

Professionnel paths of french young PhD earners : « taste for science » faces labor market's reality.

Julien Calmand

Cereq

Deeva

August 31, 2011

Abstract

In the knowledge society young PhD graduates should have a major role in our economy. They play a central part in the dissemination of "scientific and technical human capital" (Dasgupta et David, 1994[5]) in the academic sector but also in the private sector. However, data in several countries shows that PhD graduates are facing growing difficulties in the labor market (Enders, 2002[7] ; Ma et Stephan, 2005[14]; Bonnal et Giret, 2009[2]) In France, more than 70% of them wants to work in public research or academic sector when they enter in the labor market but only 40% of them manage to find a job in this two sectors. Also when they don't find this kind of job, some of PhD graduates are unemployed (10%), in fact PhD earners have much more probability to be unemployed 3 years after graduation than graduates from engineering or business school or graduates from master degree, they also have greater chances to have fixed terms contract especially in fields of study where post doctorate experience has become necessary for working in academic sector.

The aim of this article is to study PhD graduate's paths during their first 3 years in the labor market. We use the "Génération" survey made by the Céreq (Centre d' Etudes et de Recherches sur les Qualifications) "Génération 2004". This survey analyses transition from school to work of graduates in 2004. In "Génération 2004" there is a sample of 1400 graduates from PhD in 2004 and surveyed in 2007. This sample is representative of the population of PhD earners in terms of field of study or type of education grant. "Génération 2004" is a longitudinal survey; it includes monthly information on the various stages occupied on the labor market during 3 years.

In terms of methodology, we will study paths of PhD graduates who wanted to work in academic sector at time of graduation. Our idea is to define a concept of "typical path" in order to obtain several representative and homogeneous path from the 1400 in our database. A multinomial model will give us "all things being equals" the impact of graduates' characteristics on their path. The major interest of this study is to analyze breaking points in trajectories. These breaks are for example transition from fixed terms contract to unlimited contract in academic research or reorientation from academic research to public or private sectors (outside or inside the research) but also to

unemployment. Those breaks can be related to personal study project during initial school time period . Our first results show that transition from work to school for PhD graduates are related to conditions of the thesis period (sources of financial supports obtained during the Phd , nature of the research laboratory, numbers of scientific publications...). As a summary, first cumulative advantages in the first years of the thesis have a major impact on the scientific productivity of young PhD graduates but also on professional path.

Introduction

In a knowledge-based economy, young PhD earners should occupy a central role in the dissemination of scientific production in the public and private research (Gaughan et Robin, 2004[11]). However, for several years, surveys in several countries, on career path of PhD earners point their increasing difficulties to find job in the labor market and to secure their positions (Enders, 2002[7] ; Ma et Stephan, 2005[14]; Bonnal et Giret, 2009[2]). While the PhD diploma is the highest and most prestigious level of education that young people can achieve, the professional value of the PhD is often questioned. In France, surveys from the Céreq repeatedly show the difficulties for young PhD earners to stabilize their positions in the labour market compared to young engineers and even to Master graduates.

In this work, we propose to study more precisely the professional plans and career paths of young PhD earners during their first three years in the labour market using the latest survey made by the Céreq called "Generation 2004" which concern the French school leavers in 2004. This survey has the advantage of having a sample of 1400 PhD graduates in 2004 and interviewed in 2007. This cohort of young PhD earners is representative in terms of major disciplines and types of funding at the national level and they are questioned retrospectively on their first three years of working life. A monthly professional calendar allows us to identify their path in the labor market and thus to better understand the dynamics of their trajectory. From a methodological point of view, in this work we use a classification method based on coupling a "dynamic clustering - hierarchical classification." Dozens of classes are defined from the first algorithm and are aggregated into eight classes based on a hierarchical classification (Ward's method) by integrating the weight classes. We then study the impact "all things are being equal" of individual characteristics of PhD earners on their initial trajectory. The interest is to understand the particular points of breaks in the paths that are characterized for young PhD graduates by the abandonment of temporary jobs in the academic field, shifts to the private sector or public outside research or periods unemployment. These breakpoints may be particularly relevant to the projects and paths of young people in higher education (Fox et Stephan, 2001[9]; Giret et alii., 2007[13]).

The thesis: a worthwhile investment for students ?

Since Gary Becker's work, economists apprehend educational choices in terms of investment: an individual decides to continue his studies when the marginal benefit

of education is higher than his marginal cost (Becker, 1994[1]). This question arises after compulsory education when young people actually have the opportunity to choose their training. Among the various choices throughout the process of learning, it is logical to think that the question of the choice between two alternatives arises really for young people after a Master's degree or after an Engineering Schools' degree: direct entry into the labor market or pursue in a PhD. According to the theory of human capital gains associated to the PhD should exceed the costs of the three years of studies.

The employment status of PhD earners in the labor market studied in several investigations made by the Céreq in the "Génération" surveys, raise questions about the theoretical framework. According to surveys of Céreq, while the number of PhD students increased by 9 000 to about 10 000 between 2000-2001 and 2005-2006, the unemployment rate of PhD earners rose from 7% to 11% during this period. Another recurrent finding of these investigations, PhD earners are more often unemployed than graduates from Engineering Schools, and than graduates from a Master's degree (vocational or general). Their jobs are more uncertain due to the increase of temporary situations in early career (post-doc fellowships, participation in research contracts). As Perrucher (Perruchet, 2005[22]) showed, the monetary returns to a PhD is often very low. It is true that economic calculation is more complex than it seems: a portion of PhD students receive fundings, which reduces quite significantly the opportunity cost. Others PhD students work during their training, which often changes the nature of the choice by extending the duration of the training and by deferring income or by making it more random when the professional activity does not allow the achievement of the thesis.

In a knowledge-based economy (Foray, 2009[8]), the thesis may also benefit the society and therefore represent a profitable investment for society, even if it is not the case for individuals. To reach their technological frontier, countries must develop a proactive innovation policy, mainly based on research. The revival of growth theories in the 90's has given a prominent role in highly qualified staff (Nelson et Phelps, 1966[20]). Young PhD earners are supposed to occupy a central role in the dissemination of scientific production in public and academic research. The adoption and implementation of new technology are enhanced by the presence of highly qualified personnel in companies. Dagusta and David (Dasgupta et David, 1994[5]) stress the importance of the mobility of academic researcher to industry, to promote the transfer of knowledge between academic research and R&D.

In our point of view, few studies have clearly demonstrated the effects of the number of PhD earners or the number of thesis on economic growth in France. However, surveys on the access of young PhD earners to private sector point a stagnation of career opportunities in R&D or outside the R&D, although there are nuances based on profiles of the students (Giret et alii., 2007[13]). The causes of these difficulties are numerous, they are both found on the supply and the demand sides. In the R&D sector, young PhD earners suffer from competition from engineers who are much appreciated by employers (Perrin, 2001[21]). There are many reasons (Beltramo, Paul et Mason, 1994[16]) :the importance of networks of high schools in recruiting and a desire to focus on a relatively homogenous culture across all services, the management of careers in R&D that emphasize mobility to other functions within

the company. In addition, there may be different prejudices of employers towards doctoral training (Duhautois, 2005[6]) : too much specialization, too little productivity for the company. In all, the doctors (excluding health) represent only 9.4% of researchers in the private sector (against 52.5% of engineers) and young PhD graduates are only 11.7% of researchers recruited in the year.

The question of the social utility of the doctorate does not have to be reduced to access to R&D. The majority of young PhD earners (at least relative) are still three years after their graduation in the academic sector (41% in the last survey Cereq). However, only one part has gained a permanent position and for the others, the probability of being recruited is generally reduced gradually recedes as the end of thesis. In the non-academic, public and private, the question of over education and dissatisfaction with their professional career is at stake.

Taste for research and transfer of academic capital.

Despite the difficulties of integration in the public and academic research sector most PhD earners graduated in 2004 and interviewed in the "Génération" surveys wants to work in academic or public research: over 70% of PhD graduates in 2004 wanted at the time of graduation to work in this area. This observation leads us to ask several questions. Why do young PhD earners prefer to work in academic and public research? Why investigations in "Génération" surveys show a stability of this choice ver the time ?

The choice is apparently not rational, especially for economists of human capital, except to apply a hedonic approach of employment: they have a "taste for research". They would favor research compared to other job characteristics, including the salary. Stern (Stern, 2004[23] shows that the "taste for research" of scientists pushes them to "pay" for working in research. Indeed if we compare to other positions in business sector, scientists suffer earnings losses compared to those who do not occupy positions in R&D. Finally researchers, because they have a taste for research accept a devaluation of their pay in order to access to research functions. Work in academic research can be explained by the fact that PhD graduates have a marked taste for science (Merton, 1973[19]), that is to say, learn, understand, study and research but also by the fact that they are attracted by the rewards and prestige of the position of researcher. Here is the function of research in itself which can explain the preference of young PhD graduates for academic research. Rewards such as awards, recognition and honors, as the name given to an eponymous discovery are examples that motivate scientists to work in research (Merton, 1957[18]). Finally, as explained Menger there is a parallel with the artist occupation, the uncertainty of the realization of the research profession contributes to the social prestige by producing the rarity of this mode of election (Menger, 1989[17]). The prestige associated to academic research is linked to the fact that there are many contenders and few are chosen. As for being an artist, the work of a researcher, is valued under the aspects of the variety and complexity of the tasks performed, their ability to showcase all the individual skills, sense of responsibility, consideration, individual recognitions, working conditions, role of technical competence in the definition and

mode of exercise of hierarchical authority, degree of autonomy in the arrangement of tasks, structure of industrial relations, social prestige of the profession and status accorded to those who succeed (Menger, 1989[17]). These non-monetary benefits: do what you love (research), the prestige of the profession, recognition, quality of work (autonomy, hierarchy) justify the choice of a career in academic research and trajectories more uncertain in terms of professional transition.

However, the question arises of the construction of this taste for research. The work of P. Bourdieu in *Homo Academicus* provides an interesting response (Bourdieu, 1984[4]). For the sociologist, access to the research community is using the same principle that governs the reproduction of social classes. Young people from more advantaged backgrounds are turning to academic research because they have an “habitus” higher than young people from more modest backgrounds and their available economic, social and cultural capital is valued within the field of academic research.

When young PhD graduates start their thesis they are developing a specific scientific capital in the field of research, thus they have no idea that their habitus is valuable in another field than research (Bourdieu, 1984[4]). After reading the explanation of Bourdieu, young PhD earners are investing at the beginning of their thesis in the only capital valued in academic research (publications, funding, CNRS lab¹) and they are not aware that they can be exploited in others fields other than research. The irreversibility of the choice at the time of PhD training (Mangematin, 2000[15]) is that recruitment criteria between academic and private spheres are not the same. Thus from the beginning of their thesis, PhD graduates comply with the criteria in academic research, not those prevailing in the recruitment in the private sphere, they adjust from the beginning of their thesis to the selection criteria of their future employer and must make the right choices when they start their PhD training: financing options, choice of the supervisor. It is very difficult to change of professional paths when it has set a goal to work in academic research because recruitment patterns between academic research and private research are highly differentiated. The common feature of this analysis is that young PhD internalize during the beginning of their training the norm of universalism of science (Merton, 1957[18]), they make research-oriented school choice from the beginning of their doctoral education that prevent them from forking to other sectors. Therefore we need to check if having been funding, publishing during his thesis, doing a thesis in a laboratory, university or in a firm have an effect on the choice of working in academic research.

Finally, the preference for academic research is built through a linkage between the representations of employment of the PhD earners and the actual conditions of employment in these areas (Fox et Stephan, 2001[9]). Although the study of preference for a sector is very complex. Preferences are inherently subjective and they are determined by the actual conditions of employment in these sectors. Employment prospects of young PhD earners are based on their perception of the possible future. Perspectives and perceptions can be built through experience. The prospects are a range of possibilities in the near future while the possible perceptions are determined by the situation during their PhD training. Therefore the economic conditions in the labor market for PhD earners when they are graduated shape their preferences for

¹CNRS: Centre national de la recherche scientifique

the different sectors (Freeman, 1975[10]). The preference for academic research can also be explained by the unemployment rate of PhD earners, the number of available positions in the civil service, the qualification rate by disciplines, the proportion of young doctors in other areas, all at time of their graduation.

A preference for research that begins early in the thesis.

In this article we seek to show first that access to doctoral studies is determined by social background but also by a taste for research in the early days of enrollment in higher education. We know that access to different levels of higher education is largely determined by socio-demographic characteristics of young people and the democratization of education, that is to say access for young people from the lowest socio economic background to the highest degrees of higher education, is a very slow process (Merle, 2002[?]). To test these hypotheses we created a model all things being equal on the determinants of leaving the labor market with a PhD. Of the 80 000 graduates from a Master degree that came out of the workforce almost 18% of them have a PhD. In order to assess the sociodemographic characteristics of young people we have introduced in the model variables which telling us about the social profile of parents and variables which give us information about higher education trajectories. To measure the effect of social background we have introduced the following variables: the fact that both parents are professionals, the fact that only the father is a professional, the fact that only the mother is a professional and finally the fact that the father was born abroad. In the context of analysis of reproduction in academia (Bourdieu, 1984[4]), it would have been preferable to know if one of the parents had a PhD, but this information is not available in "Génération" surveys. Also it seems important to introduce the occupation of both parents because we know that the social background of the father or the mother has a different influence on access to education level according to the level of education, the discipline and gender (Boumadhi et Lemistre, 2006[3]). In order to introduce the educational determinants of school leavers we have introduced the grade at Baccalauréat (good and very well vs the rest), the type Baccalauréat (General vs Vocational) and finally the type of study pursued directly after obtaining the Baccalaureat (General²/Vocational Bachelor³, CPGE⁴). To measure the preference for research project we introduced the professional prospect of young graduates at time of the Baccalauréat.

The results presented in the table 1 show that being graduated of a PhD is largely conditioned by social background, the educational trajectory and the career plan at the time of Baccalauréat. Having both professional parents has a positive effect on getting out in 2004 with a PhD, on the contrary have a foreign father has a negative effect on the same probability. Men are more likely to enter into the labor market with a PhD than women. Been enrolled directly after Baccalauréat

²General Bachelor: DEUG (Diplôme d'Etudes Universitaires Générales).

³Vocational Bachelor: DUT (Diplôme Universitaire de Technologie) or BTS (Brevet de Technicien Supérieur).

⁴CPGE: Classes Préparatoires aux Grandes Ecoles.

Table 1: Les facteurs explicatifs de la sortie au niveau doctorat en 2004.

	(1)	(2)	(3)
	doctorat	doctorat	doctorat
onepecadre	-0.125 (-1.79)	-0.0969 (-1.26)	-0.106 (-1.35)
onemecadre	-0.0421 (-0.39)	0.0351 (0.31)	0.0405 (0.34)
peretra	-0.297* (-2.11)	-0.394** (-2.71)	-0.428** (-2.84)
homme	0.141* (2.39)	0.256*** (4.14)	0.239*** (3.77)
parcad		0.304*** (3.82)	0.305*** (3.76)
mention_btb		0.492*** (6.40)	0.471*** (6.00)
bacg2		-0.0951 (-0.68)	-0.0595 (-0.42)
tiut		-1.386*** (-11.02)	-1.322*** (-10.38)
tprepa		-0.231** (-2.97)	-0.204* (-2.56)
tbts		-1.473*** (-6.93)	-1.359*** (-6.34)
tautre		0.316*** (3.45)	0.257** (2.72)
rechbac			1.778*** (13.30)
_cons	-0.605*** (-12.17)	-0.559*** (-3.71)	-0.708*** (-4.58)
<i>N</i>	5075	5075	5075

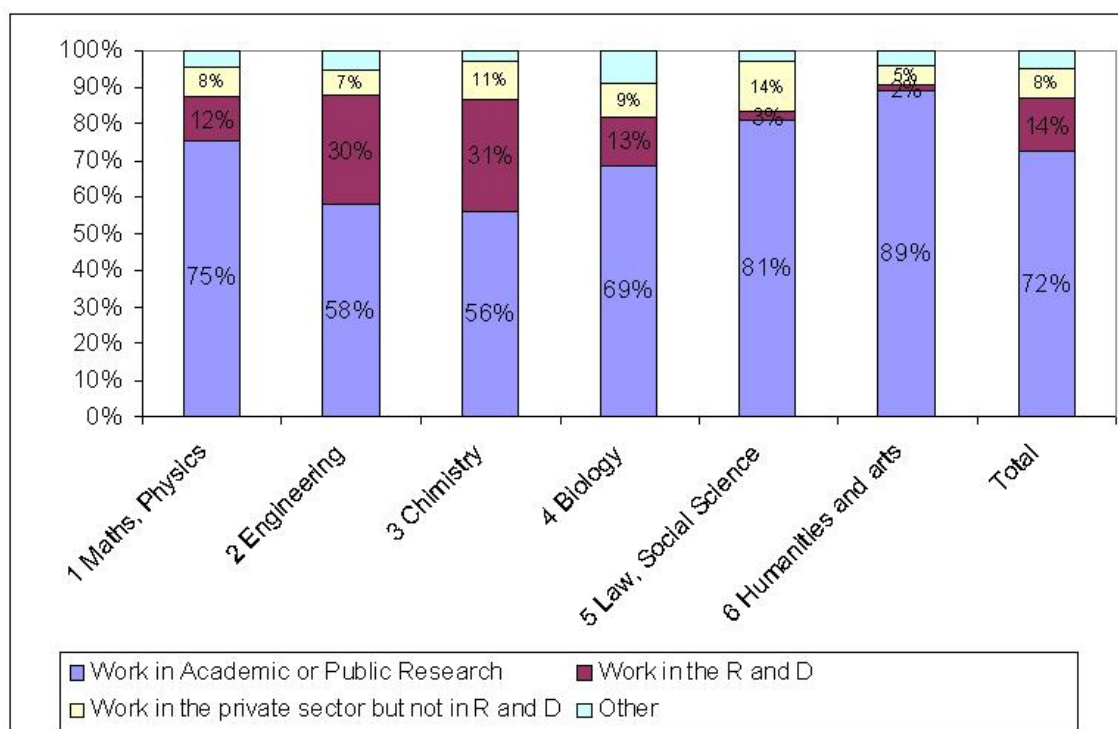
t statistics en parenthèses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

in a vocational Bachelor, in a CPGE has a negative effect on the probability of entering into the labor market with a PhD, on the contrary been enrolled of a general Bachelor has a positive effect. We may think that young people who have done CPGE after their Baccalauréat are more frequently on the job market with a degree in Engineering Schools. Having a professional project "work in research" at the time of the Baccalauréat has a positive effect on getting out with a PhD, the preference for research at the start of enrollment in higher education has an effect on being graduated from a PhD.

We will now test the determinants of the preference for academic research among young people who had a PhD in 2004. The variable here is the preference for public research at time of graduation in 2004. Several choices are offered in the questionnaire "Génération", working in public and academic research, work in R&D, work in private sector outside of the research, etc.... As shown in the following table and as we mentioned in the introduction more than 70% of the PhD earners want to work in public and academic research at the time of their graduation.

Figure 1: Professional prospect at time of PhD graduation in 2004.



Sources : Génération 2004.

We therefore seek to develop a model in order to explain the determinants of preference for academic research at the time of graduation. Depending on the assumptions used in the first part, we made five logit models. The first model helps us to determine the influence of sociodemographic characteristics on the preference for academic research, to be done we used the same variables as for the model previously developed. To achieve the second model we added the educational characteristics of young PhD earners, the grade of the Baccalauréat and also if the Baccalauréat is specialized in Sciences. The third model takes into account the characteristics of the

PhD. We consider the discipline of the thesis, the funding of the thesis, the place of production of the thesis, the type of laboratory where the PhD earner carried out his thesis, the number of peer-reviewed publication, and finally obtaining or not a “Grandes Ecoles” diploma before enrollment in PhD. The fourth model takes into account two variables in order to achieve a proxy of market conditions of the PhD earners. The first variable is the success rate for “qualification” in 2004 by fields of studies and the number of researchers in the private sector for 1000 Employees by regions in 2006. Finally in the last model, we introduced the professional prospect at time of the Baccalauréat.

Table 2: Les Facteurs explicatifs de la préférence pour la recherche.

	(1)	(2)	(3)	(4)	(5)
	rechthese	rechthese	rechthese	rechthese	rechthese
parcad	0.355*	0.323*	0.295	0.298	0.199
	(2.44)	(2.19)	(1.84)	(1.86)	(1.22)
onepecadre	-0.159	-0.177	-0.267	-0.267	-0.275
	(-1.12)	(-1.24)	(-1.72)	(-1.72)	(-1.74)
onemecadre	0.185	0.174	0.0498	0.0565	0.00853
	(0.85)	(0.79)	(0.21)	(0.24)	(0.04)
peretra	-0.515	-0.564	-0.316	-0.309	-0.247
	(-1.67)	(-1.81)	(-0.93)	(-0.92)	(-0.72)
homme	-0.326**	-0.309**	-0.230	-0.230	-0.0974
	(-2.78)	(-2.62)	(-1.77)	(-1.77)	(-0.71)
mention_btb		0.167	0.325*	0.319*	0.256
		(1.27)	(2.14)	(2.10)	(1.65)
bac_s		-0.389***	-0.367**	-0.367**	-0.0946
		(-3.37)	(-2.66)	(-2.66)	(-0.63)
ingenieur			-0.468**	-0.463**	-0.250
			(-2.67)	(-2.65)	(-1.38)
moniteur			-0.608***	-0.610***	-0.553**
			(-3.51)	(-3.52)	(-3.14)
autre			-0.541**	-0.538**	-0.668***
			(-3.16)	(-3.14)	(-3.76)
cifre			-2.059***	-2.062***	-1.975***
			(-8.54)	(-8.55)	(-8.43)
inscr01			-0.155	-0.160	0.140
			(-0.89)	(-0.92)	(0.76)
inscr00			-0.125	-0.129	0.0965
			(-0.78)	(-0.81)	(0.57)
ratachcnrs			-0.455**	-0.454**	-0.249
			(-2.82)	(-2.81)	(-1.48)
ratachautre			-1.156***	-1.144***	-1.132***
			(-4.48)	(-4.43)	(-4.27)
ratachepts			-0.636*	-0.647**	-0.486
			(-2.55)	(-2.59)	(-1.85)

Suite page suivante...

	(1)	(2)	(3)	(4)	(5)
	rechthese	rechthese	rechthese	rechthese	rechthese
lieuorga			-0.00521 (-0.03)	-0.00919 (-0.05)	0.0162 (0.09)
lieuautre			-0.527** (-2.94)	-0.521** (-2.90)	-0.452* (-2.44)
publi2			0.148*** (3.95)	0.146*** (3.91)	0.162*** (4.21)
rqualif			0.00549 (0.82)	0.00583 (0.87)	
densird			-0.00667 (-0.39)	-0.00685 (-0.40)	
rechbac				0.122 (0.70)	
svt					-0.197 (-0.80)
inge					-0.467* (-2.02)
chimie					-0.844*** (-3.43)
dreco					0.375 (1.18)
lsh					0.868** (2.87)
_cons	1.027*** (8.89)	1.215*** (8.83)	2.134*** (7.18)	2.119*** (7.11)	1.702*** (4.86)
<i>N</i>	1552	1552	1552	1552	1552

t statistics en parenthèses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results of the models show a predominance of conditions of the thesis on the preference for academic or public research. Although the sociodemographic characteristics seem to have a role in the preference for academic research, having a father born in foreign country has a negative effect, of having both parents working as professional has a positive effect, it seems that the irreversibility assumption seems to dominate. For example, the funding of the thesis has significant effect. Having received funding such as a CIFRE⁵ has a negative effect on the preference for research opposed to receive a ministerial funding, we can assume that these PhD earners are more relevant to work in R&D. Another determinant of the completion of the thesis is the number of publications in peer-reviewed journals, the higher the number the higher the probability of choosing public research is high. Being attached to EPST⁶ or CNRS has negative effect on the preference for academic research at the time of graduation as opposed to being attached to a university. Having done his research in another place than in a university or a laboratory has a negative effect on the

⁵CIFRE: Convention Industrielle de Formation par la Recherche

⁶EPST: Etablissement Public à caractère Scientifique et Technologique

preference at the time of graduation. We see the importance of the determinants of the characteristics of the thesis on the preference for public/academic research, doctors are investing from early time in their thesis in the capital valued in the field of academic research (funding, laboratory, publication), and these investments do not seem valuable in other economic sectors such as private research or private non-research. We see from these models all things being equal that the various indicators on the labor market such as the rate of success in the “qualification” by disciplines or the number of researchers per 1000 employees by regions has no significant effect on the preference for research even if the effects have the sign expected. Indeed the higher the rate of success in the qualification, the higher the probability of preferring academic research is high as well as the number of researchers per region is high unless the probability of the preference for academic research is high. Although these variables deserve to be refined, we can assume that preferences are not determined by the actual conditions of employment. The model can also reject the hypothesis of hedonic preference for research. Indeed having professional project to work in research at time of the Baccalaureat has no significant effect on the preference for research.

The high segmentation of the trajectories after the PhD.

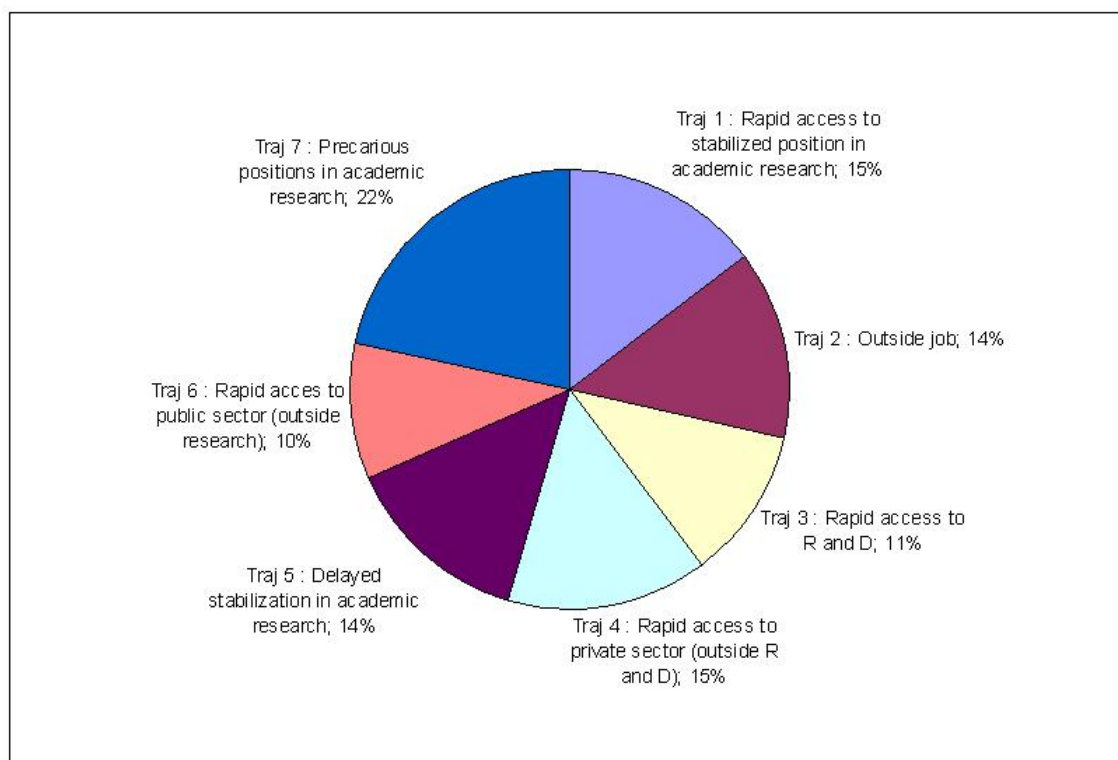
At this level of analysis we can distinguish seven types of transition profiles of young PhD earners who wanted to work in academic research or public.

The calendar of employment of young PhD earners were recoded by grouping situations of non-employment (unemployment and inactivity) and disaggregating employment status according to the nature of the professional activity and the employment contract. In total, seven states were selected:

- still in PhD preparation,
- not in employment (that is to say in a situation of unemployment or inactivity),
- stable employment (unlimited contract and civil servant) in public/academic research
- limited contract in public/academic research,
- employment in private research,
- employment in the private sector outside the research,
- employment in the public outside the research.

Depending on its pathway, each youth will be involved in a typical trajectory ;

Figure 2: The different trajectories in public/academic research.



Sources : Génération 2004.

Two trajectories are geared toward stabilization in the academic job:

- The trajectory of rapid stabilization in academic research (Figure 3) which brings 15% of PhD earners, in September 2004, 64% of doctors are stabilized in public/academic research. At the time of the survey 75% of PhD earners are civil servants in public/academic research. At time of their first job 63% of PhD earners are already civil servant.
- A trajectory is characterized by a delayed access to stable employment in academic/public research (Figure 7) this concerns 14% of PhD earners. Stabilization in academic/public research is mainly in September 2005, one year after graduation. In August 2005, 52% of young PhD earners are in fixed-term contracts in public/academic research and 23% are unemployed. A third of PhD earners in this trajectory had at least three sequences of employment. At time of their first job more than a third of these young people were assistant (ATER)⁷.
- The most important trajectory (22%), is characterized by a long period of precarious employment in academic/public research (Figure 9). In May 2006, that is to say, two years after graduation, 98% of the PhD earners of this trajectory are in fixed-term contract. Unlike the previous path only 15% of doctors are assistant (ATER) at their first job and more than 61% in a fixed

⁷ATER: Attaché Temporaire d'Enseignement et de Recherche

terms contract in academic/public research. At the time of the survey 48% of PhD earners are not yet stabilized in this sector. One quarter of the PhD are able to get an unlimited contract in academic/public research, 10% are unemployed three years after graduation, 8% in R&D and 7% in the private sector but outside the research. Yet in these two sectors over a third of the PhD has still a fixed terms contract at time of the survey.

A trajectory is characterized by rapid access to R&D (Figure 5). It represents 11% of PhD earners who were ready to work in academic/public research. For a third of PhD earners who work in this sector this work experience is their first step into working life. A year later, 75% of PhD earners are working in R&D. This path is marked by relatively stabilized positions since the third of the PhD earners has only one sequence of employment and 30% experiencing 2 sequences. At the time of the survey more than half of the PhD earners are in unlimited contract and thus stabilized in R&D. The following three paths do not concerned access to research whether in private or public sector. More than a third of PhD earners are in these types of trajectories.

- The first path is a quick access to the private sector outside of the research (Figure 6), 15% of PhD earners are in this case. In January 2005 more than 65% of PhD earners are working in this sector and nine months after it is over 85%. Over 50% of PhD earners are in unlimited contract at the time of investigation.
- The second path concerns 10% of PhD earners and is characterized by fast access to the public sector outside of the research (Figure 8). In September 2005, 85% of PhD earners are working in public sector but outside of research. Almost 60% of PhD earners in this part are civil servant at the time of the survey and 13% are in unlimited contract.

The last trajectory brings 14% of PhD earners who wanted to work in public/academic sector at time of graduation (Figure 4). This trajectory is marked by a distance to employment.

When we look at the distribution by fields of studies, the results seem consistent with the descriptive statistics presented above (Giret, 2005[12]). Disciplines where the PhD earners know a fairly difficult integration can be found in the path marked by a distance from employment; this is the case of young people in chemistry and Humanities. The path of delayed access to research is characterized by a large number of PhD earners from Chemistry and Biology on the contrary, very few PhD earners in Law, Social Science and Humanities are in this path. The aim of this last part is to investigate the déterminants which influence the belonging in different types of trajectories. In order to analyze this process we created a multinomial logit model (Table4). The reference trajectory is the trajectory of rapid access to stability in academic/public research. The model tells us the effect of each variable on the fact of belonging to a trajectory rather than the path that we believe to be the best that is to say, the quick path to stability in the academic/public research. We first notice that the conditions of realization of the thesis are still important on the probability of being in a different path than the reference trajectory. Do not be published or

Table 3: Trajectories by fields of study.

	Math Physics	Eng.	Chim.	Biology	Law Eco- nomic	Hum.	Total
Trajectory 1	20%	17%	7%	7%	20%	15%	15%
Trajectory 2	7%	6%	16%	9%	19%	20%	14%
Trajectory 3	15%	14%	20%	26%	2%	1%	11%
Trajectory 4	8%	18%	11%	10%	25%	14%	15%
Trajectory 5	14%	16%	10%	8%	21%	13%	14%
Trajectory 6	8%	7%	7%	6%	5%	19%	10%
Trajectory 7	28%	22%	29%	33%	8%	18%	22%

Sources : Génération 2004.

have not published in journals with peer review increases the likelihood of being in the path of distance from employment or in the path of access to private sector outside research. Having received only national funding and not being assistant during his thesis increases the likelihood for all other paths rather than the rapid stabilization in academic/public research. We find the same results with the fact of not having funding or funding other than the national funding or CIFRE. Receiving a CIFRE rather than a public funding raises the probability of being in the path of access to private outside research. Sociodemographics and school characteristics have a slight effect on the probability of being in a different path than the reference. And not having both parents as professionals has a negative effect on being in the path of access to private research. Also having a good or very good grade at the Baccalaureat has a negative effect on the probability of being in the most difficult path which is the distance from the labor market. These results show that there is very little effect of the fields of the studies in the probability of belonging to any path. Finally, we find that there is very little difference in characteristics between the PhD earners who are in the path of rapid access to the stabilization in academic/public research and the access of delayed access to the stabilization in academic/public research.

Conclusion

Analysis of the conditions of transition from school to work of the PhD earner questioned about the rationality of the choice of orientation in doctoral training, but also about the preference for integration into the academic research of young PhD earners. Analysis of the transition from school to work paths of PhD earners in the "Generation 2004" in academic research confirms two strong assumptions. When they are designed to work in academic research, they make research oriented choices from the beginning of the doctoral program, over these choices seem irreversible. Evolutions of staff in higher education announced by the DEPP in 2009 (DEPP, 2009 citeEmploiscientifique2009) may have several implications which may affect the

PhD earners. Indeed, the number of higher education students should fall sharply in 10 years (-6.9 %), ie 153 800 students fewer than in 2007. The number of students in doctoral training therefore decrease 32.2 %. With this in mind we can assume that with the announced retirement in higher education, competition for access to tenured positions in this sector will be lower. However, if the declining enrollment in higher education is accurate, we can also assume a reduction of placements in higher education. It is possible that there is a potential shortage of doctors in certain fields of studies.

References

- [1] Gary S. Becker. *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education (3rd Edition)*. Number beck94-1 in NBER Books. National Bureau of Economic Research, Inc, 1994.
- [2] Liliane Bonnal and Jean-François Giret. La stabilisation des jeunes docteurs sur le marché de l'emploi académique. *Revue d'Economie Politique*, 119:pp. 373–400, 2009.
- [3] Rachid Boumadhi and Philippe Lemistre. Accès à l'emploi qualifié en début de vie active : les déterminants. *Les notes du Livre*, 428, 2006.
- [4] P. Bourdieu. *Homo Academicus*. London: Polity Press., 1984.
- [5] Partha Dasgupta and Paul David. Toward a new economics of science. *Research Policy*, (23):pp.487–521, 1994.
- [6] Richard Duhautois and Maublanc Severine. Les carrières des chercheurs en entreprise. Technical Report 25, CEE, 2005.
- [7] Jürgen Enders. Serving many masters : The phd on the labour market, the everlasting need of inequality, and the premature death of humboldt. *Higher Education*, 44(3/4):pp. 493–517, Oct-Dec 2002.
- [8] Dominique Foray. *L'économie de la connaissance*. Collection Repères. Éditions La Découverte, Paris, 2009. new and completely revised version of the 2000 book.
- [9] Mary Franck Fox and Paula Stephan. Careers of young scientists : Preferences, prospects and realities by gender and field. *Social Studies of Science*, 31:pp. 109–122, 2001.
- [10] R. B. Freeman. Supply and salary adjustments to the changing science manpower market: Physics, 1948-1973. *The American Economic Review*, 65(1):pp.27–39, 1975.
- [11] Monica Gaughan and Stephane Robin. National science training policy and early scientific careers in france and the united states. *Research Policy*, 33(4):569 – 581, 2004. Scientific and Technical Human Capital: Science Careers and Networks as Knowledge Assets.
- [12] Jean-François Giret. De la thèse à l'emploi. les débuts professionnels des jeunes titulaires d'un doctorat, 2005.
- [13] Jean-François Giret, Cathy Perret, and Isabelle Recotillet. Le recrutement des jeunes docteurs dans le secteur privé. *Revue d'Economie Industrielle*, 119:pp 85–102, 2007.

- [14] Jennifer Ma and Paula Stephan. The increased frequency and duration of the postdoctorate career stage. *The American Economic Review*, 95(2):pp. 71–75, 2005.
- [15] V. Mangematin. Phd job market : professional trajectories and incentives during the phd. *Research Policy*, 29:pp741–756, 2000.
- [16] Geoff Mason, Jean-Paul Beltramo, and Jean-Jacques Paul. External knowledge sourcing in different national settings: a comparison of electronics establishments in britain and france. *Research Policy*, 33(1):pp. 53 – 72, 2004.
- [17] Pierre Michel Menger. Rationalité et incertitude de la vie d’artiste. *L’année sociologique*, 1989.
- [18] Robert K. Merton. Priorities in scientific discovery: A chapter in the sociology of science. *American Sociological Review*, 22(6):pp. 635–659, 1957.
- [19] Robert K. Merton. *The sociology of science: Theoretical and empirical investigations*. University of Chicago Press, 1973.
- [20] R. Nelson and E. S. Phelps. Investment in humans, technological diffusion, and economic growth. *American Economic Review*, 56:pp. 69–75, 1966.
- [21] Jacques Perrin. *Concevoir l’innovation - Méthodologie de conception de l’innovation*. CNRS Editions, 2001.
- [22] A. Perruchet. *Investir dans une thèse : capital humain ou capital culturel ?* PhD thesis, Université de Bourgogne, 2005.
- [23] Scott Stern. Do scientists pay to be scientists? *Management Science*, 50(6):835–853, 2004.

A Annexes

Table 4: Multinomial Model: Determinants of trajectories.

VARIABLES	(1) Traj2	(2) Traj3	(3) Traj4	(4) Traj5	(5) Traj6	(6) Traj7
parcadre	-0.752(**) (0.325)	-0.887(***) (0.335)	-0.605(**) (0.300)	-0.0531 (0.298)	-0.0903 (0.334)	-0.598(**) (0.282)
onepecadre	-0.349 (0.321)	-0.664(*) (0.342)	-0.978(***) (0.339)	-0.381 (0.329)	-1.141(***) (0.434)	-0.458 (0.294)
onemecadre	0.0611 (0.474)	-0.204 (0.506)	-0.598 (0.513)	0.104 (0.474)	-0.472 (0.583)	0.00131 (0.432)
peretra	-0.470 (0.866)	-0.283 (0.855)	0.348 (0.714)	-0.243 (0.856)	-1.439 (1.194)	-0.610 (0.815)
homme	-0.315 (0.263)	-0.0922 (0.284)	0.191 (0.265)	0.0730 (0.260)	0.145 (0.298)	-0.152 (0.239)
mention_btb	-1.159(***) (0.324)	-0.610(**) (0.306)	-0.433 (0.288)	-0.0474 (0.266)	0.190 (0.312)	-0.352 (0.250)
bac_s	0.258 (0.289)	0.213 (0.305)	-0.221 (0.284)	-0.0749 (0.275)	0.252 (0.328)	0.407 (0.258)
svt	0.606 (0.555)	0.954(**) (0.484)	0.820 (0.541)	0.325 (0.520)	0.0736 (0.652)	0.978(**) (0.440)
inge	-0.396 (0.525)	-0.106 (0.438)	0.261 (0.474)	0.252 (0.429)	-0.0550 (0.564)	-0.270 (0.390)
chimie	1.073(*) (0.606)	0.863 (0.559)	0.631 (0.631)	0.472 (0.598)	0.901 (0.681)	0.638 (0.520)
dreco	-0.0455 (0.572)	-1.876(**) (0.773)	0.138 (0.563)	0.468 (0.516)	-1.598(**) (0.707)	-0.912(*) (0.524)
lsh	0.474 (0.522)	-2.040(***) (0.689)	-0.118 (0.526)	0.112 (0.484)	0.0293 (0.579)	0.0484 (0.435)
publi2	-0.195(***) (0.0742)	0.0102 (0.0766)	-0.137(*) (0.0725)	-0.0937 (0.0715)	-0.124 (0.0826)	-0.0984 (0.0656)
ingenieur	-1.171(**) (0.562)	-0.256 (0.398)	-0.304 (0.407)	-0.0511 (0.385)	-1.434(**) (0.620)	-0.330 (0.361)
moniteur	1.251(***) (0.360)	1.635(***) (0.366)	1.473(***) (0.362)	0.941(***) (0.344)	0.725(*) (0.428)	1.308(***) (0.324)
autre	0.646(**) (0.311)	0.792(**) (0.355)	1.087(***) (0.314)	0.0709 (0.315)	0.832(**) (0.343)	0.375 (0.287)
cifre	0.140 (0.780)	0.822 (0.623)	1.244(**) (0.590)	0.122 (0.629)	-0.564 (1.132)	0.582 (0.562)
inscr01	0.150 (0.383)	0.447 (0.399)	0.321 (0.360)	0.742(**) (0.367)	-1.013(**) (0.452)	1.080(***) (0.344)
inscr00	-0.125 (0.318)	-0.288 (0.359)	-0.657(**) (0.324)	0.294 (0.318)	-0.841(**) (0.352)	0.334 (0.304)

Suite page suivante...

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Traj2	Traj3	Traj4	Traj5	Traj6	Traj7
rechbac	0.245 (0.370)	0.133 (0.351)	-0.0185 (0.376)	-0.00655 (0.356)	-0.930(*) (0.544)	0.0209 (0.319)
ratachcnrs	0.221 (0.288)	0.808(**) (0.375)	-0.275 (0.288)	0.0771 (0.281)	-0.445 (0.324)	0.292 (0.268)
ratachautre	-0.190 (0.568)	-0.817 (0.790)	-0.104 (0.504)	-0.341 (0.585)	-1.114(*) (0.667)	-1.047(*) (0.602)
ratachepts	0.480 (0.654)	1.258(**) (0.626)	0.322 (0.615)	0.929 (0.617)	0.261 (0.737)	0.373 (0.569)
lieuorga	-0.406 (0.420)	0.736(**) (0.357)	0.0943 (0.372)	-0.399 (0.391)	0.0343 (0.442)	0.263 (0.330)
lieuautre	0.441 (0.416)	0.641 (0.434)	0.119 (0.411)	-0.104 (0.408)	0.270 (0.462)	0.0151 (0.386)
Constant	0.263 (0.675)	-0.865 (0.720)	0.254 (0.668)	-0.389 (0.639)	0.539 (0.745)	0.00146 (0.591)
<i>N</i>	1,093	1,093	1,093	1,093	1,093	1,093

t statistics en parenthèses

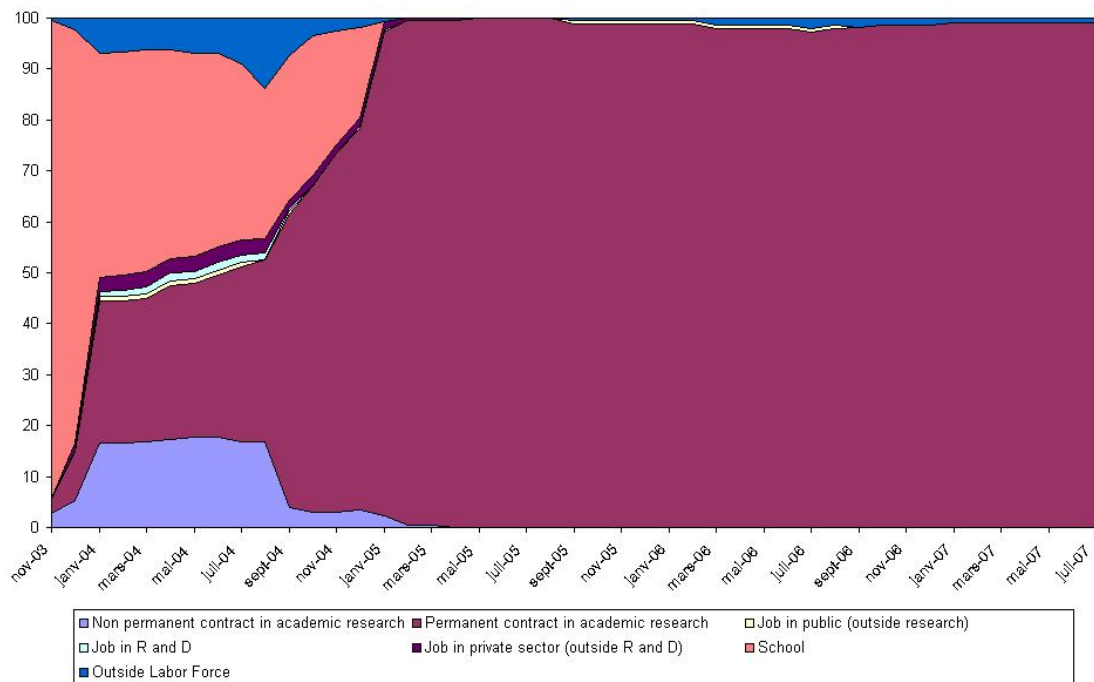
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

List of variables used in the models.

- parcadre : both parents in a professional position ;
- onepecadre : father in a profesional position ;
- onemecadre: mother in a professional position ;
- peretra : father born in a foreign country ;
- homme : man ;
- mention_btb : grade at Baccalauréat ;
- bac_s : Baccalauréat in scientific field of study ;
- svt : biology;
- inge : engineering ;
- chimie : chemistry ;
- dreco : law and economics ;
- lsh : humanities and art ;
- publi2 : number of publications ;
- ingenieur : garduates from engeneering school ;

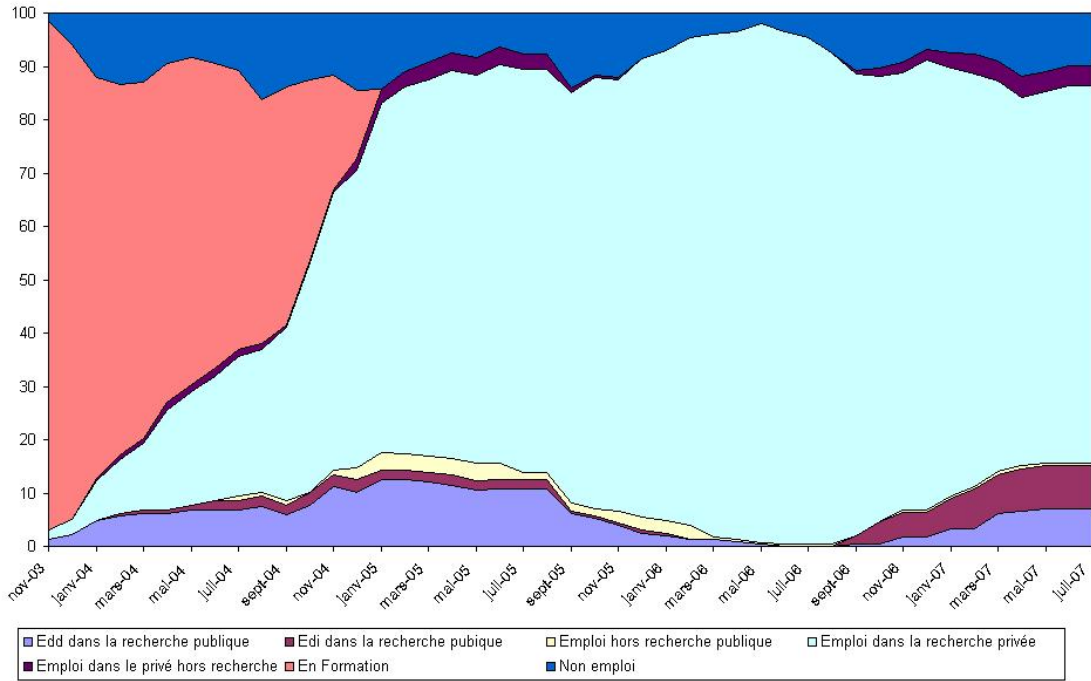
- moniteur : assistant as major funding ;
- autre : other fundings ;
- cifre : Cifre ;
- inscr01 : first enrollment in PhD in 2001 ;
- inscr00 : first enrollment in PhD in 2000 ;
- rechbac : work in research as professionnall prospect at time of Baccalauréat ;
- ratachcnrs : PhD done in CNRS labotory ;
- ratachautre : PhD done in other labotory ;
- ratachepts : PhD done in an EPTS labotory;
- lieuorga : major place where the PhD have been done (public organization) ;
- lieuautre : major place where the PhD have been done (other).

Figure 3: Trajectoire 1 : Rapid access to stabilisation in public/academic research.



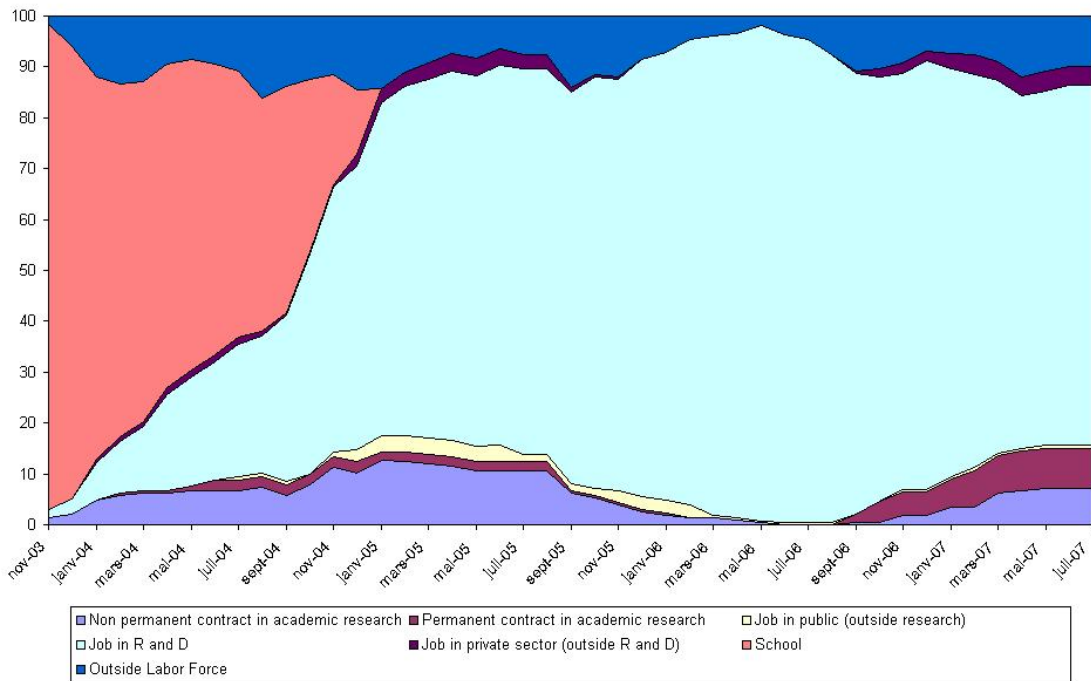
Sources : Génération 2004.

Figure 4: Trajectoire 2 : Distance from employment.



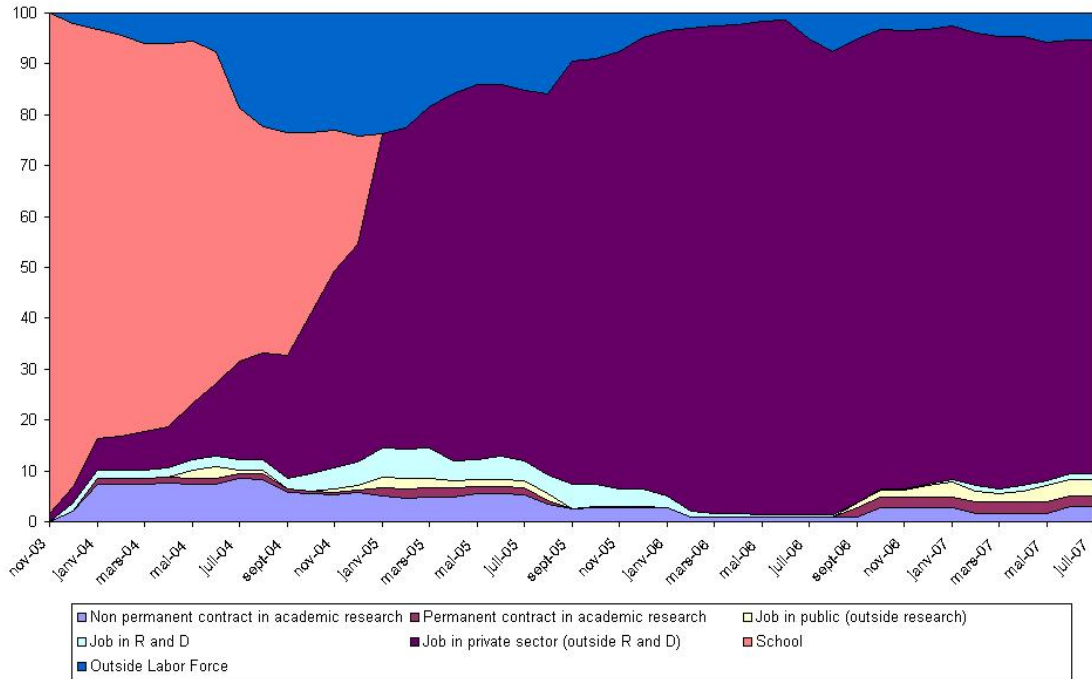
Sources : Génération 2004.

Figure 5: Trajectoire 3 : Rapid access to R&D.



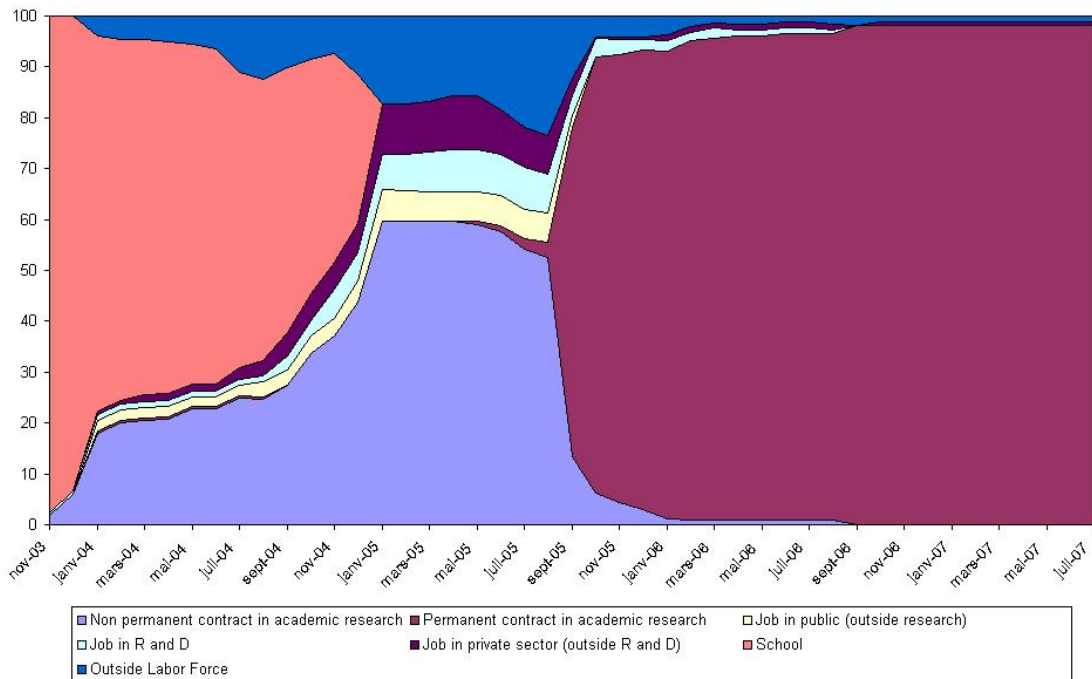
Sources : Génération 2004.

Figure 6: Trajectoire 4 : Rapid access to private sector outside R&D.



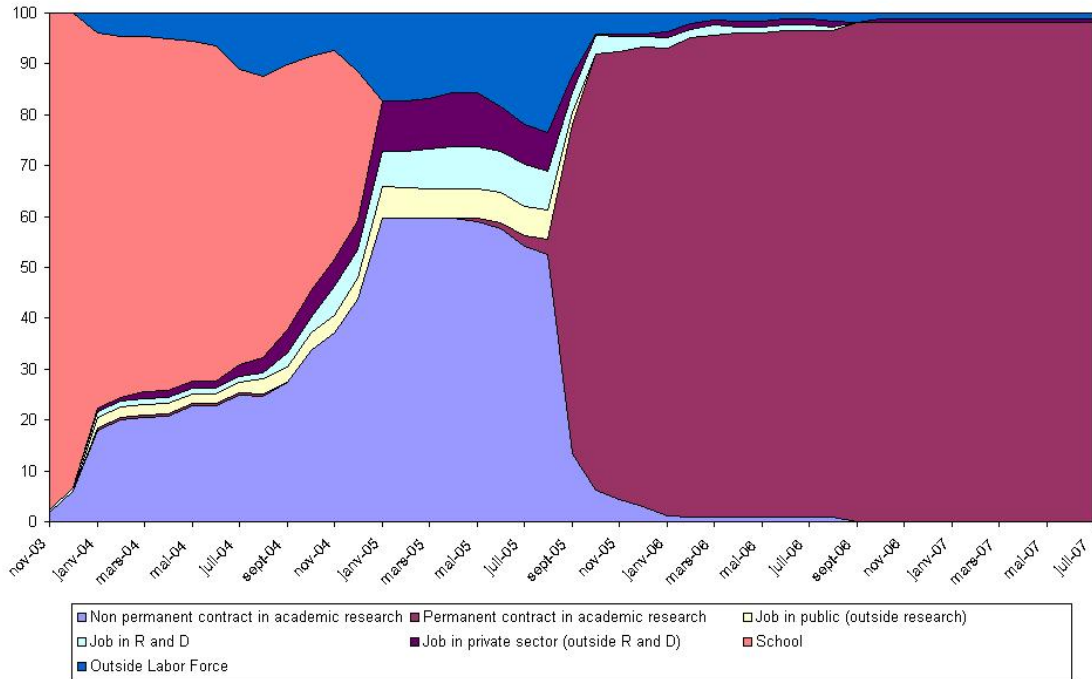
Sources : Génération 2004.

Figure 7: Trajectoire 5 : Delayed access to public/academic research.



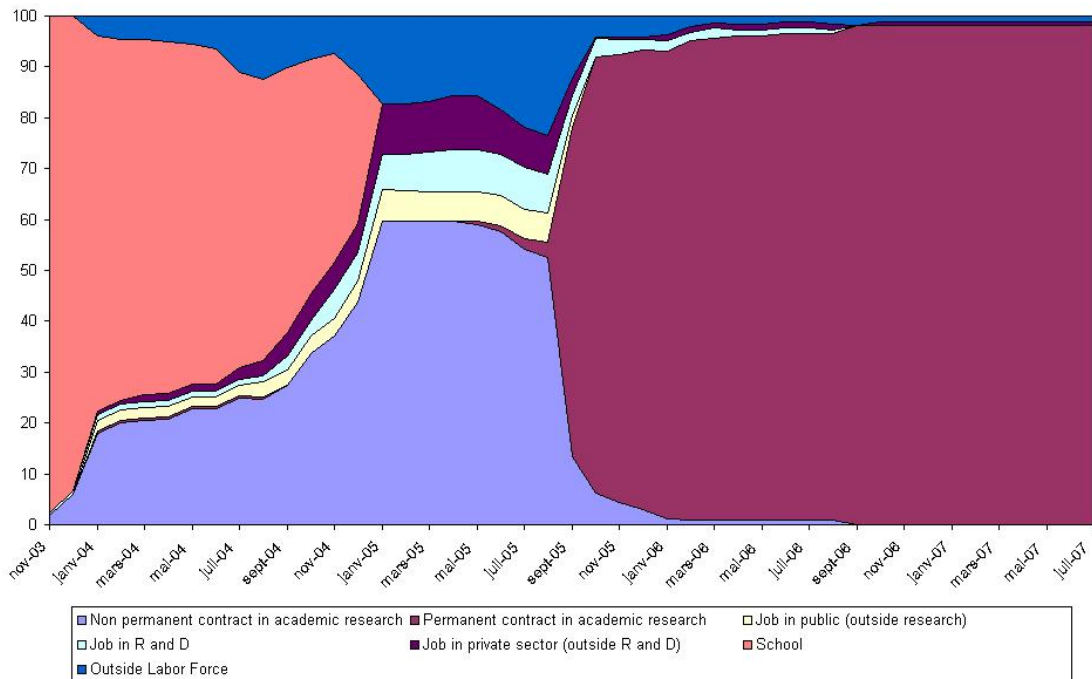
Sources : Génération 2004.

Figure 8: Trajectoire 6 : Rapid access to public sector outside research.



Sources : Génération 2004.

Figure 9: Trajectoire 7 : Precarious in public/academic research.



Sources : Génération 2004.