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PHD GRADUATES IN SPAIN: DOES IT PAY TO STUDY IT ABROAD?

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Title: PhD graduates in Spain: does it pay to study it abroad?

Abstract: In this paper, we provide information on PhD graduates using the Spanish University Graduate Placement Survey from 2019. We analyze whether studying the PhD partially or fully abroad affects wages and the probability of being overeducated. When controlling for endogeneity of the decision to study abroad, we find that it is associated with higher wages. However, the effect of studying abroad on the probability of being overeducated is insignificant. Another result of this paper is that living abroad significantly increases the chances of having a high wage and a matched job. These results are important to understand the job opportunities of PhD holders in Spain and their job characteristics.

JEL Codes: J24; I23

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1. Introduction

There is a growing body of research on the careers of PhDs (Keith A. Bender & Heywood, 2011; Canal-Domínguez & Wall, 2013; Di Paolo, 2016; Gaeta, Lubrano Lavadera, & Pastore, 2021). Studies concentrate mainly on the quality of labor match of doctoral graduates (Keith A Bender & Heywood, 2009; Ermini, Papi, & Scaturro, 2017; Gaeta, 2015; Gaeta et al., 2021), their subsequent wages (Canal-Domínguez & Wall, 2013; Canal Domínguez & Rodríguez Gutiérrez, 2013; Gaeta, Lubrano Lavadera, & Pastore, 2022; Schwabe, 2011) and job satisfaction (Di Paolo, 2016; Parenti, Pinto, & Sarno, 2020; Waaijer, Belder, Sonneveld, van Bochove, & van der Weijden, 2016). In this paper, we add to this literature by analyzing the job match quality and wages of a sample of Spanish PhDs putting special emphasis on the international mobility experience of PhD students during their PhD. We use a rather broad and recent sample (2019) that allows us to add to the literature on PhD careers in Spain. Previous research for Spain is either based on subsamples of the countrywide surveys (Di Paolo, 2016 analyzes data from Catalonia) or older data (Caparros-Ruiz, 2019 uses data from 2010).

There is a stream of research looking at the international mobility of PhDs (Caparros-Ruiz, 2019; Docquier & Rapoport, 2012). PhDs move during and after their studies, creating networks that result in higher academic prestige and wages (Gupta, Nerad, & Cerny, 2003; Kim, Bankart, & Isdell, 2010). Having studied in one place and worked or done research, even if only temporarily, in another is thought to provide extra experience and thus, the ability to command higher salaries. International experience renders individuals with more networks and better skills which, in turn, weigh positively into their academic prestige (Melin, 2004; Woolley, Turpin, Marceau, & Hill, 2008). Thus, attracting talent from abroad requires offering higher wages. On the other hand, however, domestic PhDs may flee from their home country in search of higher wages and better labor market prospects abroad contributing to the well-known phenomenon of brain drain (Cattaneo, Malighetti, & Paleari, 2018; Docquier & Rapoport, 2012). Beine, Docquier, and Rapoport (2008) reviewed evidence for 127 countries and concluded that affected countries lose a significant part of their most valuable human capital causing potential productivity loss in the long term. In this paper, we look at the effects of the international experience during the PhD studies on wages and their vertical match to jobs in terms of overeducation. Resorting to a recent wave of Spanish University Graduate Placement Survey from 2019 we show that having studied abroad partially or entirely during the PhD studies provides wage benefits although it does not seem to improve the education-job match. Additionally, we find that living abroad significantly increases wages and education-job match. These findings suggest the existence of a brain drain for Spanish PhDs due to a lack of well-rewarded and adequate PhD jobs in Spain.

The rest of the paper is organized as follows. The next section discusses the related literature. Section 3 describes the data and explains the econometric specifications used in the analysis. Section 4 presents and discusses the estimation results. Finally, section 5 concludes.

2. Related literature

Only a few papers study the effect of mobility on labor outcomes of PhD graduates. A first group of papers considers the effect of international mobility during PhD studies on job match. Ermini et al. (2017) and Gaeta (2015) use the Italian PhD national survey and find that having visiting periods abroad during PhD studies reduces the likelihood of overeducation. Both papers analyze over-skilling and over-qualification. They find that visiting study or research spells abroad reduce mismatch in all cases and those living abroad are less likely to be mismatched. Paolo and Mañé (2023) study the mismatch of PhD graduates from public universities in Catalonia, Spain. Their regressors include preand post-doctoral mobility experiences. They find that both types of experiences reduce overeducation and skill mismatch of PhD graduates, although post-doctoral mobility has a stronger effect. They do not examine the effect of mobility on wages.

Other papers examine the effect of having a postdoctoral stay abroad on wages and job match afterward. Caparros-Ruiz (2019) uses the Spanish 2009 Survey on Human Resources in Science and Technology. The sample consists of PhD holders that were employed in Spain in 2009 and analyzes the effect of having had an international mobility spell after the PhD on wages and overeducation, controlling for endogeneity of international mobility. Di Cintio and Grassi (2016) use Italian data on PhDs from 2004 and 2006 which are surveyed three and five years after graduation in 2009. They analyze the effect of international mobility after PhD studies on current wages and find a positive effect when controlling for endogeneity of the mobility decision.

Overall, there is a consensus that having an international mobility experience, either during or after PhD studies, improves the chances of having a better paid job and betterquality education-job match. Several mechanisms could drive these results. First, the mobility experience allows to develop some competences that are relevant in the labor market, such as foreign language skills and adaptability. Second, it brings a network and social capital that can be useful in some jobs, especially in academic and researchoriented positions. Third, it can be read as a prestigious experience which is rewarded in the labor market.

The lessons that come from the literature on the mobility of PhDs is that it is not an exogenous phenomenon and controlling for endogeneity is important here as it affects the results significantly. Secondly, the mobility may be pre- or post-doctoral and it makes a difference in terms of subsequent PhD wages and job matches.

3. Data and econometric specifications

3.1 Data

We use the Survey on the Labour Insertion of University Graduates 2019 (EILU 2019 by the Spanish acronym). EILU provides information on the transition of university graduates to the labor market. The data consist of a representative sample of bachelor's and master's graduates of the 2013-2014 academic year at Spanish universities. The survey was conducted in 2019. Individuals are asked about their current labor situation, further studies attained, several characteristics of their study path, mobility experiences, and working experience. We pool the two samples of individuals: those that graduated from a bachelor's degree and those that graduated from a master's degree in 2013/2014. The total sample consists of approximately 32,000 university graduates and 12,000 master's degree holders. Close to 4% of these individuals completed a PhD between 2014 and 2019. We use this PhD sample in our analysis. We exclude part-time workers and all observations with missing values. The final sample consists of 1055 PhD graduates, of which 906 have full-time employment in 2019.

We study the determinants of wage and the education-job match of PhD graduates, with special emphasis on the effect of pre- and post-doctoral international mobility experiences. The PhD wage is reported in wage bands. For the overeducation variable, we use the information reported by respondents whether their job requires a PhD. This type of subjective variable has been extensively used in the literature to describe overeducation (Capsada-Munsech, 2019; Gaeta, 2015; McGuinness, Pouliakas, & Redmond, 2018; Paolo & Mañé, 2023).¹

The two independent variables of interest are the place of the PhD studies, which has three options: Spain, partially abroad, or fully abroad; and whether the individual currently lives abroad. The other variables used in the analysis are individual characteristics such as gender, age, whether individuals cohabitate with a partner, parental education, knowledge of languages, PhD field of study, characteristics of previous studies such as whether the university was public, whether the individual had a scholarship of excellence or a general scholarship, whether the studies where useful to find a job, whether the individual had an international exchange in the previous studies, and job characteristics such as whether it is an academic job, whether the contract is permanent and firm size. A detailed definition of all variables used is in Table A1 in the Appendix.

Information on scholarships is not common in most databases. We have information on whether the individual enjoyed a scholarship during their previous studies. There are different types of scholarships. The general scholarship requires a low family income/wealth level and to pass a minimum number of credits every year (the minimum

¹ Unfortunately, we do not have information on other types of mismatches, such as skills or field mismatch. The survey questions on skills and field mismatch refer to the match between the studies finished in 2013/2014 and the current job only.

varies per field of study). It covers the enrolment fee for everyone plus some amount depending on the family income. The excellence scholarship depends on academic achievement and is independent of family income. It is a lumpsum amount. Around 8% of PhD holders have enjoyed some excellence scholarship in their previous studies versus 4% of non-PhD holders. In contrast, a general scholarship is more common among non-PhD holders than among PhD holders.

Table 1 presents the descriptive statistics where individuals are grouped by the place of PhD studies. Most of the PhD graduates of our sample studied fully in Spain (56%), while around one third studied partially abroad, and only 8.6% studied fully abroad. Those that studied the PhD fully abroad tend to be younger, doing PhD in Sciences, they previously studied in a public university, 18% of them enjoyed a scholarship of excellence and close to 42% had an international exchange experience in their previous studies. Moreover, most of them have a father with tertiary education and close to 70% have at least one parent with tertiary education. They speak on average 2.4 languages apart from their mother tongue and are very likely to live abroad. In contrast, those that studied the PhD fully in Spain are older, only close to 7% of them had a scholarship of excellence in their previous studies, around one third of them has a father with tertiary education, and 45% of them have at least one parent with tertiary education. Among those that study partially abroad, we observe that more than half are females, they are younger than those who stayed in Spain, they studied Sciences and Engineering mostly, around 12% of them got a scholarship of excellence in the previous studies, and around 30% obtained the general scholarship, a slightly larger share compared to the other two groups. The parental background is slightly better than the one of those who studied fully in Spain but worse than the one of those who studied fully abroad. Some of these individuals could be financially constrained and this could explain why they did not study fully abroad.

When it comes to wages and overeducation among the three groups, we can see a clear pattern, particularly while comparing studies abroad fully vs partly or fully in Spain. While those who studied fully in Spain, or partly in Spain and abroad earn mostly between 1499 and 2499€ per month, those who studied their PhD fully abroad earn more often above 2499€. Also, the overeducation after the PhD declines almost linearly between having completed PhD only in Spain (50% overeducated), through studies shared between Spain and abroad (34% overeducated) and finishing on those who completed their PhD work fully abroad (29% overeducated). It is clear from this descriptive view that PhD abroad commands higher wages and decreases the threat of overeducation for PhD graduates.

Finally, as it comes to an academic job, having studied abroad is associated with slightly higher probability than having studied fully in Spain (19.5% vs 16.2%). The difference between the middle category and the other two is not significant.

Table 1. Descriptive statistics.

PhD place						1		
	Only	/ Spain	Spain & abroad		Only Abroad			
		Std.		Std.		Std.		
Variable	Mean	dev.	Mean	dev.	Mean	dev.	Min	Max
Female	0.422	0.494	0.537	0.499	0.462	0.501	0	1
Partner	0.529	0.500	0.433	0.496	0.473	0.502	0	1
Age: <30	0.400	0.490	0.570	0.496	0.615	0.489	0	1
Age: 30-34	0.288	0.453	0.345	0.476	0.286	0.454	0	1
Age: >34	0.312	0.464	0.086	0.280	0.099	0.300	0	1
PhD field of study:								
Arts and others	0.125	0.331	0.083	0.276	0.099	0.300	0	1
Science	0.242	0.429	0.398	0.490	0.505	0.503	0	1
Social Sciences	0.168	0.374	0.112	0.316	0.055	0.229	0	1
Engineering & Architecture	0.181	0.386	0.235	0.425	0.165	0.373	0	1
Health Science	0.283	0.451	0.171	0.377	0.176	0.383	0	1
About previous studies:								
Public university	0.853	0.355	0.896	0.306	0.912	0.285	0	1
Master sample	0.741	0.439	0.738	0.440	0.538	0.501	0	1
Scholarship of Excellence	0.061	0.240	0.118	0.323	0.187	0.392	0	1
General scholarship	0.268	0.443	0.302	0.460	0.264	0.443	0	1
International exchange	0.068	0.252	0.126	0.332	0.418	0.496	0	1
Studies useful to find a job	0.715	0.452	0.802	0.399	0.835	0.373	0	1
Father's education:								
At most low secondary	0.353	0.478	0.337	0.473	0.242	0.431	0	1
Higher secondary								
/vocational	0.297	0.457	0.289	0.454	0.220	0.416	0	1
University	0.351	0.478	0.374	0.485	0.538	0.501	0	1
One parent w/tertiary ed	0.449	0.498	0.505	0.501	0.681	0.469	0	1
Languages spoken	1.641	0.862	1.818	0.805	2.451	1.036	0	5
Live abroad	0.059	0.236	0.168	0.375	0.703	0.459	0	1
Observations	ŗ	590	. 3	374		91		
Wage: <700 Euro	0.002	0.044	0.010	0.099	0.00	0.000	0	1
Wage: 700-999 Euro	0.054	0.227	0.036	0.186	0.024	0.155	0	1
Wage: 1000-1499 Euro	0.279	0.449	0.345	0.476	0.146	0.356	0	1
Wage: 1500-1999 Euro	0.323	0.468	0.313	0.464	0.220	0.416	0	1
Wage: 2000-2499 Euro	0.178	0.383	0.140	0.348	0.195	0.399	0	1
Wage: 2500-2999	0.083	0.276	0.078	0.269	0.220	0.416	0	1
Wage: >3000 Euro	0.081	0.273	0.078	0.269	0.195	0.399	0	1
Overeducated	0.503	0.500	0.339	0.474	0.293	0.458	0	1
Firm size < 50	0.205	0.404	0.140	0.348	0.220	0.416	0	1
Firm size > 49 & <250	0.176	0.381	0.195	0.397	0.171	0.379	0	1
Firm size > 249	0.619	0.486	0.664	0.473	0.610	0.491	0	1
Academic job	0.162	0.369	0.186	0.389	0.195	0.399	0	1
Permanent contract	0.455	0.498	0.221	0.416	0.415	0.496	0	1
Employed individuals	ŗ	517	3	307		82		

3.2 Econometric specification

We estimate two different models. We first estimate a wage equation and then the probability of being overeducated. The wage equation is estimated using an interval regression model to account for the fact that wages are reported in wage bands. This is equivalent to a linear regression estimation with the only difference that the dependent variable is observed within intervals. The coefficients inform us about the effect of each variable on the wage of individuals, which refers to the monthly wage after taxes. The overeducation probability is estimated using a probit model.

In both cases all individuals are employed. Therefore, there is an endogenous sample selection. We use a probit model to estimate the probability of employment in a selection equation. The exclusion restriction variables used are the education of the father and whether the previous studies were useful to find a job. Parental education is often used as an exclusion restriction variable in employment selection equations. Whether the previous studies were useful to find a job is an additional variable that helps identify the selection into employment.

The variable of interest in both the wage and the overeducation equations is where individuals did their PhD. For the estimated coefficient to be unbiased it is required to have no omitted variables that are correlated with both the dependent and the independent variables. Some personality traits or life preferences could be correlated with both the place of PhD studies and wage/overeducation. It is therefore important to account for this endogeneity. We do that by estimating the place of PhD studies using an ordered probit estimation. ² In this case, the exclusion restriction variables are whether at least one parent has tertiary education, whether the individual had an international exchange experience in the previous studies, and the number of spoken languages other than the mother tongue. Many papers find that mobility increases with previous mobility experiences (Parey & Waldinger, 2011), so previous exchange

² We use the Stata extended regression models, which do not allow us to estimate a multinomial probit. In any case, we believe that an ordered probit is a good model to estimate the place of PhD given the categories considered.

program participation is a good exclusion restriction. The number of languages also helps identify this equation.

The control variables in the main equations are individual characteristics (gender, age, living with a partner), PhD field of study, previous studies characteristics (public university), job characteristics (academic job, permanent contract, firm size) and whether the individual lives abroad. A detailed definition of the variables is available in Table A1 in the Appendix.

4. Results

4.1 Wage equations

Table 2 provides the estimated coefficients of the wage interval regression estimations. The coefficients can be interpreted as in a linear OLS estimation. Column (1) reports the results of a basic interval regression estimation. In column (2) the estimation includes a selection into employment equation. Column (3) has employment selection and endogenous PhD place variable, which is estimated using an ordered probit. Column (4) is equivalent to column (3), but the sample is restricted to those currently living in Spain. All the selection equation estimated coefficients, and the estimation of the PhD place equations are reported in the Appendix in Tables A2 and A3.

We find that employment selection is not relevant in all these estimations as the correlations between the error terms of the wage equation and the selection equation are not significant. Similarly to what other studies found, controlling for endogeneity of the mobility variable is important. The correlation between the error terms of the equation estimating the PhD place and the main estimation is strongly significant. Its negative sign indicates that some unobserved characteristics affect the wage and the probability of doing the PhD abroad in opposite directions. Moreover, the effect of doing the PhD abroad becomes significant once we control for endogeneity. This is similar to what Carrasco (1999) and (Di Cintio & Grassi, 2016) find when they endogenize their mobility variable. Our prefer specifications are those that control for endogeneity, reported in columns (3) and (4). Our results indicate that there is a wage premium of around 600 euros monthly if the individual did the PhD partially abroad and a wage premium of around 1000 euros monthly if the individual did the PhD fully abroad

(column 3). There is an additional premium of around 925-950 euros monthly if the individual is working abroad. The returns to PhD mobility are larger for the sample of those that live in Spain. We observe a wage premium of 710 euros for those that did the PhD partly abroad and 1500 euros for those that did the PhD fully abroad.

The coefficients of the rest of the variables have the expected sign and do not change much across estimations. There is a gender wage gap of around 190 euros monthly on average. Experience is rewarded positively as indicated by the age coefficients. PhD graduates in Health Science seem to earn close to 200 euros more monthly than the rest of fields on average. Having an academic job, which is defined as working as a teacher in a job that requires a PhD in the education sector, has a wage penalty of around 200 euros monthly. Finally, having a permanent contract is associated with a higher wage as expected.

Our main results corroborate the consensus in the literature that international mobility allows individuals to gain additional skills and networks that are rewarded in the labor market. In our case, mobility refers to the place of doing the PhD. We also see that living abroad brings a higher wage. In the decision whether to live abroad, individuals weigh costs and benefits of doing so. Access to better paid jobs is often a good motivation.

	(1)	(2)	(3)	(4)
PhD place: Spain & Abroad	-10.013	-10.517	570.470***	710.813***
	(40.093)	(40.026)	(167.074)	(83.532)
PhD place: Only Abroad	-57.804	-59.099	977.305***	1505.955***
	(85.865)	(85.779)	(323.142)	(191.333)
Living abroad	946.902***	947.635***	925.434***	
	(65.333)	(65.219)	(63.539)	
Female	-146.669***	-145.740***	-192.804***	-190.490***
	(37.114)	(37.165)	(46.124)	(48.029)
Lives with a Partner	-15.357	-23.168	-10.447	0.961
	(37.697)	(38.240)	(43.968)	(48.385)
Age: 30-34	72.073 [*]	62.378	102.120**	125.401**
	(43.110)	(43.580)	(51.818)	(56.867)

Table 2. Estimation results for the interval regression estimation of wages.

Age: >34	244.250***	228.511***	429.899***	475.287***
	(55.414)	(56.806)	(89.505)	(76.442)
PhD Field of Study (base categor	y: Social Scienc	es)		
Arts and Others	-115.915	-97.987	-144.333	-95.095
	(79.132)	(80.927)	(90.762)	(94.086)

Science	65.757	72.796	-72.745	-144.987
	(62.288)	(62.857)	(81.826)	(76.480)
Engineering & Architecture	134 773**	127 668**	29 597	39 814
	(64.095)	(64.124)	(79.165)	(78.272)
	(0.1000)	(0)	(/ 0/200)	(/ 0/2/ 2)
Health Science	154.626**	162.541**	181.297**	199.026**
	(71.978)	(72.651)	(81.893)	(86.152)
Public university previous	-101.565	-101.884	-100.638	-41.448
studies				
	(62.989)	(63.011)	(70.322)	(81.145)
Acadamiaiah	204 212***	202 040***	102 400***	101 444**
Academic Job	-204.313	-203.840	-192.480	-191.444
	(42.923)	(42.950)	(45.803)	(44.952)
Master Sample	86.384**	88.686**	127,118**	69,445
	(41.677)	(41.670)	(51.488)	(54.720)
	(,	(((2 2)
Permanent contract	357.873***	358.078***	342.317***	312.883***
	(41.870)	(41.842)	(40.988)	(42.311)
Firm size: between 50 and 249	25.569	25.685	28.227	34.345
	(64.724)	(64.662)	(62.672)	(62.460)
5	74.075	74.205	65.240	47 440
Firm size: 250 or more	74.075	/4.365	65.219	47.113
	(52.699)	(52.030)	(52.127)	(52.051)
Constant	1526 562***	1554 218***	1268 003***	1248 776***
constant	(106.517)	(109.336)	(138.394)	(125.779)
var(e.wageband)	269766.8***	272606.15***	381934.85***	395443.25***
	(16749.41)	(17516.816)	(72757.106)	(44010.106)
corr(e.employed,e.wageband)		-0.186	-0.135	-0.107
		(0.130)	(0.103)	(0.094)
corr(e.phd_place,e.wageband)			-0.678***	-0.787***
			(0.140)	(0.055)
corr(e.phd_place,e.employed)			-0.012	-0.063
			(0.057)	(0.062)
Employment selection	No	Yes	Yes	Yes
Endogenous PhD place	No	No	Yes	Yes
Observations	906	906	906	755

Interval regression estimation. Robust standard errors in parentheses * p < 0.1, ** p < 0.1

0.05, *** *p* < 0.01

4.2 Overeducation among PhD holders

In this section, we draw attention to the quality of the current job in terms of the match between the education acquired (PhD) and the required education in the job. For example, PhD holders that follow an academic career are clearly in a matched job, as the PhD is required in this occupation by definition. We consider overeducated those PhD holders that perform a job which does not require a PhD, according to the information provided by the respondent.

Table 3 presents the marginal effects of the probit estimation where the dependent variable is whether the individual is overeducated. The model strategy is the same as in the case of wages. Estimation (1) is the simple probit estimation. Estimation (2) adds selection into employment equation. Estimation (3) adds employment selection and endogenizes the variable PhD place. Finally, estimation (4) is similar to estimation (3), but the sample is restricted to people living in Spain. Estimation results of employment selection and PhD place variable are available upon request. They are very similar to those reported in Tables A2 and A3.

In contrast to the wage estimations, we find that employment selection is relevant when analyzing overeducation. The correlation between the errors of the overeducation and employment equations is strongly significant and positive. Some unobserved characteristics affect both equations in the same direction. The marginal effects are however not very different between estimations (1) and (2), indicating that the biases due to omitted variable are small. Since we are studying people that most likely graduated from their PhD close to the survey time, it is possible that those that those who are still unemployed are looking for a matching job. Endogenizing the variable PhD place is not relevant in this case as the correlations between the errors of the overeducation equation and the PhD place equation are not significant.

According to our estimation results doing the PhD either partially or fully abroad does not affect the probability of being in a matched job. Only in estimation (3) the estimated coefficient of doing the PhD partially abroad is significant at the 10% level. Results reveal that those living abroad are more likely to be in a matched job. The probability of overeducation is significantly reduced if the individual lives abroad. The size of the marginal effect is large. Living abroad reduces close to 30 percentage points the probability of overeducation. These results suggest that there is a lack of PhD level jobs in Spain, which may lead to a brain drain problem, especially combined with the results from the previous analysis that jobs abroad command higher wages.

The rest of the variables indicate that having a partner or being older increases the probability of being overeducated, as well as having a permanent contract. We do not observe gender differences in the likelihood of being overeducated. Having an academic job is obviously reducing the probability of overeducation. Having a PhD from a STEM field is also reducing the likelihood of overeducation. Those individuals that graduated from a master in 2013-2014 are less likely to be overeducated. They are more likely to have finished the PhD earlier and therefore had more time to look for an adequate job.

	(1)	(2)	(3)	(4)
PhD place: Spain & Abroad	-0.034	-0.034	-0.147*	-0.177
	(0.031)	(0.028)	(0.083)	(0.141)
PhD place: Only Abroad	0.021	0.015	-0.182	-0.280
	(0.055)	(0.054)	(0.145)	(0.251)
Living abroad	-0.295***	-0.272***	-0.268***	
	(0.039)	(0.038)	(0.039)	
Female	0.009	0.007	0.016	0.013
	(0.028)	(0.026)	(0.027)	(0.032)
Live with a Dente or	0.024	0.040*	0.040*	0.074**
Lives with a Partner	0.034	0.049	0.048	0.071
	(0.028)	(0.026)	(0.026)	(0.030)
Age: 30-34	0 079**	0 094***	በ በ87***	0 088**
Ngc. 30 34	(0.034)	(0.032)	(0.033)	(0 030)
	(0.034)	(0.052)	(0.033)	(0.035)
Age: >34	0.110***	0.138***	0.100**	0.110^{*}
5	(0.041)	(0.040)	(0.049)	(0.062)
PhD Field of Study (Ref: Social	Sciences)	. ,	. ,	, , , , , , , , , , , , , , , , , , ,
Arts and Others	0.059	0.002	0.009	-0.035
	(0.059)	(0.060)	(0.061)	(0.062)
Science	-0.096**	-0.105**	-0.077	-0.067
	(0.047)	(0.045)	(0.049)	(0.055)
Engineering & Architecture	-0.212***	-0.184***	-0.166***	-0.168***
	(0.050)	(0.048)	(0.050)	(0.054)

Table 3. Estimation results for overeducation.

Public university -0.003 (0.044) -0.000 (0.040) -0.002 (0.040) -0.002 (0.040) Academic job -1.645 ^{***} (0.037) -1.652 ^{***} (0.036) -1.703 ^{***} (0.037) -1.773 ^{***} (0.035) Master sample -0.077 ^{**} (0.032) -0.074 ^{**} (0.029) -0.079 ^{***} (0.030) -0.067 ^{**} (0.034) Permanent contract 0.144 ^{****} (0.028) 0.129 ^{****} (0.026) 0.129 ^{****} (0.030) 0.124 ^{****} (0.030) Firm size: > 49 & < 250 0.009 (0.042) 0.004 (0.038) 0.001 (0.031) 0.001 (0.034) Firm size: >249 0.027 (0.034) 0.022 (0.031) 0.020 (0.031) 0.018 (0.031) Employment selection No Yes Yes Yes Endogenous PhD place No No Yes Yes corr(e.employed,e.overed) 0.792 ^{***} (0.099) 0.012 0.045 corr(e.phd place,e.overed) 0.012 -0.045 place,e.employed) 0.057) (0.064)	Health Science	-0.106 ^{**}	-0.118 ^{***} (0.045)	-0.123 ^{***}	-0.129 ^{***}
Public university -0.003 (0.044) -0.000 (0.040) -0.002 (0.040) -0.002 (0.040) Academic job -1.645 ^{***} (0.037) -1.652 ^{***} (0.036) -1.703 ^{***} (0.037) -1.773 ^{***} (0.035) Master sample -0.077 ^{**} (0.032) -0.074 ^{**} (0.029) -0.079 ^{***} (0.030) -0.067 ^{**} (0.034) Permanent contract 0.144 ^{****} (0.028) 0.129 ^{***} (0.026) 0.129 ^{****} (0.030) 0.124 ^{****} (0.030) Firm size: > 49 & < 250		(0.047)	(0.0+3)	(0.043)	(0.045)
(0.044) (0.040) (0.040) (0.044) Academic job -1.645^{***} (0.037) -1.703^{***} (0.036) -1.773^{***} (0.037) (0.035) Master sample -0.077^{**} (0.032) -0.074^{**} (0.029) -0.079^{***} (0.030) -0.067^{**} (0.034) Permanent contract 0.144^{***} (0.028) 0.129^{***} (0.026) 0.124^{***} (0.026) 0.124^{***} (0.030) Firm size: >49 & < 250	Public university	-0.003	-0.000	-0.002	-0.002
Academic job -1.645^{***} (0.037) -1.652^{***} (0.036) -1.703^{***} (0.037) -1.773^{***} (0.035)Master sample -0.077^{**} (0.032) -0.074^{**} (0.029) -0.079^{***} (0.030) -0.067^{**} (0.034)Permanent contract 0.144^{***} (0.028) 0.129^{***} (0.026) 0.129^{***} (0.026) 0.124^{***} (0.030)Firm size: > 49 & < 250		(0.044)	(0.040)	(0.040)	(0.044)
(0.037)(0.036)(0.037)(0.035)Master sample -0.077^{**} (0.032) -0.074^{**} (0.029) -0.079^{***} (0.030) -0.067^{**} (0.034)Permanent contract 0.144^{***} (0.028) 0.129^{***} (0.026) 0.129^{***} (0.026) 0.124^{***} (0.030)Firm size: > 49 & < 250	Academic job	-1.645***	-1.652***	-1.703***	-1.773***
Master sample -0.077** -0.074** -0.079*** -0.067** Permanent contract 0.144*** 0.129*** 0.129*** 0.124*** (0.028) (0.026) (0.026) (0.030) 0.124*** Firm size: > 49 & < 250		(0.037)	(0.036)	(0.037)	(0.035)
(0.032) (0.029) (0.030) (0.034) Permanent contract 0.144*** 0.129*** 0.129*** 0.124*** (0.028) (0.026) (0.026) (0.030) (0.030) Firm size: >49 & < 250	Master sample	-0.077**	-0.074**	-0.079***	-0.067**
Permanent contract 0.144*** 0.129*** 0.129*** 0.124*** (0.028) (0.026) (0.026) (0.030) Firm size: >49 & < 250	•	(0.032)	(0.029)	(0.030)	(0.034)
Firm size: > 49 & < 250	Permanent contract	0.144***	0.129***	0.129***	0.124***
Firm size: > 49 & < 250 0.009 (0.042) 0.004 (0.038) 0.001 (0.038) 0.001 (0.038)Firm size: >249 0.027 (0.034) 0.022 (0.031) 0.020 (0.031) 0.018 (0.031)Employment selectionNoYesYesEndogenous PhD placeNoNoYesCorr(e.employed,e.overed) 0.792^{***} (0.099) 0.799^{***} (0.095) 0.863^{***} (0.077)corr(e.phd place,e.overed) 0.792^{***} (0.099) 0.284 (0.186) 0.266 (0.307)corr(e.phd place,e.overed) 0.012 (0.057) -0.045 (0.064)Dbservations906906906		(0.028)	(0.026)	(0.026)	(0.030)
Firm size: >49 & < 230	Firm cize > 40.8 < 350	0.000	0.004	0.001	0.001
Firm size: >249 0.027 (0.034) 0.022 (0.031) 0.020 (0.031) 0.018 (0.034) Employment selection No Yes Yes Yes Endogenous PhD place No Yes Yes Yes corr(e.employed,e.overed) 0.792*** 0.799*** 0.863*** corr(e.phd place,e.overed) 0.792*** 0.284 0.266 corr(e.phd place,e.overed) 0.012 -0.045 corr(e.phd place,e.overed) (0.057) (0.064) Observations 906 906 906 755	1 1111 SIZE: 2 43 & < 230	(0.042)	(0.038)	(0.038)	(0.041)
Firm size: >249 0.027 0.022 0.020 0.018 (0.034) (0.031) (0.031) (0.034) Employment selection No Yes Yes Endogenous PhD place No No Yes Yes corr(e.employed,e.overed) 0.792*** 0.799*** 0.863*** corr(e.phd place,e.overed) 0.284 0.266 (0.307) corr(e.phd place,e.overed) 0.012 -0.045 place,e.employed) (0.057) (0.064) Observations 906 906 906 906					
(0.034) (0.031) (0.031) (0.031) (0.034) Employment selection No Yes Yes Yes Endogenous PhD place No No Yes Yes corr(e.employed,e.overed) 0.792*** 0.799*** 0.863*** corr(e.phd place,e.overed) 0.099) (0.099) (0.095) (0.077) corr(e.phd place,e.overed) - 0.284 0.266 (0.307) corr(e.phd place,e.overed) - 0.012 -0.045 place,e.employed) - (0.057) (0.064) Observations 906 906 906 755	Firm size: >249	0.027	0.022	0.020	0.018
Employment selection No Yes Yes Yes Endogenous PhD place No No Yes Yes corr(e.employed,e.overed) 0.792*** 0.799*** 0.863*** (0.099) (0.095) (0.077) corr(e.phd place,e.overed) 0.284 0.266 (0.186) (0.307) corr(e.phd place,e.overed) 0.012 -0.045 place,e.employed) (0.057) (0.064) Observations 906 906 906		(0.034)	(0.031)	(0.031)	(0.034)
Endogenous PhD place No No Yes Yes corr(e.employed,e.overed) 0.792*** 0.799*** 0.863*** (0.099) (0.095) (0.077) corr(e.phd place,e.overed) 0.284 0.266 (0.186) (0.307) corr(e.phd place,e.overed) 0.012 -0.045 place,e.employed) (0.057) (0.064) Observations 906 906 906	Employment selection	NO	Yes	Yes	Yes
corr(e.employed,e.overed) 0.792*** 0.799*** 0.863*** (0.099) (0.095) (0.077) corr(e.phd place,e.overed) 0.284 0.266 (0.186) (0.307) corr(e.phd place,e.employed) 0.012 -0.045	Endogenous PhD place	No	No	Yes	Yes
(0.099) (0.095) (0.077) corr(e.phd place,e.overed) 0.284 0.266 (0.186) (0.307) corr(e.phd place,e.employed) 0.012 -0.045	corr(e.employed,e.overed)		0.792***	0.799***	0.863***
corr(e.phd place,e.overed) 0.284 0.266 corr(e.phd 0.186) (0.307) place,e.employed) 0.012 -0.045 Observations 906 906 906			(0.099)	(0.095)	(0.077)
corr(e.phd 0.012 -0.045 place,e.employed) (0.057) (0.064) Observations 906 906 906	corr(e.phd place,e.overed)			0.284	0.266
corr(e.phd 0.012 -0.045 place,e.employed) (0.057) (0.064) Observations 906 906 955				(0.186)	(0.307)
(0.057) (0.064) Observations 906 906 955	corr(e.phd place,e.employed)			0.012	-0.045
Observations 906 906 906 755				(0.057)	(0.064)
	Observations	906	906	906	755

Probit estimation. Marginal effects. Robust standard errors in parentheses. * p < 0.1, **

p < 0.05, *** p < 0.01

5. Conclusions

In this paper, we provide information on PhD graduates using the Spanish University Graduate Placement Survey from 2019. We focus on the effect of doing a PhD partially or fully abroad on wages and education-job match. We also highlight the effect that living abroad has on these outcomes. We find that PhD graduates that did their PhD at least partially abroad get a significant wage premium that ranges between 600 and 1500 euros monthly. There is no evidence that studying the PhD abroad affects the probability of being overeducated in our sample. Instead, those living abroad have a much lower probability of being overeducated and tend to have higher wages. This brings awareness about the difficulty to attract back the talent that went to study abroad. The lack of adequate jobs and low wages compared to other countries makes it difficult to retain and attract talent in Spain. It is important particularly, as the previous research indicates that brain drain causes significant loss of human capital and potential productivity in the affected countries (Beine et al., 2008).

As regards policy implications, it is clear that Spain has an important job to do when it comes to creating graduate jobs, adequate for PhDs. Graduating from a PhD in Spain often means competing for scarce and relatively underpaid jobs in academia versus trying luck in the industry. As our results reveal, it is much more attractive for a Spanish PhD to emigrate already at the PhD studies level and find a job abroad. Spain should implement strategies which would allow industry to attract the highly skilled PhDs into matching and well-paid jobs in the industry. A good example may be industrial doctorates which are being implemented in Spain nowadays. Their aim is to link directly the PhD studies with the necessities of real business to avoid the above-described pitfalls. The new EILU data (currently in elaboration by the Spanish Statistical Office) should shed some light whether these policies are good enough to tackle the brain drain from Spain.

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APPENDIX

Table A1. Definition of variables

Female	Dummy with value 1 if the individual is female, 0 otherwise.
Partner	Dummy with value 1 if the individual lives with a partner, 0
	otherwise.
Age group	Three age groups: <30, 30-34, >34
Father's	Three categories: At most low secondary, Higher secondary or
education	vocational education, University education.
At least one	Dummy with value 1 if either father or mother has tertiary
parent has	education, 0 otherwise.
tertiary educ	
PhD field	Field of study of the PhD. It has five categories: Arts and others;
	Science; Social Sciences; Engineering & Architecture; Health
	Science.
PhD place	Place of studying the PhD. It has three categories: Spain. Spain
	and abroad. only abroad.
Master sample	Dummy with value 1 if the individual graduated from a master's
	degree in 2014. 0 if the individual graduated from an
	undergraduate degree in 2014.
Excellence	Dummy with value 1 if the individual got an excellence
scholarshin	scholarship during in the studies finished in the academic year
Serielarship	2013/2014 Given to those with high academic achievement
General	Dummy with value 1 if the individual got a general scholarship
scholarshin	during the studies finished in the academic year 2013/2014
Scholarship	Given to those with low family income
Exchange	Dummy with value 1 if the individual bad an international
Exendinge	ERASMUS experience during the studies finished in the academic
	vear 2013/2014
Public university	Whether the individual graduated in 2014 from a public
	university (either undergraduate or master studies)
Wage hands	Monthly wage after taxes. This variable has seven categories:
Wage bands	<700 euro 700-999 euro 1000-1/99 euro 1500-1999 euro 2000-
	2/99 euro, 2500-2999 euro, >3000 euro
Overeducated	Dummy with value 1 if the individual reports that the level of
Overeducated	education most adequate for present job is at most a master's
	dogroe 0 otherwise
Acadomic	Dummy with value 1 if the individual is a teacher in a job that
Academic	requires a PhD in the education sector. O otherwise
Dormonont	Dummu with value 1 if the individual has a normanant contract 0
Permanent	otherwise.
Firm size	Three categories: less than 50 employees, between 50 and 249
	employees, 250 or more employees.
Live abroad	Dummy with value 1 if the individual currently lives abroad, 0
	otherwise.
Languages	Number of spoken languages apart from the mother tongue.

Previous studies	Dummy with value 1 if the studies finished in the academic year
useful to find a	2013/2014 are considered useful to find a job.
job	

Table A2. Selection into employment of models (2), (3) and (4) in Table 2.

Employed vs unemployed	(2)	(3)	(4)
Female	-0.029	-0.028	-0.052
	(0.102)	(0.102)	(0.109)
Lives with a Partner	0.244**	0.245**	0.329***
	(0.104)	(0.104)	(0.110)
Age: 30-34	0.326***	0.324***	0.371***
-	(0.118)	(0.118)	(0.125)
Age: >34	0.703***	0.696***	0.717***
PhD Field of Study (Ref: Social Sciences):			
Arts and Others	-0.562***	-0.562***	-0.578***
	(0.201)	(0.201)	(0.209)
Science	-0.226	-0.228	-0.331*
	(0.173)	(0.173)	(0.181)
Engineering & Architecture	0.369^{*}	0.367*	0.323
	(0.215)	(0.215)	(0.227)
Health Science	-0.247	-0.250	-0.265
	(0.176)	(0.176)	(0.182)
Excellence Scholarship during studies	-0.187	-0.209	-0.243
	(0.164)	(0.161)	(0.175)
Father's education:			
Higher secondary / vocational	0.095	0.098	0.082
	(0.129)	(0.128)	(0.133)
University	0.247**	0.238^{*}	0.189
	(0.125)	(0.123)	(0.130)
Previous studies useful to find a job	0.458***	0.462***	0.459***
	(0.117)	(0.117)	(0.125)
Constant	0.497**	0.503**	0.464**
	(0.210)	(0.210)	(0.218)
Observations	1055	1055	893

Coefficients of a probit estimation. Robust standard errors in parentheses. * p < 0.1, ** p

< 0.05, *** *p* < 0.01

Where you studied Phd	(3)	(4)
Female	0.218***	0.217**
	(0.079)	(0.084)
Lives with a Partner	-0.058	-0.037
	(0.077)	(0.085)
Age: 30-34	-0.134	-0.176*
	(0.089)	(0.101)
Age: >34	-0.693***	-0.716***
-	(0.130)	(0.141)
PhD Field of Study:		
Arts and Others	0.089	-0.052
	(0.159)	(0.166)
Science	0.577***	0.484***
	(0.126)	(0.134)
Engineering & Architecture	0.427***	0.322**
	(0.132)	(0.140)
Health Science	-0.031	-0.152
	(0.144)	(0.152)
Public university	0.050	0.012
	(0.124)	(0.146)
Excellence Scholarship	0.132	0.209**
	(0.102)	(0.102)
Master sample	-0.032	0.082
	(0.093)	(0.099)
General Scholarship	0.007	0.006
	(0.078)	(0.077)
At least one parent has tertiary education	0.185***	0.084
	(0.070)	(0.074)
Study Abroad during previous studies	0.444***	0.135
	(0.160)	(0.104)
Number of other languages spoken	0.187***	0.113**
	(0.056)	(0.049)
Cut 1	0.847	0.710
	(0.210)	(0.218)
Cut 2	2.217	2.359
	(0.218)	(0.227)
Observations	1055	893

Table A3. Endogenous PhD Place estimation in models (3) and (4) in Table 2.

Coefficients of an ordered probit estimation. Robust standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01