.236 |
| Working in the EU | 0.060 | 0.237 | 0.094 | 0.292 | 0.021 | 0.142 | 0.029 | 0.169 |
| Working outside the EU | 0.049 | 0.216 | 0.055 | 0.229 | 0.006 | 0.077 | 0.037 | 0.190 |
| JOB ATTRIBUTES | | | | | | | | |
| Current job tenure | 6.66 | 5.98 | 4.35 | 4.34 | 10.25 | 7.32 | 6.06 | 5.95 |
| Permanent contract | 0.250 | 0.434 | 0.402 | 0.491 | 0.853 | 0.355 | 0.939 | 0.241 |
| # Workers < 50 | — | — | 0.130 | 0.337 | 0.041 | 0.199 | 0.324 | 0.468 |
| 50 < # Workers < 250 | 0.000 | 0.000 | 0.296 | 0.457 | 0.094 | 0.293 | 0.257 | 0.437 |
| 250 < # Workers < 500 | 0.043 | 0.202 | 0.119 | 0.324 | 0.029 | 0.169 | 0.078 | 0.268 |
| # Workers > 500 | 0.957 | 0.202 | 0.454 | 0.499 | 0.835 | 0.372 | 0.342 | 0.475 |

Table 1A (continued): Descriptive Statistics

| | University | | Research Institutes | | Public Sector | | Private Sector | |
|---|------------|-------|---------------------|-------|---------------|-------|----------------|-------|
| | Mean | S.D. | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| ANNUAL EARNINGS | | | | | | | | |
| Annual earnings < 18,000 € | 0.044 | 0.205 | 0.025 | 0.156 | 0.050 | 0.219 | 0.035 | 0.183 |
| Annual earnings between 18,000 € and 24,000 € | 0.143 | 0.351 | 0.169 | 0.375 | 0.118 | 0.323 | 0.102 | 0.303 |
| Annual earnings between 24,000 € and 30,000 € | 0.293 | 0.455 | 0.341 | 0.475 | 0.177 | 0.382 | 0.163 | 0.370 |
| Annual earnings between 30,000 € and 40,000 € | 0.342 | 0.475 | 0.291 | 0.455 | 0.263 | 0.441 | 0.329 | 0.470 |
| Annual earnings between 40,000 € and 50,000 € | 0.083 | 0.277 | 0.080 | 0.272 | 0.124 | 0.330 | 0.115 | 0.319 |
| Annual earnings > 50,000 € | 0.025 | 0.157 | 0.055 | 0.229 | 0.201 | 0.401 | 0.198 | 0.399 |
| Annual earnings missing | 0.069 | 0.254 | 0.039 | 0.193 | 0.068 | 0.252 | 0.059 | 0.236 |
| ACADEMIC REQUIREMENTS (CURRENT JOB) | | | | | | | | |
| PhD required for the job | 0.540 | 0.499 | 0.693 | 0.462 | 0.038 | 0.192 | 0.329 | 0.470 |
| Specific undergraduate degree required | 0.395 | 0.489 | 0.252 | 0.435 | 0.832 | 0.375 | 0.519 | 0.500 |
| Specific undergraduate degree required | 0.060 | 0.237 | 0.050 | 0.218 | 0.094 | 0.293 | 0.112 | 0.316 |
| No academic requirements for the job | 0.005 | 0.069 | 0.006 | 0.074 | 0.035 | 0.185 | 0.040 | 0.196 |
| MAIN ACTIVITY (NON-EXCLUDING) | | | | | | | | |
| Direction | — | — | 0.194 | 0.396 | 0.254 | 0.436 | 0.422 | 0.495 |
| Teaching | — | — | 0.197 | 0.398 | 0.560 | 0.497 | 0.195 | 0.397 |
| R&D | — | — | 0.931 | 0.254 | 0.307 | 0.462 | 0.489 | 0.501 |
| Technical tasks | — | — | 0.186 | 0.389 | 0.221 | 0.416 | 0.366 | 0.482 |
| Health-related tasks | — | — | 0.028 | 0.164 | 0.419 | 0.494 | 0.086 | 0.280 |
| PHD TYPE | | | | | | | | |
| Geography and Demography | 0.017 | 0.131 | 0.011 | 0.105 | 0.009 | 0.094 | 0.008 | 0.089 |
| History, Philosophy and Arts | 0.060 | 0.237 | 0.033 | 0.180 | 0.091 | 0.289 | 0.051 | 0.220 |
| Language, Linguistics and Literature | 0.054 | 0.225 | 0.011 | 0.105 | 0.062 | 0.241 | 0.024 | 0.153 |
| Economics, Business and Related Fields | 0.079 | 0.270 | 0.003 | 0.053 | 0.024 | 0.152 | 0.027 | 0.162 |
| Pedagogy and Psychology | 0.076 | 0.265 | 0.011 | 0.105 | 0.053 | 0.225 | 0.019 | 0.136 |
| Other Social Sciences | 0.080 | 0.272 | 0.014 | 0.117 | 0.118 | 0.323 | 0.043 | 0.203 |
| Chemistry | 0.074 | 0.262 | 0.127 | 0.334 | 0.038 | 0.192 | 0.190 | 0.393 |
| Biology | 0.099 | 0.299 | 0.313 | 0.464 | 0.088 | 0.284 | 0.201 | 0.401 |
| Environmental Studies | 0.041 | 0.198 | 0.091 | 0.289 | 0.041 | 0.199 | 0.053 | 0.225 |
| Maths and Physics | 0.093 | 0.291 | 0.075 | 0.263 | 0.024 | 0.152 | 0.035 | 0.183 |
| Medicine | 0.030 | 0.171 | 0.105 | 0.307 | 0.375 | 0.485 | 0.096 | 0.295 |
| Other Health-Related Fields | 0.033 | 0.179 | 0.069 | 0.254 | 0.038 | 0.192 | 0.099 | 0.299 |
| Architecture and Civil Engineering | 0.036 | 0.187 | 0.019 | 0.138 | 0.003 | 0.054 | 0.021 | 0.145 |
| Production Engineering | 0.072 | 0.259 | 0.075 | 0.263 | 0.018 | 0.132 | 0.061 | 0.241 |
| Computers and Information Engineering | 0.156 | 0.363 | 0.042 | 0.200 | 0.018 | 0.132 | 0.072 | 0.259 |
| UNIVERSITY | | | | | | | | |
| University of Barcelona (UB) | 0.372 | 0.484 | 0.460 | 0.499 | 0.487 | 0.501 | 0.455 | 0.499 |
| Autonomous University of Barcelona (UAB) | 0.239 | 0.427 | 0.283 | 0.451 | 0.316 | 0.465 | 0.275 | 0.447 |
| Polytechnic University of Catalonia (UPC) | 0.209 | 0.407 | 0.091 | 0.289 | 0.029 | 0.169 | 0.120 | 0.326 |
| Pompeu Fabra University (UPF) | 0.047 | 0.212 | 0.033 | 0.180 | 0.024 | 0.152 | 0.037 | 0.190 |
| University of Lleida (UdL) | 0.055 | 0.228 | 0.050 | 0.218 | 0.032 | 0.177 | 0.040 | 0.196 |
| University of Girona (UdG) | 0.036 | 0.187 | 0.039 | 0.193 | 0.056 | 0.230 | 0.013 | 0.115 |
| Rovira i Virgili University (URV) | 0.041 | 0.198 | 0.044 | 0.206 | 0.056 | 0.230 | 0.059 | 0.236 |
| Number of observations (%) | 635 | 37% | 361 | 21% | 339 | 20% | 374 | 23% |

Table 2A: Average Marginal Effects for Sector Choice

| | <i>ΔPr[s = University]</i> | | <i>ΔPr[s = Research Institute]</i> | | <i>ΔPr[s = Public Sector]</i> | | <i>ΔPr[s = Private Sector]</i> | | | | | |
|--|----------------------------|--------------|------------------------------------|---------------------------|-------------------------------|-------------|--------------------------------|--------------|--------------|--------------|--------------|-----|
| | Marg. Eff. | S.E. | Marg. Eff. | S.E. | Marg. Eff. | S.E. | Marg. Eff. | S.E. | | | | |
| Cohort 2011 | 0.011 | <i>0.023</i> | -0.063 | <i>0.022</i> | *** | 0.026 | <i>0.018</i> | 0.026 | <i>0.021</i> | | | |
| SOCIODEMOGRAPHIC VARIABLES | | | | | | | | | | | | |
| Female | -0.050 | <i>0.021</i> | ** | 0.055 | <i>0.019</i> | *** | 0.010 | <i>0.017</i> | -0.015 | <i>0.020</i> | | |
| log(Age) | 0.019 | <i>0.129</i> | | 0.140 | <i>0.131</i> | | 0.034 | <i>0.095</i> | -0.192 | <i>0.129</i> | | |
| Parental education = primary or less | | | | <i>reference category</i> | | | | | | | | |
| Parental education = secondary | 0.058 | <i>0.025</i> | ** | -0.027 | <i>0.023</i> | | -0.039 | <i>0.020</i> | * | 0.007 | <i>0.024</i> | |
| Parental education = tertiary | 0.042 | <i>0.023</i> | * | -0.007 | <i>0.021</i> | | -0.027 | <i>0.018</i> | | -0.007 | <i>0.022</i> | |
| ACADEMIC VARIABLES | | | | | | | | | | | | |
| Log(Elapsed time between degree and PhD) | -0.018 | <i>0.015</i> | | 0.032 | <i>0.015</i> | ** | 0.010 | <i>0.013</i> | | -0.025 | <i>0.015</i> | |
| Research fellowship during the PhD | 0.091 | <i>0.048</i> | * | 0.113 | <i>0.054</i> | ** | -0.056 | <i>0.034</i> | | -0.148 | <i>0.044</i> | *** |
| Teaching/research contract during the PhD | 0.364 | <i>0.065</i> | *** | -0.040 | <i>0.061</i> | | -0.139 | <i>0.027</i> | *** | -0.185 | <i>0.027</i> | *** |
| Work related to the PhD | 0.033 | <i>0.053</i> | | 0.008 | <i>0.060</i> | | 0.064 | <i>0.032</i> | ** | -0.104 | <i>0.034</i> | *** |
| Work not related to the PhD or others | | | | <i>reference category</i> | | | | | | | | |
| log(PhD duration) | 0.019 | <i>0.025</i> | | -0.003 | <i>0.024</i> | | -0.008 | <i>0.018</i> | | -0.008 | <i>0.024</i> | |
| Extraordinary PhD prize | 0.088 | <i>0.031</i> | *** | 0.002 | <i>0.027</i> | | -0.024 | <i>0.024</i> | | -0.066 | <i>0.026</i> | ** |
| PhD thesis in English | 0.026 | <i>0.029</i> | | 0.057 | <i>0.030</i> | * | -0.062 | <i>0.027</i> | ** | -0.021 | <i>0.027</i> | |
| PhD thesis within a research group | 0.004 | <i>0.027</i> | | 0.066 | <i>0.027</i> | ** | -0.051 | <i>0.023</i> | ** | -0.020 | <i>0.026</i> | |
| PRE & POST DOCTORAL MOBILITY | | | | | | | | | | | | |
| No pre-doctoral mobility | | | | <i>reference category</i> | | | | | | | | |
| Pre-doctoral mobility in national centres | -0.097 | <i>0.044</i> | ** | 0.024 | <i>0.043</i> | | 0.062 | <i>0.036</i> | * | 0.012 | <i>0.043</i> | |
| Pre-doctoral mobility in European centres | 0.041 | <i>0.026</i> | | 0.006 | <i>0.024</i> | | -0.052 | <i>0.022</i> | ** | 0.005 | <i>0.025</i> | |
| Pre-doctoral mobility in U.S. centres | 0.062 | <i>0.035</i> | * | 0.029 | <i>0.031</i> | | -0.060 | <i>0.025</i> | ** | -0.031 | <i>0.030</i> | |
| Pre-doctoral mobility in other countries | 0.128 | <i>0.044</i> | *** | -0.044 | <i>0.040</i> | | -0.104 | <i>0.033</i> | *** | 0.020 | <i>0.040</i> | |
| No post-doctoral mobility | | | | <i>reference category</i> | | | | | | | | |
| Post-doctoral mobility in national centres | 0.146 | <i>0.050</i> | *** | 0.101 | <i>0.043</i> | ** | -0.156 | <i>0.028</i> | *** | -0.091 | <i>0.047</i> | * |
| Post-doctoral mobility in European centres | 0.176 | <i>0.029</i> | *** | 0.162 | <i>0.029</i> | *** | -0.145 | <i>0.023</i> | *** | -0.193 | <i>0.024</i> | *** |
| Post-doctoral mobility in U.S. centres | 0.214 | <i>0.041</i> | *** | 0.094 | <i>0.036</i> | *** | -0.081 | <i>0.032</i> | ** | -0.227 | <i>0.030</i> | *** |
| Post-doctoral mobility in other countries | 0.186 | <i>0.055</i> | *** | 0.096 | <i>0.053</i> | * | -0.113 | <i>0.036</i> | *** | -0.169 | <i>0.040</i> | *** |

*Note: marginal effects are derivatives for continuous variables and probability changes for discrete variables. Robust standard errors in italic. * Significant at 0.1%, **significant at 0.05%, *** significant at 0.01%.*

Table 2A: Average Marginal Effects for Sector Choice (continued)

| | $\Delta Pr[s = University]$ | | $\Delta Pr[s = Research Institute]$ | | $\Delta Pr[s = Public Sector]$ | | $\Delta Pr[s = Private Sector]$ | |
|---|-----------------------------|-----------|-------------------------------------|-----------|--------------------------------|-----------|---------------------------------|-----------|
| | Marg. Eff. | S.E. | Marg. Eff. | S.E. | Marg. Eff. | S.E. | Marg. Eff. | S.E. |
| WORKING REGION | | | | | | | | |
| Working in Barcelona province | | | <i>reference category</i> | | | | | |
| Working in Tarragona province | 0.089 | 0.048 * | -0.114 | 0.035 *** | 0.067 | 0.056 | -0.042 | 0.041 |
| Working in Girona province | 0.152 | 0.049 *** | -0.180 | 0.024 *** | 0.102 | 0.043 ** | -0.074 | 0.045 * |
| Working in Lleida province | 0.198 | 0.070 *** | -0.078 | 0.044 * | 0.041 | 0.055 | -0.160 | 0.039 *** |
| Working in the rest of Spain | -0.018 | 0.035 | 0.004 | 0.031 | 0.054 | 0.029 * | -0.040 | 0.033 |
| Working in the EU | -0.014 | 0.053 | -0.014 | 0.038 | 0.084 | 0.068 | -0.057 | 0.050 |
| Working outside the EU | 0.002 | 0.058 | -0.037 | 0.046 | -0.103 | 0.061 * | 0.138 | 0.086 |
| PhD TYPE | | | | | | | | |
| Geography and Demography | 0.205 | 0.087 ** | -0.035 | 0.072 | -0.041 | 0.057 | -0.129 | 0.048 *** |
| History, Philosophy and Arts | 0.149 | 0.048 *** | -0.126 | 0.030 *** | 0.075 | 0.040 * | -0.098 | 0.034 *** |
| Language, Linguistics and Literature | 0.176 | 0.050 *** | -0.172 | 0.025 *** | 0.106 | 0.049 ** | -0.110 | 0.039 *** |
| Economics, Business and Related Fields | 0.332 | 0.051 *** | -0.210 | 0.015 *** | -0.018 | 0.050 | -0.103 | 0.039 *** |
| Pedagogy and Psychology | 0.299 | 0.053 *** | -0.177 | 0.025 *** | 0.036 | 0.045 | -0.159 | 0.028 *** |
| Other Social Sciences | 0.280 | 0.047 *** | -0.183 | 0.021 *** | 0.032 | 0.037 | -0.129 | 0.030 *** |
| Chemistry | -0.016 | 0.039 | -0.071 | 0.026 *** | 0.001 | 0.040 | 0.086 | 0.040 ** |
| Biology | | | <i>reference category</i> | | | | | |
| Environmental Studies | -0.033 | 0.047 | -0.037 | 0.033 | 0.126 | 0.049 ** | -0.056 | 0.038 |
| Maths and Physics | 0.129 | 0.054 ** | -0.054 | 0.035 | 0.040 | 0.053 | -0.115 | 0.034 *** |
| Medicine | -0.127 | 0.044 *** | -0.069 | 0.030 ** | 0.253 | 0.043 *** | -0.058 | 0.035 * |
| Other Health-Related Fields | 0.019 | 0.052 | -0.065 | 0.031 ** | -0.004 | 0.038 | 0.049 | 0.045 |
| Architecture and Civil Engineering | 0.087 | 0.091 | -0.087 | 0.056 | -0.018 | 0.124 | 0.018 | 0.087 |
| Production Engineering | 0.112 | 0.056 ** | -0.042 | 0.041 | -0.045 | 0.050 | -0.025 | 0.047 |
| Computers and Information Engineering | 0.231 | 0.058 *** | -0.142 | 0.029 *** | -0.026 | 0.056 | -0.063 | 0.043 |
| UNIVERSITY | | | | | | | | |
| University of Barcelona (UB) | | | <i>reference category</i> | | | | | |
| Autonomous University of Barcelona (UAB) | 0.013 | 0.025 | 0.009 | 0.022 | -0.024 | 0.018 | 0.002 | 0.023 |
| Polytechnic University of Catalonia (UPC) | 0.067 | 0.046 | 0.002 | 0.044 | -0.080 | 0.038 ** | 0.012 | 0.047 |
| Pompeu Fabra University (UPF) | -0.029 | 0.050 | 0.033 | 0.055 | -0.042 | 0.041 | 0.038 | 0.062 |
| University of Lleida (UdL) | -0.093 | 0.060 | 0.194 | 0.087 ** | -0.074 | 0.040 * | -0.027 | 0.063 |
| University of Girona (UdG) | -0.075 | 0.060 | 0.050 | 0.064 | 0.095 | 0.061 | -0.070 | 0.062 |
| Rovira i Virgili University (URV) | -0.055 | 0.055 | 0.052 | 0.065 | -0.014 | 0.061 | 0.018 | 0.059 |

Testing the validity of the exclusion restrictions

As discussed in section 5.1, the simultaneous multinomial treatment model estimated using the STATA routine “MTREATREG” could in principle be identified even if the variables included in the multinomial treatment equation are the same as the RHS variables of the outcome equation (i.e. $z_i = x_i$), because of the former’s non-linear functional form. However, we incorporated some exclusion restrictions into the model in order to avoid this somewhat tedious method of identification. We considered the (logged) elapsed time between obtaining an undergraduate degree and enrolment on the PhD programme and a set of indicators for pre- and post-doctoral mobility as exclusion restrictions. Here, we seek to provide evidence of the validity of the elicited exclusion restrictions. For them to be valid, the variables should be relevant determinants of occupational choices but not directly related to job satisfaction — once we have conditioned for the employment sector and other individual and academic attributes.

The validity of the “relevance” condition can be directly tested from the estimates of the multinomial selection equation. Table 3A contains several Wald tests for the joint statistical significance of the exclusion restrictions for each estimated model. As can be seen, the relevance of the exclusion restrictions for the whole multinomial model is clearly not rejected by the data. Taking each equation separately, the variables included are good predictors of the differences in the likelihood of working in either the public or the private sectors (in relation to working in academia), but there is less statistical power in the case of the research institute equation (only the elapsed time between graduating and enrolment on the PhD programme is statistically significant in this equation). As for the “excludability” condition, no formal overidentification test has yet been developed in this framework. Therefore, this condition has to be informally checked by examining the joint statistical significance of the exclusion restrictions in the outcome equation(s), conditional on other determinants of job satisfaction. The results of these Wald tests — which are reported in the last column of Table 3A — suggest that the exclusion restrictions are not jointly significant in the outcome equations at any conventional significance level, with the exception of models (1) and (2) of the job content satisfaction equation, in which the null hypothesis that the exclusion restriction’s coefficients are jointly equal to zero is not rejected when considering a significance level of 5%. Overall, the evidence obtained when adopting this informal approach to demonstrating the validity of the exclusion restrictions suggests that the model is well identified without relying on functional form assumptions.

Table 3A: Testing the validity of the exclusion restrictions

| | Relevance | | | Excludability | |
|--|--|--|---|--|---|
| | <i>Research Institutes vs University</i> Wald Test (<i>P-value</i>) | <i>Public Sector vs University</i> Wald Test (<i>P-value</i>) | <i>Private Sector vs University</i> Wald Test (<i>P-value</i>) | <i>All</i> Wald Test (<i>P-value</i>) | <i>Satisfaction equation(s)</i> Wald Test (<i>P-value</i>) |
| Satisfaction with Earnings | | | | | |
| (1) | 13.46 (0.143) | 90.29 (0.000) | 95.41 (0.000) | 185.88 (0.000) | 15.30 (0.083) |
| (2) | 13.39 (0.146) | 90.70 (0.000) | 95.26 (0.000) | 185.89 (0.000) | 16.38 (0.059) |
| (3) | 14.96 (0.092) | 95.02 (0.000) | 95.84 (0.000) | 192.57 (0.000) | 14.04 (0.121) |
| (4) | 14.42 (0.108) | 92.23 (0.000) | 94.69 (0.000) | 188.65 (0.000) | 14.46 (0.107) |
| (5) | 14.53 (0.105) | 92.58 (0.000) | 95.39 (0.000) | 189.37 (0.000) | 13.58 (0.138) |
| Satisfaction with Promotion Opportunities | | | | | |
| (1) | 12.76 (0.174) | 99.54 (0.000) | 95.39 (0.000) | 193.07 (0.000) | 5.12 (0.824) |
| (2) | 12.86 (0.169) | 98.99 (0.000) | 95.57 (0.000) | 193.01 (0.000) | 5.81 (0.758) |
| (3) | 12.88 (0.168) | 97.83 (0.000) | 95.69 (0.000) | 191.35 (0.000) | 5.85 (0.755) |
| (4) | 12.88 (0.168) | 97.77 (0.000) | 95.70 (0.000) | 191.32 (0.000) | 5.84 (0.756) |
| (5) | 12.76 (0.174) | 97.43 (0.000) | 96.00 (0.000) | 191.14 (0.000) | 5.77 (0.763) |
| Satisfaction with Job Content | | | | | |
| (1) | 13.31 (0.149) | 90.59 (0.000) | 91.24 (0.000) | 177.47 (0.000) | 11.30 (0.256) |
| (2) | 13.33 (0.148) | 90.46 (0.000) | 91.51 (0.000) | 178.59 (0.000) | 11.96 (0.216) |
| (3) | 13.49 (0.142) | 90.34 (0.000) | 90.70 (0.000) | 178.50 (0.000) | 12.48 (0.188) |
| (4) | 13.32 (0.148) | 89.72 (0.000) | 85.02 (0.000) | 172.99 (0.000) | 14.23 (0.114) |
| (5) | 12.95 (0.165) | 89.13 (0.000) | 90.68 (0.000) | 178.22 (0.000) | 13.66 (0.135) |
| Satisfaction with Job-Skills Match | | | | | |
| (1) | 13.28 (0.150) | 91.56 (0.000) | 96.97 (0.000) | 190.16 (0.000) | 12.15 (0.205) |
| (2) | 13.24 (0.152) | 91.38 (0.000) | 96.88 (0.000) | 189.39 (0.000) | 11.31 (0.255) |
| (3) | 13.36 (0.147) | 92.04 (0.000) | 96.81 (0.000) | 189.58 (0.000) | 10.46 (0.315) |
| (4) | 13.16 (0.156) | 92.06 (0.000) | 96.48 (0.000) | 187.52 (0.000) | 7.00 (0.637) |
| (5) | 13.03 (0.161) | 91.34 (0.000) | 95.96 (0.000) | 186.20 (0.000) | 5.06 (0.829) |
| Overall Job Satisfaction | | | | | |
| (1) | 12.89 (0.168) | 90.90 (0.000) | 69.71 (0.000) | 187.68 (0.000) | 9.87 (0.361) |
| (2) | 13.02 (0.161) | 90.79 (0.000) | 96.67 (0.000) | 187.53 (0.000) | 10.10 (0.342) |
| (3) | 13.05 (0.160) | 90.71 (0.000) | 96.06 (0.000) | 187.11 (0.000) | 10.40 (0.319) |
| (4) | 13.19 (0.154) | 90.48 (0.000) | 95.99 (0.000) | 187.05 (0.000) | 12.21 (0.202) |
| (5) | 12.88 (0.168) | 90.10 (0.000) | 93.14 (0.000) | 183.06 (0.000) | 13.21 (0.153) |

Relevance: statistical significance of the exclusion restrictions in the three sector choice equations.

Excludability: statistical insignificance of the exclusion restrictions in each job satisfaction equation.



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Álvarez-Albelo, C. D. (CREB), **Manresa, A.** (CREB), **Pigem-Vigo, M.** (CREB)

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Callejón, M. (PPRE-IREA), **Ortún V, M.**

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“Competition between TV Platforms”
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