DETERMINANTS AND CONSEQUENCES OF QUALIFICATION AND SKILLS MISMATCH AMONG RECENT PHD GRADUATES

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Motivation (1)

- High expansion of higher education during the last decades.

- Expansion of (post)graduate and **doctoral education**:

- Creation of new university sites.
- Increase of the supply of PhD programmes.
- Rise in access and enrolment.

- Spain (and Catalonia) are not an exception (*).

→ *Does the labour market (properly) absorbed this rising flow of new PhD graduates?*

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Motivation (2)

- Why fostering doctoral education is important?

- Societal point of view:

- PhD holders represent a key element for innovation and for the generation of new knowledge in the economy (Auriol 2010).

- Individual perspective:

- Pursuing a PhD in order to obtain a job where being doctor is “important” (Mangematin 2000).
- Professional prestige and vocational reasons are of secondary importance.

Motivation (3)

➢ The other side of the coin:

- (Relative) contraction of academic job openings.
- Productive structure with an insufficient "absorptive capacity".

→ The creation of academic and research-oriented jobs did not follow the increasing pattern of PhDs' production (= **excess of supply of PhDs**).

→ A certain number of new doctors may end up being mismatched in the labour market.

➢ *In this work:*

- *We analyse the **determinants of labour market mismatch** among doctorate holders.*
- *We examine the **consequences** of mismatch in terms of **earnings** and **job (dis)satisfaction**.*

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The rest of the talk

1. Related Research and our contribution
2. Data, definitions and descriptive evidence
3. The determinants of mismatch
4. Mismatch and earnings
5. Mismatch and job satisfaction
6. Conclusions

Related Research (1)

- Sizeable literature on labour market mismatch (McGuinnes 2006, Leuven & Oosterbeek 2011).

→ Measures of mismatch:

- **Overeducation/qualification** (self-reported, realized matches, job analyst).
- **Overskilling** (usually self-reported).

→ **<u>Concerns</u>**:

- Unobserved heterogeneity bias.
- Misclassification/measurement errors.
- Permanent or transitory?

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Related Research (2)

- Growing # of contributions concerned with mismatch among highly educated workers (mainly university graduates).

→ *Research based on surveys that contain explicit questions about mismatch.*

- **Overeducation**:

  Battu et al. (1999), Dolton & Vignoles (2000), Frenette (2004) McGuinnes & Bennet 2007, Bárcena-Martín et al. (2011).

- **Overeducation or Overskilling**:

  Allen & van der Velden (2001), McGuinnes (2003), Dolton & Silles (2008), McGuinnes & Sloane (2011).

- **Overeducation & Overskilling**:

  Chevalier (2003), Chevalier & Lindley (2009), Green & Zhu (2010), Mavromavras et al. (2011).

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Related Research (3)

- Main findings:

→ Job Mismatch among graduates depends on individual, academic and job characteristics, and it is bad for earnings and for job satisfaction.

→ Overskilling appears to be more problematic than overeducation, at least for job satisfaction.

→ Big issue when overskilling is accompanied by overqualification.

→ The negative effect of mismatch is still there (but reduced) using FE strategies.

- **Scarce evidence about (skills) mismatch among PhDs**: panel data evidence from the SDR (US, Bender & Heywood 2009, 2011).

→ Overskilling is a “permanent” problem among doctors.

Our contribution

- We focus on mismatch among doctors from the seven Catalan Public Universities about 4 years after graduation.
- We explore the determinants of overqualification and overskilling.
- Combining the two measures of mismatch, we analyse its consequences in terms of earnings and job (dis)satisfaction.

→ **<u>Main limitations</u>**:

- No causality, only conditional associations.
- Self-assessed measures → perceived or real overskilling?
- No long standing effects → mismatch as just transitory?

Data description (1)

- **<u>AQU Survey on PhD holders</u>**— wave 2011:

- (Spaniard) Doctors graduated in 2006/2007 in any of the 7 Catalan Public Universities (N = 1,225) → response rate = 67%.

- Information on socio-demographic attributes, academic credentials, job characteristics, annual earnings, overall job satisfaction and job domains satisfaction...

- Selected sample (N* = 1002): full-time workers aged less than 40 at the end of the PhD, with valid information for the variables of interest.

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Data description (2)

➢ Two self-reported mismatch indicators:

- **Overqualification** = PhD not required for entering the job.

- **Overskilling** = the skills acquired during the PhD are not useful to perform the job.

→ Descriptive evidence:

- Overqualification (53.4%), Overskilling (27.5%), correlation = 51%.
- Overqualification & Overskilling (26%).
- Well-matched doctors (45%).
- Clear differences in terms of observed characteristics (academic profile?).
- Higher % top earnings among those who are mismatched (especially overskilled), but less job satisfaction.

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The determinants of mismatch (1)

- Different parameters for the two forms of mismatch.
- Two (seemingly unrelated) probit equations for overskilling and overqualification.

→ Progressive inclusion of control variables:

(1) socio-demographic variables and academic credentials, plus PhD-type and University FE.
(2) + type and region of work.
(3) + job attributes.
(4) + main activities at work (non-excluding).

- Average marginal effects on the predicted probabilities.

The determinants of mismatch (2)

- **Main results** (*):

- Gender and age affect only the probability of underutilizing skills.

- Academic attribute appear to be mainly “indirect” determinants of mismatch, because their effect diminishes once job-related variables are controlled for.

  → ***Exceptions: post-doctoral mobility (both), PhD funding and developing the PhD thesis in a research group (only on Pr[overqualification]).***

- Working in the Public Sector or in the Private Sector increases the likelihood of mismatch of a significant amount (compared to the University).

- Developing R+D (outside the university) favours job match and may compensate the penalisation for working outside the academy.

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The consequences of mismatch (1)

➢ (1) Mismatch and Annual Earnings:

- Earnings equation (interval regression) with a large list of individual, academic and job-related controls.
- Combination of the two measures of mismatch (Mavromavras et al 2011, Green & Zhu 2010, Chevalier & Lindley 2009, Chevalier 2003).

➢ Main results (*):

Dependent Variable: Ln(annual earnings)	Coefficient	S.E.
MISMATCH VARIABLES		
Matched (PhD required and skills necessary)	*Reference Category*	
Overskilled but NOT Overqualified	-0.034	*0.089*
Overqualified but NOT Overskilled	-0.032	*0.028*
Overqualified and Overskilled	-0.121	*0.043***

→ There exists an earning penalisation only with the combination of overqualification and overskilling (as in Mavromavras et al 2011 and consistent with other findings).

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The consequences of mismatch (2)

- (2) Mismatch and Job Satisfaction:

- 5 equations to explain overall job satisfaction and 4 job domains satisfaction (promotion, earnings, job content and job-skills match).
- We control for a large list of individual, academic and job-related variables, as well as for earning categories.

- Main results (*):

- The existence of mismatch reduces satisfaction with the job as a whole, with its content and with how well it matches with the acquired skills, but not with promotion opportunities and earnings.
- Less pronounced effect of being “overqualified only”.
- Being “overskilled but NOT overqualified” generates high dissatisfaction with the job (just a matter of expectations?).

Conclusions (1)

- The existence of mismatch among doctors represents a worrisome issue

- It reflects (at least to some extent) the academic/professional profile of PhD recipients.
- The most severe form of mismatch (overqualification and overskilling) is associated with lower earnings.
- Mismatch (especially overskilling) reduces job satisfaction.

→ Skills underutilisation among doctors represents a misuse of public and individual resources.

- Caveats and pending questions: causality, perception, persistence....

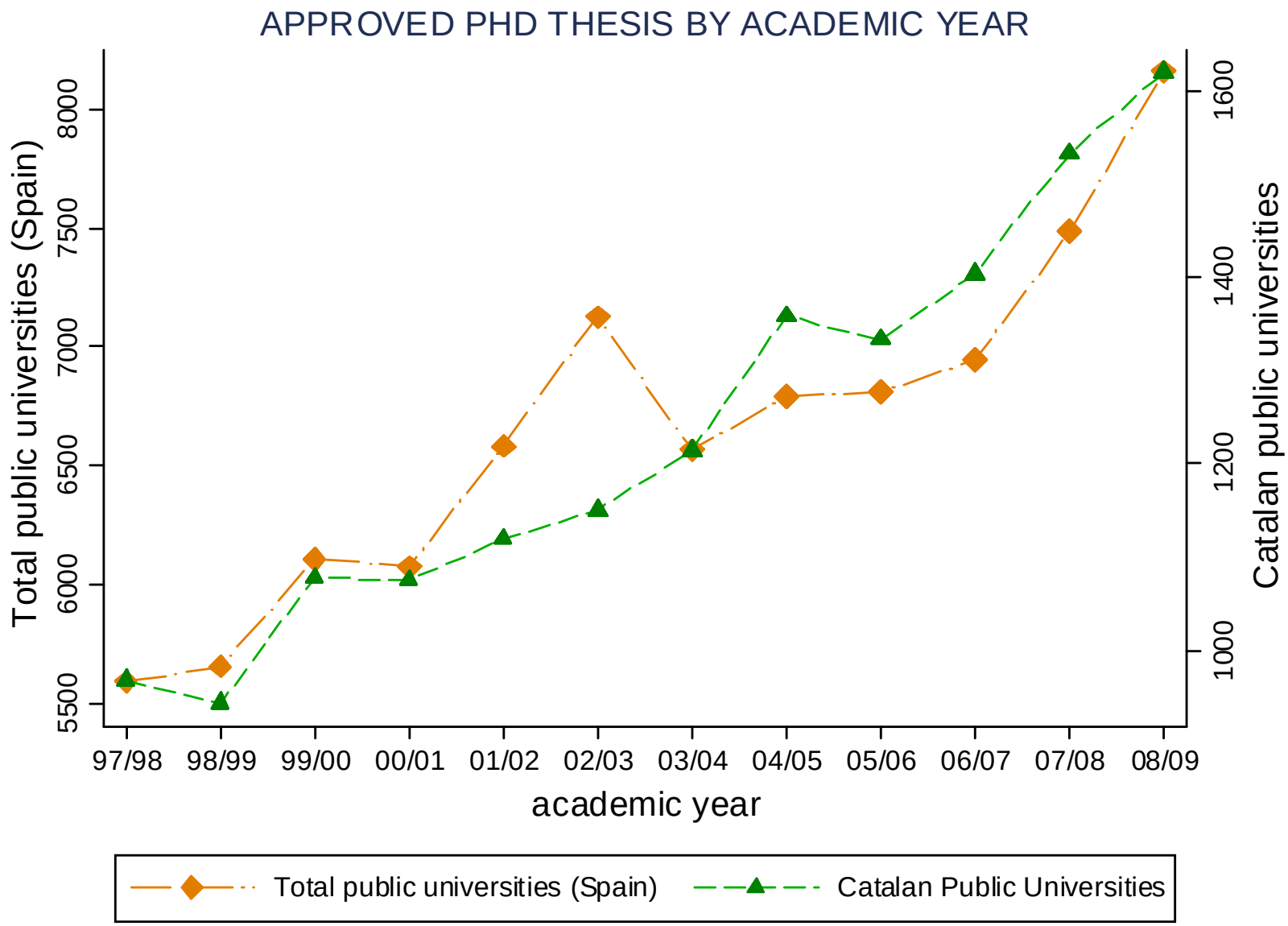
Conclusions

➢ Which policies may improve this situation?

- Separating academic and professional PhD programmes (with different prices?).
- More general and transferable skills (= more adaptability).
- Foster the employability of doctors outside traditional academic and research-oriented occupations.

→ Many previous attempts, probably ineffective (i.e. Acción IDE, Torres-Quevedo programme).

THANK YOU!!


APPROVED PHD THESIS BY ACADEMIC YEAR
Total public universities (Spain)
5500
6000
6500
7000
7500
8000
Catalan public universities
1000
1200
1400
1600
97/98
98/99
99/00
00/01
01/02
02/03
03/04
04/05
05/06
06/07
07/08
08/09
academic year
Total public universities (Spain)
Catalan Public Universities

	ΔPr[Overskilling]				ΔPr[Overqualification]			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
SOCIODEMOGRAPHIC VARIABLES								
Female	0.05	0.04	0.041	0.048	0.032	0.025	0.013	0.033
	0.021[b]	*0.021[c]*	*0.02[b]*	*0.017[a]*	*0.037*	*0.031*	*0.027*	*0.03*
Age/10	0.333	0.557	0.439	0.533	0.014	0.194	0.047	0.045
	0.307	*0.248[b]*	*0.237[c]*	*0.239[b]*	*0.363*	*0.31*	*0.354*	*0.411*
$(Age/10)^2$	-0.044	-0.066	-0.052	-0.06	0.002	-0.019	-0.024	-0.023
	0.037	*0.03[b]*	*0.029[c]*	*0.029[b]*	*0.045*	*0.038*	*0.045*	*0.053*
ACADEMIC VARIABLES								
Elapsed time between the degree and the PhD/10	0.004	0.002	0.002	-0.001	0.007	0.006	0.009	0.009
	0.006	*0.004*	*0.004*	*0.004*	*0.007*	*0.006*	*0.004[b]*	*0.004[b]*
PhD funding: research fellowship during the PhD	-0.142	-0.04	-0.044	0.026	-0.258	-0.199	-0.152	-0.161
	0.065[b]	*0.061*	*0.063*	*0.054*	*0.065[a]*	*0.058[a]*	*0.039[a]*	*0.037[a]*
PhD funding: teaching or research during the PHD	-0.143	0.022	-0.001	0.037	-0.149	-0.06	-0.106	-0.117
	0.06[b]	*0.068*	*0.066*	*0.061*	*0.056[a]*	*0.056*	*0.043[b]*	*0.036[a]*
PhD funding: Work related to the PHD	-0.056	-0.066	-0.063	-0.018	-0.104	-0.12	-0.092	-0.106
	0.055	*0.046*	*0.047*	*0.045*	*0.056[c]*	*0.05[b]*	*0.047[c]*	*0.041[b]*
PhD funding: work not related to the PHD or other situations	*Reference Category*							
PhD duration > 6 years	0.012	0.004	-0.002	-0.025	0.048	0.036	0.023	0.028
	0.043	*0.031*	*0.031*	*0.028*	*0.041*	*0.04*	*0.03*	*0.031*
Extraordinary PhD prize	-0.104	-0.041	-0.038	-0.024	-0.068	-0.032	0.002	0.007
	0.034[a]	*0.041*	*0.041*	*0.036*	*0.03[b]*	*0.027*	*0.024*	*0.02*
PhD thesis in English	-0.051	-0.026	-0.03	-0.03	-0.037	-0.018	0.004	0.013
	0.041	*0.038*	*0.037*	*0.033*	*0.035*	*0.035*	*0.026*	*0.027*
PhD thesis within a research group	-0.065	-0.019	-0.011	0.008	-0.146	-0.112	-0.064	-0.054
	0.041	*0.034*	*0.034*	*0.029*	*0.032[a]*	*0.031[a]*	*0.032[a]*	*0.027[b]*
Participation to internal seminars	-0.023	-0.029	-0.035	-0.043	-0.002	0.01	0.006	-0.003
	0.034	*0.03*	*0.03*	*0.029*	*0.031*	*0.029*	*0.025*	*0.025*
Participation to external conferences	0.005	-0.005	-0.003	0.005	0.11	0.105	0.084	0.088
	0.04	*0.029*	*0.028*	*0.025*	*0.046[b]*	*0.039[a]*	*0.029[a]*	*0.026[a]*
PRE & POST DOCTORAL MOBILITY								
No pre-doctoral mobility	*Reference Category*							
Pre-doctoral mobility in national centers	-0.069	-0.06	-0.031	-0.043	-0.027	-0.003	0.001	-0.001
	0.043	*0.036[c]*	*0.03*	*0.03*	*0.056*	*0.048*	*0.039*	*0.036*
Pre-doctoral mobility in European centers	-0.022	-0.001	-0.001	0.002	-0.086	-0.056	-0.045	-0.041
	0.036	*0.026*	*0.025*	*0.029*	*0.038[b]*	*0.031[c]*	*0.022[c]*	*0.022[c]*
Pre-doctoral mobility in U.S. centers	-0.08	-0.006	-0.001	0.007	-0.132	-0.077	-0.057	-0.053
	0.041[c]	*0.032*	*0.03*	*0.03*	*0.05[a]*	*0.046[c]*	*0.041*	*0.044*
Pre-doctoral mobility in other countries	-0.077	-0.072	-0.07	-0.06	-0.021	0.002	0.017	0.012
	0.054	*0.038[c]*	*0.04[c]*	*0.04*	*0.057*	*0.047*	*0.035*	*0.036*
No post-doctoral mobility	*Reference Category*							
Post-doctoral mobility in national centers	-0.237	-0.132	-0.142	-0.122	-0.214	-0.128	-0.059	-0.054
	0.047[a]	*0.052[b]*	*0.049[a]*	*0.045[a]*	*0.059[a]*	*0.051[a]*	*0.05*	*0.043*
Post-doctoral mobility in European centers	-0.261	-0.115	-0.116	-0.079	-0.27	-0.122	-0.058	-0.06
	0.028[a]	*0.036[a]*	*0.037[a]*	*0.038[b]*	*0.036[a]*	*0.033[a]*	*0.034[c]*	*0.032[c]*
Post-doctoral mobility in U.S. centers	-0.27	-0.138	-0.139	-0.083	-0.304	-0.184	-0.102	-0.071
	0.035[a]	*0.039[a]*	*0.036[a]*	*0.035[b]*	*0.041[a]*	*0.037[a]*	*0.037[a]*	*0.037[c]*
Post-doctoral mobility in other countries	-0.217	-0.087	-0.104	-0.106	-0.223	-0.085	-0.02	-0.026
	0.055[a]	*0.065*	*0.074*	*0.067*	*0.049[a]*	*0.048*	*0.041*	*0.039*

	ΔPr[Overskilling]				ΔPr[Overqualification]			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
TYPE OF WORK								
University				*Reference Category*				
Research Institute		0.036	0.007	0.025		-0.013	0.064	0.081
		0.032	*0.036*	*0.035*		*0.041*	*0.031[b]*	*0.028[b]*
Public Sector		0.508	0.484	0.301		0.357	0.412	0.287
		0.036[a]	*0.045[a]*	*0.057[a]*		*0.035[a]*	*0.026[a]*	*0.042[a]*
Private Sector		0.388	0.345	0.21		0.215	0.254	0.144
		0.043[a]	*0.045[a]*	*0.048[a]*		*0.035[a]*	*0.038[a]*	*0.041[a]*
WORKING REGION								
Working in Barcelona province				*Reference Category*				
Working in Tarragona province		-0.046	-0.067	-0.04		-0.005	0.003	0.018
		0.06	*0.055*	*0.048*		*0.052*	*0.037*	*0.033*
Working in Girona province		-0.07	-0.073	-0.077		-0.003	-0.003	0.003
		0.053	*0.052*	*0.041[c]*		*0.057*	*0.058*	*0.064*
Working in Lleida province		-0.039	-0.038	-0.059		-0.116	-0.11	-0.125
		0.048	*0.046*	*0.044*		*0.055[b]*	*0.032[a]*	*0.037[a]*
Working in the rest of Spain		0.026	0.01	-0.002		-0.027	0.009	-0.009
		0.033	*0.035*	*0.028*		*0.043*	*0.039*	*0.038*
Working in the EU		-0.149	-0.154	-0.137		-0.205	-0.11	-0.063
		0.059[b]	*0.054[a]*	*0.058[b]*		*0.044[a]*	*0.047[b]*	*0.05*
Working outside the EU		-0.123	-0.122	-0.049		-0.229	-0.154	-0.128
		0.078	*0.084*	*0.083*		*0.052[a]*	*0.039[a]*	*0.047[a]*
JOB ATTRIBUTES								
Current job tenure (in years/10)			-0.01	-0.014			0.568	0.543
			0.028	*0.026*			*0.054[a]*	*0.053[a]*
Permanent contract			0.012	-0.009			-0.036	-0.042
			0.028	*0.024*			*0.025*	*0.019[b]*
# Workers < 50				*Reference Category*				
50 < # Workers < 250			0.052	0.058			-0.04	-0.058
			0.038	*0.034[c]*			*0.031*	*0.03[b]*
250 < # Workers < 500			-0.112	-0.121			-0.126	-0.136
			0.037[a]	*0.031[a]*			*0.046[a]*	*0.043[a]*
# Workers > 500			-0.029	-0.018			-0.031	-0.031
			0.037	*0.033*			*0.028*	*0.026*
MAIN ACTIVITIES (OUSTIDE UNIVERSITY; NON-EXCLUDING)								
Direction				0.044				0.013
				0.023[c]				*0.021*
R&D				-0.304				-0.234
				0.041[a]				*0.033[a]*
Technical assistance				0.057				0.118
				0.025[b]				*0.028[a]*
Teaching				0.007				0.037
				0.021				*0.033*
Medical assistance				0.062				0.083
				0.04				0.102

Note: all the estimations include fixed effects for PhD type and university (not shown). Standard errors (in italic) are clustered at the PhD program level; [a] significant at 0.01%, [b] significant at 0.05%, [c] significant at 0.01%.The average marginal effect for indicator variables are average discrete changes in the predicted probabilities.

Gross Annual Earnings Equation — Interval Regression

Dependent Variable: Ln(annual earnings)	**Coefficient**	***S.E.***
Constant	9.595	*0.169***
MISMATCH VARIABLES		
Matched (PhD required and skills necessary)	*Reference Category*	
Overskilled but NOT Overqualified	-0.034	*0.089*
Overqualified but NOT Overskilled	-0.032	*0.028*
Overqualified and Overskilled	-0.121	*0.043****
SOCIODEMOGRAPHIC VARIABLES		
Female	-0.115	*0.021****
Age/10	0.129	*0.043****
ACADEMIC VARIABLES		
Elapsed time between the degree and the PhD/10	-0.088	*0.047**
PhD funding: research fellowship	0.057	*0.066*
PhD funding: teaching or research	0.062	*0.066*
PhD funding: work related to the PHD	0.111	*0.063**
PhD funding: work not related to the PHD or other situations	*Reference Category*	
PhD duration > 6 years	-0.075	*0.036***
TYPE OF WORK		
University	*Reference Category*	
Research Center	0.029	*0.032*
Public Sector	0.065	*0.047*
Private Sector	0.14	*0.043****
WORKING REGION		
Working in Barcelona province	*Reference Category*	
Working in Tarragona province	0.066	*0.057*
Working in Girona province	0.009	*0.056*
Working in Lleida province	-0.054	*0.056*
Working in the rest of Spain	-0.091	*0.034****
Working in the EU	0.16	*0.037****
Working outside the EU	0.221	*0.051****
JOB ATTRIBUTES		
Current job tenure (in years/10)	0.17	*0.040****
Permanent contract	0.169	*0.028****
# Workers < 50	*Reference Category*	
50 < # Workers < 250	0.051	*0.046*
250 < # Workers < 500	0.155	*0.052****
# Workers > 500	0.148	*0.039****
MAIN ACTIVITIES (OUSTIDE UNIVERSITY; NON-EXCLUDING)		
Direction	0.11	*0.022****
R&D	0.015	*0.035*
Technical assistance	-0.007	*0.028*
Teaching	-0.023	*0.027*
Medical assistance	0.253	*0.057****

Gross Annual Earnings Equation — Interval Regression

Dependent Variable: Ln(annual earnings)	**Coefficient**	***S.E.***
PHD TYPE		
Geography and Demography	-0.199	*0.086***
History. Philosophy and Arts	-0.139	*0.054****
Language. Linguistic and Literature	-0.216	*0.051****
Economics and Related Fields	0.129	*0.062***
Law and Related Fields	0.071	*0.097*
Sociology, Political Sciences and Communication	-0.189	*0.077***
Pedagogy and Education	-0.061	*0.064*
Physiology	0.093	*0.069*
Chemistry	0.073	*0.031***
Biology	*Reference Category*	
Environmental Studies	0.034	*0.043*
Mathematics	0.049	*0.051*
Physics	0.031	*0.08*
Medicine	0.091	*0.041***
Pharmacy	0.021	*0.067*
Veterinary	0.07	*0.094*
Architecture	-0.109	*0.139*
Civil, Nautical and Aeronautical Engineering	0.109	*0.079*
Production Engineering	0.093	*0.049**
Computers and Information Engineering	0.164	*0.041****
Agricultural Engineering	0.004	*0.116*
UNIVERSITY		
University of Barcelona (UB)	*Reference Category*	
Autonomous University of Barcelona (UAB)	-0.001	*0.023*
Polytechnic University of Catalonia (UPC)	0.04	*0.043*
Pompeu Fabra University (UPF)	0.159	*0.049****
University of Lleida (UdL)	-0.034	*0.061*
University of Girona (UdG)	-0.025	*0.061*
Rovira i Virgili University (URV)	-0.08	*0.068*
Pseudo R^2	0.331	
N	937	

*Note: robust standard errors in italic; * significant at 0.1%, **significant at 0.05%, *** significant at 0.01%.*

Job Satisfaction Equations (Ordered Probit — average marginal effects on Pr[very satisfied])

	Coefficient	S.E.	
PROMOTION OPPORTUNITIES			
Matched (PhD required and skills necessary)	*Reference Category*		
Overskilled but NOT Overqualified	-0.061	*0.040*	
Overqualified but NOT Overskilled	-0.012	*0.021*	
Overqualified and Overskilled	-0.038	*0.025*	*
EARNINGS			
Matched (PhD required and skills necessary)	*Reference Category*		
Overskilled but NOT Overqualified	-0.028	*0.028*	
Overqualified but NOT Overskilled	0.009	*0.015*	
Overqualified and Overskilled	-0.014	*0.018*	
JOB CONTENT			
Matched (PhD required and skills necessary)	*Reference Category*		
Overskilled but NOT Overqualified	-0.266	*0.096*	***
Overqualified but NOT Overskilled	-0.072	*0.038*	*
Overqualified and Overskilled	-0.226	*0.042*	***
JOB-SKILL MATCH			
Matched (PhD required and skills necessary)	*Reference Category*		
Overskilled but NOT Overqualified	-0.259	*0.041*	***
Overqualified but NOT Overskilled	-0.101	*0.032*	***
Overqualified and Overskilled	-0.282	*0.028*	***
OVERALL JOB SATISFACTION			
Matched (PhD required and skills necessary)	*Reference Category*		
Overskilled but NOT Overqualified	-0.158	*0.048*	***
Overqualified but NOT Overskilled	-0.044	*0.029*	*
Overqualified and Overskilled	-0.102	*0.032*	***

*Note: each model includes controls for gender, age and age squared, Elapsed time between the degree and the PhD, PhD-funding, PhD duration greater than six years, PhD type and university FE, type of job, job location, current job tenure, permanent contract, firm size, main activities and annual earnings categories. Complete estimates are shown in the Appendix. Robust standard errors in italic; * significant at 0.1%, **significant at 0.05%, *** significant at 0.01%.*