The Determinants of Delayed Entrance into the Academic Career : The Case of France

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THE DETERMINANTS OF DELAYED ENTRANCE INTO THE ACADEMIC CAREER: THE CASE OF FRANCE

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Abstract: *The recruitment of young PhD graduates in the academic sector is linked to a strong uncertainty on their potential teaching and research productivity. When giving tenure to a PhD graduate, employers -universities or research institutions in France- attempt to reduce the asymmetric information on the research abilities of the applicant. However, because of the nature of the scientific work and the way it is rewarded, it is difficult to assess the absolute value of much of the work of PhD graduates in the short term. So, in order to recruit the best PhD graduates for permanent jobs, public employers select from the signals sent by the applicant in their curriculum vitae. Our paper analyses the factors affecting the access duration to a permanent job in the French academic sector. We focus on a sample of 1400 individuals who obtained their PhDs in 2001 and were interviewed in 2004. A discrete time model is used to analyse the main factors influencing the access duration. In order to assess the effect of a post-doctoral position on the academic job search, our empirical approach involves estimation of models that simultaneously explain the access duration to a permanent job and post-doc participation. Our main results indicate that the scientific publications and the sources of financial supports obtained during the PhD have an influence on the access duration to a permanent job, which is coherent with the idea that potentials employers use this information as a proxy of research and teaching abilities. In addition, our results provide consistent support for the hypothesis that a post-doc position may be useful to move up in the job queue for permanent positions in France.*

JEL classification: *I23, J45, J62*

Keywords: *PhD, academic sector, labour market entrance, post-doc*

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I. Introduction

Graduate students, especially those in thesis and dissertation programs and postdoctoral fellows, are generally considered to be of the utmost importance in the generation of new knowledge in our economy. They play a central part in the dissemination of "scientific and technical human capital" (Bozeman, 2001). However, data in several countries shows that PhD graduates are facing growing difficulties in the labor market (Enders, 2002 ; Cruz, Sanz 2004 ; Gaughan M. and Robin S., 2004…) : supply is generally lower than demand for tenure positions in the academic sector although different surveys clearly show that PhD students still have a strong preference for joining this sector. So, a multiplication of short term contracts in the academic sector and post-doctoral posts has appeared. For Stephan and Lewin (1997), this trend has led to the break down of the implicit contract between professors and PhD students.

In France, the increasing use of short term contracts in the academic sector is leading to a growing job queue in the PhD labor market (Beret and al., 2003). One of the main characteristics of the French recruitment procedure is the moment when the access to a quasi-secured position occurs (Musselin, 2004): the average age for a position as tenured assistant professor is around 33 and until 2005, to apply for a lowered tenure position in the national research institutions, the candidate had to be less than 31. At the same time, the situation for PhD graduates in the private sector is worse than it was at the end of the nineties (Giret, 2005).

In this context, the aim of the paper is to sketch out the main determinants of access to the public academic sector for recent PhD graduates in France. Our research uses data from a French survey of school and university leavers "Generation 2001", carried out by the Cereq. We focus on a sample of 1400 individuals who obtained their PhDs in 2001 and were interviewed in 2004 The survey includes general information on young graduates' characteristics (Educational background and characteristics of the PhD, diploma awarded before the PhD, family's socioeconomic status, age, university area, job…) and work history from 2001 to 2004. It also provides detailed information on doctoral conditions for PhD students (financial support, researcher institutions, duration of the PhD, postdoctoral experience…). This sample is representative of PhDs awarded in exact science, human and social science in France in 2001. The econometrical analysis is carried out by applying event history techniques. In this paper, we will consider that the recruitment for permanent positions depends mainly on characteristics of PhD research which can be viewed as potential indicators of productivity. In order to assess the effect of a post-doctoral position on the academic job search, our empirical approach involves estimation of models that simultaneously explain the access duration to a permanent job and post-doc participation.

The paper is organized as follow. After a brief review of related literature in section II, we present our data in section III. Section IV describes the econometric model used in this analysis and section V presents the empirical results. We conclude in section VI by discussing and summarizing the findings.

II. Literature review

The recruitment of young PhD graduates is linked to a strong uncertainty on their potential teaching and research productivity. When giving tenure to a PhD graduate, employers, universities or research institutions, attempt to reduce the asymmetric information on the research abilities of the applicant (Siow, 1991; Siow, 1995). The recruitment procedure delegated to tenured professors or researchers allows a partial reduction of asymmetric information and opportunist behaviour (Carmichael, 1988; McKenzie, 1996). However, because of the nature of the scientific work and the way it is evaluated and rewarded, it is difficult to assess the absolute value of much of the work of academics in the short term. So, in order to recruit the best PhD graduates for permanent jobs, public employers select from the signals sent by the applicant in their curriculum vitae. Publications, means of financial support of PhD, PhD duration, reputation of the PhD advisor, and the different labor experiences may be viewed as indicators that give information on the candidate's potential productivity.

Publications are generally considered as one of the main indicators of scientific productivity, especially when the quality of the publications is taken into account (Diamond, 1984 ; Levin and Stephan, 1991). Compared to other criteria that may indicate the PhD quality, like the distinction awarded or the composition of the jury, publications provide a more independent evaluation of the young PhD graduate's research abilities. Moreover, as Paul and Rubin (1984) showed, publications may also be viewed as a good proxy of the teaching abilities. Consequently, we may suppose that publications will be one of the most important criteria in selecting graduates following the end of their PhD period, when their scientific productivity is increasing. In addition, because of the time required to be published, a recruiter may benefit from the prestige of an article written while the candidate was at another institution.

The relation between the PhD student and PhD advisor is also determinant for the elaboration of the PhD and later, for the academic career. Stephan and Levin (1996) analyse these relations as an implicit contract: the PhD advisor benefits more or less directly from the student's productivity by co-signing a publication for example. In return, the PhD advisor helps him find a tenured position through his network. As a result, the PhD advisor puts his reputation on the line and is obliged to provide advice and help in finding a tenured job. This reputation allows him to select the best students who will probably be the most productive in their future research. However, as Stephan and Levin noted, the multiplication may lead to a rupture of this implicit contract. This will be the case if PhD students think that the PhD advisor cannot help them to find tenure in the academic labor market. However, we should note that the PhD advisor, a member of his research team or a university professor are better informed about the research and training abilities even if the implicit contract has been broken. Giving tenure to a PhD graduate from your university may be a better strategy and less risky, personal interest notwithstanding.

The funding obtained by students during their PhD also provides information about the potential productivity of a young researcher. On the one hand, it can be used as a signal of research abilities before the PhD enrolment: in France, public financial support mainly depends on the scholar selection procedure performed at the end of the master year. On the other hand, it may strongly affect the quality of doctoral training and the PhD duration

(Ehrenberg et Mavros, 1995). It also permits a better integration into a research team, and for some of them, training to teach at university[1].

The different temporary contracts graduates can obtain following their PhD may be considered as a means to sort through and to recruit the more productive. Compared to a direct recruitment following their PhD, several arguments may justify the preference for a longer probationary period. The first is linked to the increasing specialization of research activities which imply a greater investment for the PhD students. Since the return on this investment is frequently longer and uncertain, the potential employer needs a longer period to assess a candidate. They may use post-doc as a lower cost means of screening potential candidates for permanent jobs in their institutions. Secondly, employers may consider post-doc as a means of providing additional training opportunities that would be complementary to the doctoral training. Besides the work specialization or, on the contrary, the access to a new research subject, post-doc positions give PhD graduates the opportunity to discover a new environment or other research methods. This is especially true if the PhD graduate works in another country as it allows him to strengthen his linguistic skills. But doctoral training is also a very codified exercise in numerous fields: students have to prove they have acquired the standard skills needed to enter the scientific profession (ability to carry out scientific experiments, review the relevant scientific literature on topics assigned, test alternative hypotheses …). Other types of skills can be developed in the post-doctoral stage such as the ability to integrate a new environment, work in a team or be more autonomous. The third argument deals with the management of the job queue. The quality of the applicants and the number of vacancies for tenured positions vary from year to year. Proposing post-doc positions gives employers more flexibility in recruitment management while encouraging PhD graduates to continue to prove themselves.

We can ask ourselves the question if the post-doc is an efficient job search method for a young researcher. Given the specificity of the recruitment procedure in the French academic sector, a post-doc position may lead to greater difficulties to conduct a successful job search. First, a postdoctoral in a foreign country, which are more numerous than in France, may reduce the information on job positions in the national academic sector. In scientific activities, networks are determinant in the transmission of information on the quality of research (Bozeman et alii, 2001) and on job vacancies. In France, the final step of the recruitment procedure for assistant professorship is delegated to a local committee in each university, where some of the members are not necessarily implied in the international network, especially in small universities and technological institutes. Recent PhD graduates have to prepare the selection process by obtaining information on job profiles or establishing contacts with potential employers. These contacts may be informal discussions or seminar presentation, research cooperation or teaching activities. So, although it is still possible to apply for an academic job during a post-doc in a foreign country, distance from local or national labor market may be considered to be a risky job search strategy. In addition, the travel costs back to France in order to participate in the selection process will generally be higher. Secondly, post-doctoral positions may be interpreted as a negative screening for potential employers: for example, a long post-doc period may indicate the difficulties for a PhD graduate to find a job in the academic sector. However, the "post-doc signal" will be very dependant on the prestige of the university or the host research team of the graduate during the post-doc. In France, empirical studies on PhD graduates did not provide evidence

[1] It is a specific training for "allocataires-moniteurs" (Doctoral student with government grant and part-time lecturer position)

of positive effects of post-doc position on their subsequent careers. Cahuzac and Robin (2003), using a sample of French PhD graduates in life science between 1984 and 1997, show that post-doc positions have a negative effect on the access to the academic labor market, but the effect is less negative than other temporary contracts which exist in French universities.

III. Data.

The data used in this analysis is derived from the Cereq "Generation" surveys. Generation surveys are retrospective surveys on school and university leavers in France containing detailed longitudinal information on their occupations, earnings, individual characteristics and education. In spring 2004, Cereq questioned 15,000 young people in France who had left initial training in 2001, at all levels and in all training specializations. The scope was restricted to young people under 35 who lived in France in March 2004. This sample is representative of the 700,000 young people leaving the education system for the first time that year. Of the 15,000 school and university leavers, we reduced the sample to 1378 respondents in France who obtained their PhD between December 2000 and December 2001. Because of the scope, all PhD people living outside France in March 2004 were not interviewed, which represented approximately 6% of PhD graduates in a previous survey.

Our database includes information about individual and educational characteristics, and other information about duration and conditions of the doctoral trainings (financial support, research team…). The PhD field is aggregated into six categories: maths and physics, chemistry, life science, applied science, humanities and law, economics and management. We have information about scientific or non scientific publications obtained at the time of the visa. We also created a variable to identify graduates recruited in the region where they obtained their degree. Finally, the survey allowed us to observe post-doc positions but, unfortunately, we do not have longitudinal information about the exact post-doc period. Over 30% of recent graduates affirmed having done a post-doc between 2001 and 2004[2].

We have defined permanent employment in the academic labor market as the jobs of assistant professors (maitre de conference) and professors in the universities, the jobs of research directors, research scientists and research assistants in the French public scientific institutions. While the average waiting period is slightly over 13 months, about a quarter of young PhD graduates were hired more than twenty months after graduating. However, there are discrepancies in the waiting periods because, on the one hand, the competitive exam schedule is fixed and restrictive and on the other hand, graduates can pass their PhD viva at any time of the year. PhD graduates who obtained their degrees in December 2000 or January 2001 could apply to all the positions offered in 2001 in the universities and in the public research institutes. PhD graduated between February 2001 and May 2001 had some opportunities to apply to positions in public research institutes. This is not the case for the PhD students who graduated in the last semester of 2001. Consequently, we define a duration divided in two or three time periods, corresponding to the possibility to apply for the different competitive exams[3]. In all, 15% of PhD graduates obtained an academic position in their first year of application, 7% in their second year, and a little more than 2% in their third year.
The main descriptive statistics of the sample are presented in the annex.

[2] We do not have information on the country where the post-doc is done.
[3] More precisely, we take into account the application deadline.

IV. Econometric method

Under the standard job search model, the duration to find a job depends on the job search intensity and the probability that the offer is accepted. In the French academic labor market, the access duration to a permanent tenured job strongly depends on the frequency of competitive exam schedule. Consequently, a discrete time model is used to analyse the access duration to a permanent job in the academic sector. If the PhD graduate obtained a permanent job before March 2004, the waiting time period is an uncensored spell. If he did not obtain, it is a censored spell.

Time intervals can be written $[0, b_1[, [b_1, b_2[, ...[b_k, b_k[, [b_k, +\infty[$, with $q = k+1$ time periods. Let T be the access duration to a permanent job in the academic sector.

The probability of a PhD graduate[4] obtaining a permanent job during the j^{th} time period is:

$$P(T \in [b_{j-1}, b_j[) = S(b_{j-1}; X_t) - S(b_j, X_t)$$

where $S(b_{j-1}; X_t) = P[T \geq b_{j-1}]$ is the survival function at the beginning of the j^{th} time period and X_t are the observable characteristics for a PhD graduate *i*. These characteristics may be time-varying variable. They can also have a different effect on each time period.

The hazard function can be written:

$$h_j(X_t) = P[T \in [b_{j-1}, b_j[\,|\, T \geq b_{j-1}[= = 1 - \frac{S(b_j; X_t)}{S(b_{j-1}; X_t)}.$$

In the proportional hazard model (model 1), the survivor and the hazard functions are given by[5]:

$$S(X_t) = \exp(-\exp(X_t\beta + \alpha_j))$$
$$h_j(X_t) = 1 - \exp(-\exp(X_t\beta + \alpha_j))$$

Finally, following Jenkins (1995), we allow unobserved heterogeneity (model 2), generalizing the survivor and the hazard functions as:

$$S(X_t; \varepsilon) = \exp(-\exp(X_t\beta + \alpha_j + \varepsilon))$$
$$h_j(X_t; \varepsilon) = 1 - \exp(-\exp(X_t\beta + \alpha_j + \varepsilon))$$

where the error term ε is a random variable which characterises the unobserved heterogeneity.

For the model 1 (without unobserved heterogeneity), the logarithm of contribution to the likelihood can be written as:

$$\ell(\beta, \alpha) = cLn(S(b_{j-1}; X_t) - S(b_j; X_t)) + (1-c)Ln(S(b_j; X_t))$$
$$= cLn\left(h_j(X_t)\prod_{s=1}^{j-1}(1-h_s(X_s))\right) + (1-c)Ln\left(\prod_{s=1}^{j}(1-h_s(X_s))\right)$$

[4] Index i (for each individual) is dropped to simplify notation.
[5] For more details, see Kalbfleisch and Prentice (1980) or Jenkins (1995).

The first term of the log-likelihood is the contribution for a non censored observation (the PhD graduate obtained an academic post beyond the end of the j^{th} interval. The second term correspond to a truncated duration: the PhD graduate had not yet obtained a academic post by March 2001.

For the model 2 (with unobserved heterogeneity), this contribution is:

$$\ell(\beta,\alpha;\varepsilon) = cLn\left(h_j(X_t;\varepsilon)\prod_{s=1}^{j-1}(1-h_s(X_s;\varepsilon))\right) + (1-c)Ln\left(\prod_{s=1}^{j}(1-h_s(X;\varepsilon))\right)$$

where $c = \begin{cases} 1 \text{ if the PhD graduate obtain a tenured job during the j}^{\text{th}} \text{ period,} \\ 0 \text{ otherwise.} \end{cases}$

In order to assess the effect of a post-doctoral position on the academic job search, our empirical approach involves estimation of models that simultaneously explain the duration until work and training participation (Gritz, 1993 ; Bonnal and al, 1997). As we do not have longitudinal information about the exact post-doc period, we only consider the binary information if a PhD graduate participates in a post-doc programme.

Let Y_d be a random variable defined as:

$$y_d = \begin{cases} 1 \text{ if the PhdD find a postoc position} \\ 0 \text{ elsewhere} \end{cases}$$

The probability of accessing a post-doc position (using a logit model) may be given by:

$$P(y_d = 1) = \frac{\exp(Z\alpha+\delta)}{1+\exp(Z\alpha+\delta)} = q(\delta)$$

where δ also is the unobserved heterogeneity term

Let us assume that the unobserved terms δ et ε are discrete random variables with respectively,2 and 3 points of support [6].
The contribution of the individual to the log-likelihood is:

$$\sum_{m=1}^{2}\sum_{n=1}^{3} \ell(\beta,\alpha;\varepsilon_n)\times[q(\delta_m)]^{yd}\left[1-q(\delta_m)\right]^{(1-y_d)} \times P(\delta_m,\varepsilon_n)$$

The probabilities $P(\delta_m,\varepsilon_n)$ are

$$P(\delta_m,\varepsilon_n) = \frac{\exp(\mu_{mn})}{\sum_{v=1}^{2}\sum_{w=1}^{3}\exp(\mu_{vw})} \quad m=1,2 \text{ et } n=1,2,3,$$

where $\mu_{22} = 0$ for the identification problem (the sum of the probabilities must be equal to 1).

[6] A model with 3 points of support has been estimated. For the term δ, a zero equality test of the parameters lead no to reject the hypothesis.

The access duration to a permanent job in the academic sector is divided into three intervals. The first interval contains 15 months (from January 2001 to March 2002). The second interval contains 12 months (from April 2002 to March 2003). The third one began in April 2003 and its duration is longer than 27 months. It is important to note that all PhD students cannot apply for a permanent position in 2001. It depended on the PhD viva month. So for those who cannot apply, we only retained two time intervals. The log-likelihood contributions take into account the different application opportunities.

V. Results

In this section we present two sets of results. The first is obtained by considering post-doc positions as an exogenous variable. Secondly, we consider the possibility of endogeneity.

The results of the first estimations are presented in the first and second column of table 1. The results in the second column include some coefficients estimated for each time period[7]. As expected, the duration of tenured jobs depends on the new researcher's publications. The number of publications in peer-reviewed journals is highly significant in improving their chances of getting a permanent job in the academic sector. On the contrary, publications in other journals have no significant effect. The funding of the PhD is also a determining criteria in obtaining a job in the academic sector. On the one hand, PhD students who benefited from public research grants and part-time lecture positions are those who obtain academic tenure the most quickly. On the other hand, students who benefited from a "Cifre" contract, and thus, having done a PhD which is more in tune with the private sector needs, have a much lower probability of obtaining an academic tenure. Being recruited in the region of one's university is an advantage in obtaining a tenured post of researcher or assistant professor. However, one of the main factors influencing the labor market entry of recent PhD graduates remains the academic field. PhD graduates in chemistry and life sciences find it more difficult to rapidly obtain a tenured job. In 2001, the ratio between the vacancies and the applicants for assistant professor positions in these fields of research was the weakest. Although there are other opportunities in the academic labor market, especially in other public research institutions, the imbalance between vacancies and applicants for assistant professor tenures correctly sums up the relative difficulties for PhD graduates in this labor market. Other variables have a more ambiguous effect on the time needed to obtain a tenured job. This is especially the case of the host research team of the PhD. The affiliation of the research team to the CNRS (National Centre for Scientific Research) has no significant effect, whereas the affiliation to another public research institution[8] has a more negative effect in the first period and a more positive one in the second (Model B). Finally, the effect of a post-doc position is negative for the first period and positive for the second and third, which may be coherent with a job queue hypothesis. As a result of being abroad or in another university, a post-doc researcher has more difficulty in accessing the academic job market during the first period when one can apply. On the contrary, a post-doc position becomes an advantage afterwards and allows one to move up in the job queue. However, the post-doc position is introduced in the estimation as an exogenous variable and does not take the endogeneity into account in the process of obtaining a post-doc position.

[7] A test on the equality of the coefficients suggests significant differences for two coefficients: research institutions and post-doc position.

[8] It is mainly affiliations with National Institute of Health and Medical Research (INSERM) and National Institute for Agronomics Research (INRA).

The model presented includes this endogeneity. Table 1 shows the estimation of the probability of obtaining a post-doc position. The determinants are similar to those concerning the time needed to obtain an academic job. Obtaining a post-doc position is strongly dependant on the field of the PhD. Post-doc positions are more frequent in chemistry and life sciences, followed by mathematics and physics and then, applied science, to a lesser extent. In contrast, post-doc positions are rather infrequent in humanities and social sciences. PhD funding also have a strong influence on access to post-doc positions. Research grant holders, especially when they have a lecturer's position are more likely to obtain a post-doc than private grant holders ("Cifre" grant). Those without a grant are in an intermediary position. The host institution of the PhD student also has an influence. Post-docs are more frequent for those who did their PhD in a research team linked to CNRS and other public research institutions. A high number of scientific publications in peer-reviewed journals and a PhD completed in a short time increased access to post-doc positions. Finally, the month when the viva is done greatly influences access to post-doc positions. Those presenting between February and May and those between June and August are the most likely to continue with a post-doc, which is explained by them not being able to apply for assistant professor posts for that year. As Recotillet (2007) has already demonstrated, the absence of close deadlines results in post-doc enrolment. In this case, recent PhD graduates have fewer obstructions to going abroad in terms of preparation for selection process (seminar presentation, job profile research…).

In the third and forth columns of the table 1, we present the results for the access duration to a permanent job in the academic sector, checking for unobserved heterogeneity and endogeneity. Compared to the first results, the main difference deals with the post-doc position effect for the first time period. The effect is now positive and non significant while it was negative and significant in the first estimates. However, the correlation between the two error terms is negative and significant (table 3). The result provides evidence of a negative relation between the probability to obtain a post-doc and the access duration to a permanent job in the academic sector. The individual characteristics favourable for the post-doc access are unfavourable for the permanent job access. That can be explained by the fact that unobserved characteristics linked to the difficulties in finding a permanent job immediately lead PhD graduates to find post-doc positions. These unobserved characteristics may be linked to individual behavioural skills such as lower social skills, communications or oral aptitudes. The candidates may choose first to accede to a post-doc to improve their skills. It may also be due to the research environment of the PhD graduate as for example, the absence of job vacancies in one university or the lack of supervision, reputation or help in the job search process of the PhD advisor. However, the positive coefficient associated to a post-doc variable, non significant for the first period but significant for the second and the third periods counterbalance the selection effect. These results may be coherent with a job queue hypothesis. A post-doc position is necessary to move up in the job queue if some initial skills are too low to obtain a permanent job immediately. A post-doc position allows an applicant to become more competitive in the academic labor market.

VI. Conclusion

We examined the determinants of the recruitment for permanent positions in the French academic labor market. Our findings may be summarized as follows:

First, academic fields have the greatest influence on the recruitment procedure which is partially explained by the fact that assistant professorship vacancies are linked to the student/teacher ratio in each department in each university. The difficulties to obtained a permanent job in math and physics, chemistry, life sciences or applied sciences may be explained by the persistent decrease in science enrolment at the universities while the number of applicants for assistant professor positions in these fields has not significantly decreased.

Second, scientific publications, the types of financial supports have a strong influence on the access duration to permanent jobs in the French academic sector, which is coherent with the idea that potentials employers use this information as potential proxy of research abilities.

Third, our results suggest that a post-doc position does not have a negative effect on access to permanent jobs in the academic sector after controlling endogeneity and unobserved heterogeneity. On the contrary, our estimates indicate that, there was a positive return of post-docs in the second and the third academic recruitment period. Thus, our results provide consistent support for the hypothesis that a post-doc position may be useful to move up in the job queue for permanent position in France.

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Table 1 : Determinants of the access duration to a permanent job in the academic sector

	Model 1		Model 2	
	A	B	C	D
	Coef s.d	Coef s.d	Coef s.d.	Coef s.d.
Constant	***-2,401(0,249)***	***-2,433(0,254)***		
Constant 2nd interval	***-0,830(0,155)***	***-0,755(0,201)***	**0,632(0,289)**	*0,597 (0,328)*
Constant 3rd interval	***-1,287(0,440)***	***-1,294(0,457)***	**-0,975(0,499)**	-0,823 (0,538)
Publications (ref. No publications)				
Only non scientific publications	0,350(0,261)	0,350(0,262)	*1,094(0,598)*	0,889 (0,580)
1 or 2 publications in peer-reviewed journals	***0,711(0,202)***	***0,705(0,203)***	***1,837(0,468)***	***1,757 (0,481)***
3 or more publications in peer-reviewed journals	***0,977(0,203)***	***0,980(0,204)***	***3,139(0,523)***	***2,764 (0,509)***
Research team affiliation (réf : only university)				
National Centre for Scientific Research	-0,226(0,132)	-0,124(0,160)	-0,330(0,282)	-0,292 (0,322)
National Centre for Scientific Research (interval 2)		-0,288(0,267)		-0,313 (0,380)
National Centre for Scientific Research (interval 3)		0,040(0,501)		-0,335 (0,793)
Other public research institutions	-0,373(0,307)	**-1,397(0,634)**	*-0,942(0,541)*	***-2,178 (0,779)***
Other public research institutions (interval 2)		**1,561(0,727)**		*1,589 (0,899)*
Other public research institutions (interval 3)		-0,290(0,755)		-0,311 (1,309)
Other research team affiliation	-0,398(0,203)	-0,403(0,204)	***-1,526(0,446)***	***-1,531 (0,449)***
Financial support of PhD				
Private support (Cifre contract)	***-1,231(0,337)***	***-1,223(0,343)***	***-2,817(0,562)***	***-2,950 (0,574)***
Public research grant	0,098(0,154)	0,107(0,155)	0,404(0,327)	0,315 (0,334)
Pub. research grant and part-time lecturer position	***0,777(0,141)***	***0,779(0,142)***	***2,052(0,357)***	***1,796 (0,353)***
Other research grants	0,130(0,185)	0,131(0,185)	0,474(0,433)	0,387 (0,435)
Academic fields (ref : humanities)				
Maths and physics	-0,265(0,218)	-0,261(0,219)	***-3,163(0,593)***	***-2,900 (0,609)***
Applied science	0,086(0,189)	0,080(0,190)	***-1,186(0,440)***	***-1,211 (0,437)***
Chemistry	***-0,778(0,268)***	***-0,763(0,269)***	***-5,592(0,727)***	***-5,104 (0,737)***
Life sciences	***-0,710(0,218)***	***-0,701(0,218)***	***-4,525(0,583)***	***-4,097 (0,599)***
Law, economics and management	***0,370(0,187)***	***0,376(0,188)***	*0,703(0,433)*	0,526 (0,417)
Other PhD students characteristics				
PhD work done off campus (at home)	-0,312(0,365)	-0,310(0,369)	***-2,200(0,699)***	*-1,164 (0,631)*
Elite school graduate (pre –PhD)	0,047(0,168)	0,053(0,169)	0,499(0,343)	*0,604 (0,353)*
International pre-doctoral training	0,129(0,145)	0,122(0,146)	0,132(0,351)	-0,004 (0,350)
Recruited in the region where they obtained their degree	0,184(0,121)	0,182(0,122)	**0,538(0,255)**	**0,498 (0,252)**
Father manager, liberal or executive	***0,352(0,125)***	***0,353(0,126)***	**0,644(0,269)**	**0,612 (0,270)**
Mother manager, liberal or executive	-0,107(0,120)	-0,107(0,121)	-0,184(0,255)	-0,267 (0,255)
Gender : Man	0,148(0,123)	0,152(0,124)	-0,362(0,267)	0,034 (0,267)
Foreign nationality	-0,255(0,279)	-0,259(0,283)	-0,408(0,569)	-0,564 (0,552)
Obtained a post-doc position (interval 1)	***-0,484(0,188)***	***-0,480(0,190)***	0,359(0,410)	0,053 (0,436)
Obtained a post-doc position (interval 2)	***0,952(0,274)***	***0,947(0,280)***	***1,861(0,484)***	***1,805 (0,495)***
Obtained a post-doc position (interval 3)	***1,707(0,505)***	***1,721(0,577)***	***3,101(0,685)***	***3,071 (0,850)***
PhD duration (ref :more than 4 years))				
Less than 3 years	-0,262(0,201)	-0,257(0,203)	-0,182(0,401)	-0,332 (0,421)
Between 3 and 4 years	0,006(0,132)	0,007(0,132)	***0,964(0,317)***	**0,730 (0,305)**

Italic indicates significant results at the 10% level, bold are significant at the 5% level, results in italic and bold are significant at the 1% level

Table 2 : The probability of accessing a post-doc position

	Model 1				Model 2			
	A		B		A		B	
	Coef	s.d	Coef	s.d	Coef	s.d	Coef	s.d
Constante	-3,374	(0,332)	-3,373	(0,335)				
Publications (ref. No publications)								
Only non scientific publications	-0,056	(0,364)	-0,057	(0,364)	-0,222	(0,516)	-0,226	(0,517)
1 or 2 publications in peer-reviewed journals	*0,450*	*(0,236)*	*0,449*	*(0,237)*	*0,665*	*(0,368)*	*0,685*	*(0,368)*
3 or more publications in peer-reviewed journals	***0,776***	***(0,231)***	***0,776***	***(0,231)***	***1,070***	***(0,396)***	***1,079***	***(0,394)***
Financial support of PhD								
Private support (Cifre contract)	***-0,940***	***(0,280)***	***-0,940***	***(0,280)***	***-1,277***	***(0,478)***	***-1,303***	***(0,475)***
Public research grant	***0,496***	***(0,173)***	***0,497***	***(0,173)***	***0,658***	***(0,265)***	***0,663***	***(0,267)***
Pub. research grant and part-time lecturer position	***0,585***	***(0,213)***	***0,585***	***(0,213)***	**0,790**	**(0,317)**	**0,780**	**(0,318)**
Other research grants	***0,537***	***(0,208)***	***0,538***	***(0,209)***	**0,768**	**(0,317)**	**0,785**	**(0,318)**
Academic fields (ref : humanities)								
Maths and physics	***1,690***	***(0,302)***	***1,690***	***(0,303)***	***2,624***	***(0,849)***	***2,662***	***(0,845)***
Applied science	**0,735**	**(0,302)**	**0,734**	**(0,304)**	**1,268**	**(0,540)**	**1,290**	**(0,537)**
Chemistry	***2,301***	***(0,304)***	***2,301***	***(0,305)***	***3,463***	***(0,966)***	***3,516***	***(0,962)***
Life sciences	***1,805***	***(0,274)***	***1,805***	***(0,275)***	***2,725***	***(0,852)***	***2,757***	***(0,845)***
Law, economics and management	-0,184	(0,406)	-0,185	(0,408)	-0,194	(0,525)	-0,207	(0,520)
Research team affiliation (ref : only university)								
National Centre for Scientific Research	***0,560***	***(0,178)***	***0,560***	***(0,178)***	***0,797***	***(0,293)***	***0,766***	***(0,291)***
Other public research institutions (interval 2)	**0,480**	**(0,264)**	**0,481**	**(0,265)**	*0,742*	*(0,389)*	*0,741*	*(0,395)*
Other research team affiliation	0,137	(0,259)	0,138	(0,259)	0,220	(0,367)	0,207	(0,368)
Other PhD students characteristics								
Elite school graduate (pre-PhD)	**-0,483**	**(0,195)**	**-0,483**	**(0,196)**	**-0,707**	**(0,313)**	**-0,708**	**(0,315)**
International pre-doctoral training	0,073	(0,180)	0,073	(0,180)	0,022	(0,246)	0,027	(0,248)
Gender : Man	0,050	(0,150)	0,050	(0,150)	0,137	(0,205)	0,165	(0,208)
Foreign nationality	-0,002	(0,294)	-0,002	(0,296)	-0,064	(0,412)	-0,072	(0,413)
PhD duration (ref :more than 4 years))								
Less than 3 years	**0,529**	**(0,226)**	**0,529**	**(0,227)**	*0,578*	*(0,314)*	*0,569*	*(0,315)*
Between 3 and 4 years	0,093	(0,172)	0,093	(0,173)	0,083	(0,233)	0,063	(0,235)
Viva Phd months								
February, March, April, May	***0,554***	***(0,182)***	***0,554***	***(0,182)***	***0,619***	***(0,258)***	**0,615**	**(0,260)**
June, July, August	*0,336*	*(0,193)*	*0,336*	*(0,194)*	*0,441*	*(0,268)*	*0,445*	*(0,271)*

Italic indicates significant results at the 10% level, bold are significant at the 5% level, results in italic and bold are significant at the 1% level

Table 3 : Parameters estimates of the unobserved heterogeneity

	Model 2, A	Model 2 B
δ_1	***-5,574 (1,506)***	***-5,654 (1,481)***
δ_2	***-2,361 (0,696)***	***-2,409 (0,666)***
ε_1	0,807 (0,594)	*1,011 (0,591)*
ε_2	***-10,119 (1,232)***	***-9,428 (1,224)***
ε_3	***-4,512 (0,722)***	***-4,078 (0,686)***
p (δ_1, ε_1)	-0,563 (0,422)	-0,593 (0,458)
p(δ_1, ε_2)	-0,207 (0,806)	-0,179 (0,838)
p(δ_1, ε_3)	*0,533 (0,317)*	*0,664 (0,343)*
p(δ_2, ε_1)	***-2,010 (0,472)***	***-1,903 (0,454)***
p(δ_2, ε_3)	-4,587 (17,108)	-4,568 (19,058)
Corr(δ , ε)	**-0.523 (0.267)**	**-0.498 (0.257)**

Italic indicates significant results at the 10% level, bold are significant at the 5% level, results in italic and bold are significant at the 1% level

Table 4. Individual descriptive statistics

	Mean
Academic fields (ref : humanities)	
Maths and physics	0.13
Applied science	0.21
Chemistry	0.13
Life sciences	0.21
law, economics and management	0.13
Humanities	0.18
Publications	
No publication	0.19
Only non scientific publications	0.09
1 or 2 publications in peer-reviewed journals	0.32
3 or more publications in peer-reviewed journals	0.39
Financial support of PhD	
Private support (Cifre contract)	0.12
Public research grant	0.23
Pub. research grant and part-time lecturer position	0.16
Other research grants	0.12
Other	0.37
Research team affiliation	
National Centre for Scientific Research (and joint research unity)	0.48
Other public research institutions	0.08
Other research team affiliation	0.16
University research team (without other affiliation)	0.28
PhD duration	
Less than 3 years	0.16
Between 3 and 4 years	0.46
More than 4 years	0.16
Other PhD students characteristics	
PhD work done off campus (at home)	0.04
Elite school graduate (pre –PhD)	0.18
International pre-doctoral training	0.16
Recruited in the region where they obtained their degree	0.58
Father manager, liberal or executive	0.44
Mother manager, liberal or executive	0.32
Gender : Man	0.57
Foreign nationality	0.05
Obtained a post-doc position	0.31