PROMOTION AND PRODUCTIVITY IN FRENCH ACADEMIA: A TEST OF THE PETER PRINCIPLE

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Abstract:

The Peter Principle states that members of hierarchical organizations will be promoted until they obtain positions that involve duties beyond their abilities. The present study investigates whether or not the Peter Principle applies to French university professors by examining the productivity of professors before and after promotion from assistant professor to full professor. According to the Peter Principle, productivity should decrease for professors who are promoted and increase for professors who are not promoted. In order to test this hypothesis, matching methods were used to statistically evaluate the impact of promotion on publication scores. The robustness of the matching estimates was tested using a sensitivity analysis. No decrease in publication scores following promotion was noted; however, publication scores were found to decrease for professors whose applications for promotion were unsuccessful.

Keywords: promotions, Peter Principle, academic career, matching methods

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I- Introduction

The central role of promotions in organizations has been a major focus of the literature on careers. Promotions have two goals (Milgrom and Roberts, 1992). First, they aim to improve the organizations' performance by assigning employees to the jobs that best suit their abilities. Second, promotions serve as incentives (see Gibbons and Waldman, 1999 for a survey). The tournament model (Lazear and Rosen, 1981) illustrates well this second role. Imagine a firm that gives all its workers the same initial job. This job only requires a low level of ability and all the workers receive the same wage. Able workers are promoted to jobs that demand higher levels of ability and that are rewarded with higher wages. The greater the wage-difference between the two jobs, the greater the incentive to work hard. Promotions can also boost performance by providing incentives for higher human-capital investment (Carmichael, 1983; Prendergast, 1993).

However, this conventional view of promotions is increasingly being called into question, as it is recognized that promotions can also have negative consequences, in particular following promotion decisions (Baker *et al.*, 1998). The most famous of these negative effects, known as the Peter Principle (Peter and Hull, 1969), describes a serious flaw in the promotion dynamic. According to the Peter Principle, promotions tend to raise workers to their level of incompetence, thereby leading to a decrease in productivity after promotion. Consequently, the Peter Principle can have a major impact on hierarchical organizations, as "incompetents" are promoted and others are not, and this creates inefficiencies and negative incentives.

Numerous examples of the Peter Principle can be seen in the real world, including in universities, where the productivity of American university professors has been observed to decline after tenure is obtained (Lazear, 2004). In order to be promoted to full professor, assistant professors must publish more than the average; hence, the quest for tenure tends to boost productivity. However, this incentive vanishes once tenure, which is generally not reversible, has been obtained. Conversely, assistant professors who are denied tenure must move to other universities and publish more. In academia, as in other organizations, 'things always seem to go wrong' (Peter and Hull, 1969).

The present study tests whether or not the Peter Principle operates in French academia. Although the French and American university systems are very different, promotions may also lead to a fall in productivity among French academics. Furthermore, France is currently experiencing a move towards greater evaluation of public-sector workers in all fields, including the university sector. Consequently, the work of academics is coming under

increasing scrutiny, in terms of both teaching and research, and the Ministry of Education is expected to introduce wide-ranging reforms in professors' career structures and promotion procedures (see the Schwartz Report, 2008). However, the promotion system has never been properly evaluated – a situation the present study remedies.

In order to carry out this evaluation, an original dataset of publication scores and promotions of university professors in the field of business studies was created. As most promotions are awarded following a centralized selection process, called the *concours d'agrégation*, the study focused on this procedure. The database contained the information needed to observe promotion decisions (and their explanatory factors), and to evaluate candidates' publication records before and after the promotion procedure. For the purposes of this research, publications were divided into three categories: articles in international journals, articles in national journals, and books. The quality of each publication was also taken into account.

A major problem facing all evaluations of this type is the impossibility of knowing how productive a person would have been if promotion had not been granted (Rubin, 1974). In the present study, this difficulty was addressed by using matching methods to obtain unbiased evaluations of the impact of promotions (Heckman *et al.*, 1997, 1998). Data from the growing literature on careers in academia was used to calculate propensity scores; that is to say, the probability of being promoted. Empirical studies of the determinants of promotion highlight the effects of gender (Ginther and Hayes, 1999, 2003; Long *et al.*, 1993), productivity (Mc Dowell *et al.*, 2001) and networks (Combes *et al.*, 2008), it was therefore necessary to include all these factors in order to obtain robust propensity scores. These propensity scores were then used to calculate counterfactual publication scores and to compare productivity before and after promotion. In addition, a sensitivity analysis was carried out to test the plausibility of the Conditional Independence Assumption that underlines all matching estimates (Ichino *et al.*, 2008).

The Peter Principle with respect to promotions in academia is discussed in the next section along with a presentation of the problem of evaluating productivity. Section 3 describes the dataset, and section 4 presents a discussion of the results of the matching estimates and of the sensitivity analysis.

II- The effect of promotions on productivity

1- The Peter Principle – or why productivity should fall after promotion

The Peter Principle was first outlined by Peter and Hull (1969) on the basis of a substantial body of evidence showing declines in performance after promotion. Peter and Hull's findings directly contradicted the conventional view of promotions as a major source of incentives.

The literature on careers contains numerous explanations of the Peter Principle, probably the best known of which revolves around the potential conflict between the job-assignment process and promotion incentives (Fairburn and Malcomson, 2001). Promotion decisions are based on a worker's observed performance in a particular job, which may or may not be a good indicator of that person's suitability for a higher-level job. If the skills required by the two tasks are different, workers may be less suited to the job to which they are promoted and may therefore appear incompetent. Faria (2000) illustrates this finding for managers. To be a good manager, two types of competence are required: (1) the technical abilities needed to monitor a team and (2) the social skills (e.g., communication skills) needed to be an effective coordinator. But, as training costs are high, workers cannot invest simultaneously in the two competences: people who excel in one domain are unlikely to be as good in the other. Because overall performance depends on skill levels in the two domains, when making promotion decisions, a firm must evaluate strengths and weaknesses in the two types of competence in the current job, and decide which should be given priority. For example, if the firm decides to promote the worker with the best technical skills, that person may be a good monitor but a poor coordinator. Conversely, if the firm chooses the worker with the best social skills, that person will probably be a good coordinator but a less-effective monitor. When workers reach the limits of their skills, promotions lead to inefficiency and the Peter Principle applies.

Another explanation of the Peter Principle focuses on the information content of promotions (Bernhardt, 1995). In a competitive context, promotions can reveal workers' abilities to other firms, who may then try to headhunt these workers. To avoid revealing which of their workers are the most competent, firms may train and promote all their workers, even those for whom the cost of promotion is higher than the expected benefit. This leads to promotion inefficiencies. In addition, if workers can reveal their own abilities to competing firms, those who are less capable of vaunting their strengths have less chance of being promoted, whatever their real skills. As they are unable to reveal their skills, they cannot distinguish themselves from less able workers. Consequently, the most efficient solution for firms may be to promote workers who are skilled in their jobs but poor communicators.

In addition to asymmetric information about workers' competences, Fairburn and Malcolmson (2001) include incentive considerations, arguing that unsuitability for job assignments, which is the factor underlying the Peter Principle, occurs when promotions are used to solve a moral hazard problem and when workers are risk adverse. As workers may try to influence performance evaluations by concealing less positive aspects of their work from supervisors, using financial incentives to motivate workers may be inefficient. Thus, rather than seeing pay as an incentive, firms choose to promote workers because the interests of promoted workers tend to be more closely aligned with the interests of the firm. Even if firms promote workers to jobs beyond their abilities, this decision is efficient in the sense that promotions provide the cheapest incentive to work hard (Koch and Nafziger, 2007). In such situations, promotion criteria may be lax, thus favoring the appearance of Peter Principle effects, especially in jobs requiring multiple abilities.

According to Lazear (2004), the Peter Principle operates whenever promotion is based on both permanent and transitory ability components. Transitory components can distort assessments of workers' true abilities, as measuring and differentiating between actual performance and strategic behaviors are often difficult. In addition, it is not always easy to ascertain whether or not a candidate has the skills required by the higher position. As it is difficult for firms to distinguish between permanent and transitory abilities, they tend to promote workers who have sufficient overall pre-promotion abilities. However, the expected value of the post-promotion transitory component is zero, leading to a reduction in the productivity of promoted workers. Conversely, workers who are not promoted must increase their productivity if they are to be considered for promotion in the future. Two studies have tried to empirically test Lazear's theory of decline. A study of promotions and performance in a large British financial sector firm confirmed the expected fall in post-promotion outputs (Barmby *et al.*, 2006). Two-thirds of this fall was attributed to the Peter Principle, as defined by Lazear (2004), and one-third was attributed to reduced incentives. Dickinson and Villeval (2007) tested Lazear's model in a laboratory experiment that indicated that Lazear's theory holds true only for volatile environments and activities.

These different explanations of the Peter Principle invoke a wide variety of factors, all of which may operate in universities. As in the business world, academic promotions may be based on observed performance. Assistant professors may be promoted to full professors on the basis of a good research record, even though assistant professors and full professors have different duties. For example, full professors have increased responsibilities, including supervising Ph.D. students and managing research teams; therefore, good assistant

professors may not have the skills to be efficient full professors. In addition, universities may have to base their assessments of professors' performances on asymmetric information. To gain tenure, assistant professors must be able to reveal their skills, so assistant professors who are good communicators are more likely to be promoted (Bernhardt, 1995). To solve the moral hazard problem, universities may thus prefer promotions to reduce the rents of professors and relax promotion criteria. This could lead to over-promotion. Furthermore, professors who are denied promotion may feel the need to publish if they are to have a chance of being promoted in the future (Lazear, 2004).

Because several Peter-Principle factors operate in academia, the productivity of assistant professors who are promoted to full professor rank would be expected to fall, and the productivity of assistant professors who are denied promotion would be expected to increase. The current research tests this hypothesis.

2- Evaluation problems

In order to test the effect of promotion on productivity, and thus whether or not the Peter Principle applies to academia, it was first necessary to overcome the problem of how to evaluate performance differentials (Rubin, 1974). This problem can be presented as follows. Candidates for promotion are denoted i. Their personal attributes (age, gender, etc.) are defined in a vector, x. A binary variable, C, denotes whether a candidate was promoted to the senior professor rank (the treatment group, C = 1) or not (the reference group, C = 0).

For the purposes of the present study, the performance of candidates was evaluated via a single indicator, publication score, which is a measure of the number of journal articles and books that a candidate has published (see section 3 for more details and a discussion). Publication scores for candidates who are promoted and for candidates denied promotion are denoted P_1 and P_0 respectively. P_1 and P_0 define mutually exclusive outcomes and thus cannot be observed simultaneously. The observed outcome is given by:

$$P = CP_1 + (1 - C)P_0$$

The impact of promotion on a candidate's publication score is the difference between the candidate's observed publication score after promotion and the mean publication score the candidate would have obtained if he/she had not been promoted. This can be expressed as:

$$\alpha(x) = E[P_1 / C = 1, X = x] - E[P_0 / C = 1, X = x]$$

The second term defines the counterfactual publication score; that is to say, the hypothetical (and therefore unobservable) score successful candidates would have obtained if they had

not been promoted. An evaluator can only estimate the difference in publication scores for people who are promoted and people who are not promoted; that is to say:

$$\theta(x) = E(P_1 / C = 1, X = x) - E(P_0 / C = 0, X = x)$$

But $\theta(x) \neq \alpha(x)$. Using $\theta(x)$ to evaluate the impact of promotion on publication scores leads to an estimation bias, defined by:

$$\beta(x) = E(P_0 / C = 1, X = x) - E(P_0 / C = 0, X = x)$$

where $\beta(x)$ is the difference in average publication scores between the two populations if nobody is promoted.

In summary, the observed difference in publication scores between promoted and non-promoted candidates, $\theta(x)$, depends on two variables:

- The impact of the promotion process, $\alpha(x)$
- Initial differences between candidates who are promoted and candidates who are not promoted.

Hence $\theta(x)$ cannot be used to obtain an unbiased estimate of $\alpha(x)$, and a counterfactual publication score must be calculated. A number of experimental and non-experimental methods are available to do this (see Heckman *et al.*, 1999; Brodaty *et al.*, 2007). Because the present study was based on a non-experimental dataset consisting of publication scores and promotion data for business studies professors, a non-experimental method had to be used. The most widely used non-experimental method is based on matching estimators, which involves matching each successful candidate, i, with an unsuccessful candidate, $\tilde{i}$, with the same characteristics, x. As no two individuals are entirely similar in all observable attributes, the matching process was based on propensity scores; that is to say, on the probability of being promoted (treatment probability). This probability was estimated using a probit model. Following McDowell *et al.* (2001) and Combes *et al.* (2008), the present study introduced past productivity scores and network variables as explanatory factors of success at the selection process, taking into account both research quality and peer-rich effects. Individual attributes (gender and past career characteristics), and the level of competition (vacancy to candidate ratio) were also included (Ginther and Hayes, 1999, 2003; Long *et al.*, 1993). Research department quality may also influence the probability of being promoted; however, no chronological data on departments' members or their publications are available, so it was impossible to include information about the quality of research departments in the dataset. Details of the available variables are described below. As the matched individuals

are considered to be identical, the publication scores of unsuccessful candidates were used to estimate the counterfactual scores of promoted candidates (Rosenbaum and Rubin, 1983). To be efficient, this method must respect the Conditional Independence Assumption (CIA), that is to say, that promotion depends only on observables (see section 4 for a discussion).

Of all the available matching methods (nearest-neighbor estimators, radius matching, kernel matching, etc.), kernel-matching methods applied to the evolution of outcomes (difference in difference)[1] have been found to give robust estimations for $\alpha(x)$ in large samples (Heckman *et al.*, 1997, 1998).

The kernel-matching estimator is defined as:

$$\hat{\alpha} = \frac{1}{N_1} \sum_{i \in A_1} \left[\Delta P_i - \sum_{j \in A_0} \Delta P_j \times \frac{K\left[\left(C(x_j) - C(x_i) \right) / h \right]}{\sum_{j \in A_0} K\left[C(x_j) - C(x_i) / h \right]} \right]$$

where $\Delta P = P - P_{t-1}$, N_1 is the number of promoted candidates, K is a kernel function with $\int_{-\infty}^{+\infty} K(u)du = 1$, and h is a bandwidth function.

Frölich (2004) demonstrated the finite-sample properties of kernel-matching estimators when the control (non-promoted) to treated (promoted) ratio is large, as was the case in the present sample (346 non-promoted and 280 promoted candidates). Hence, this method was used to evaluate the effect of promotion on the publication scores of both successful and unsuccessful candidates, and thus to test the Peter Principle (Results for alternative matching methods are summarized in Appendix 1).

A sensitivity analysis was also performed for the matching estimators and the plausibility of the Conditional Independence Assumption was tested. A positive result indicates that pre-promotion variables can be used to efficiently match promoted and non-promoted people. However, a negative result (Conditional Independence Assumption not plausible) indicates that promoted and non-promoted professors also differ according to unobservable abilities. As the data do not provided information on the distribution of P_0 for promoted people, the CIA cannot be directly tested. Hence, the method of Ichino *et al.* (2008) was used to assess the robustness of matching estimators (see section 4 for the results of the sensitivity analysis).

[1] This allows the elimination of unobservable individual effects.

III – Context and data

1- Promotions in the French university system

French universities recognize two ranks of professor: *maître de conferences* (equivalent to assistant professor in the US university system) and *professeur des universities* (equivalent to full professor). The present study focused on one particular field, that of business studies. In this field (and in Economics, Law and Political Sciences[2]), promotion from assistant professor to full professor can be obtained via either a centralized procedure known as the *concours d'agrégation*, or a decentralized procedure (mainly through local selection committees). These two promotion procedures are governed by very different rules.

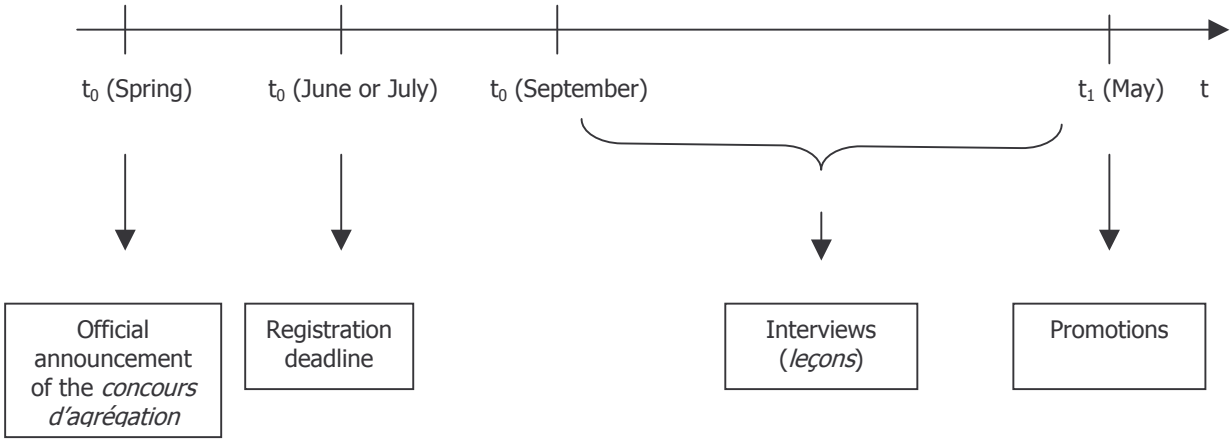
The *concours d'agrégation*, which accounts for 67% of promotions to the full professor rank, is open to anybody with a Ph.D., however much experience (if any) they have as an assistant professor. Promotion decisions are mainly based on research achievements. In contrast, the decentralized procedure is only open to assistant professors with at least ten years experience; therefore, such promotions are generally awarded later in a professor's career. These promotion decisions take into account administrative duties, such as managing departments, as well as publication scores. Because these two promotion procedures are very different, and because the *concours d'agrégation* is the main route to promotion for French business studies professors, the present study focused on the *concours d'agrégation*.

In order to evaluate the impact of the promotion process on publication scores, it was first necessary to determine the probability of being promoted. This probability was then used to estimate propensity scores, which was the first step of the evaluation procedure described above.

As can be seen in figure 1, the timetable for the *concours d'agrégation* is very long (Combes *et al.*, 2008).

[2] In other disciplines, the *concours d'agrégation* does not exist and all promotions are decided by decentralized procedures.

Figure 1: The timetable for the *concours d'agrégation*



When details of the selection process are announced, potential candidates are told how many full professorships are available and the registration deadline. The names of the jury members are announced before the registration deadline. The Ministry of Education chooses the president of the jury from amongst France's most experienced full professors in the relevant field. Other members are nominated by the President and appointed by the Ministry. Jury members are usually well-known researchers, although not all work in the university sector, and they may be from France or abroad. Despite being appointed by the Ministry of Education, jury members are independent, although they cannot hire professors for their own universities. When candidates register for the *concours d'agrégation*, they are not informed where the available full-professor posts are located. Between September and May, the jury carries out several interviews (*leçons*), during which they assess the candidates' research. In May (or June), the jury announces the names of the successful candidates and their ranking. The locations of the available positions are then revealed, and the successful candidates choose their preferred location according to their ranking (*i.e.*, the candidate ranked first can choose from all the available positions, the candidate ranked second can choose from the remaining positions and so forth). There are three major differences between the French and American promotion procedures. First, in France assistant professors are granted tenure soon after they are hired (university professors are civil servants and French civil servants have excellent job security). As a result, the main motivation for seeking promotion is not to obtain job security, but to further one's career in terms of salary, duties and mobility. Second, promoted candidates are likely to have to move to a different university, as there may not be any positions available, or they may not be ranked high enough to be able to choose their current university. Conversely, unsuccessful

candidates generally do not leave their university. Third, universities cannot choose their full professors (Combes *et al.*, 2008).

2- Dataset

Fourteen business-studies *concours d'agrégation* were held between 1979 and 2007. The Ministry of Education granted full access to its *concours d'agrégation* database, which contains the names of the candidates and the members of the jury for all 14 sessions, as well as personal data about the candidates (gender, age, etc.) and information about the juries' decisions. The present study only considers candidates who were assistant professors when they applied for promotion, thereby excluding applicants from outside the university system. This provided a database of 502 assistant professors who went through the selection process to try and become full-professors. Forty-two percent of these candidates were successful (Table 1).

The name of each candidate's Ph.D. supervisor and the date the candidate obtained his/her Ph.D. were added to the Ministry of Education data, using a database called *SUDOC*. This database also included the name of the university that awarded the Ph.D. It is widely recognized that the prestige of the university awarding a Ph.D. strongly influences future career possibilities: professors with Ph.D.s from the best universities obtain the best positions and have the best chances of being promoted (Crane, 1965; Long *et al.,* 1979). France's most prestigious university for business studies is the University of Paris 9, which is seen as the birthplace of business studies in France. Paris 9 still attracts the best students and the best professors.

The *SUDOC* data was also used to calculate the lengths of post-Ph.D. careers and the professional links between a candidate and members of the jury. By noting whether or not a candidate's Ph.D. supervisor was a member of the jury, it was possible to take into account peer-rich effects due to Ph.D. supervisors favoring past students and influencing other members of the jury. Combes *et al.* (2008) showed that networking has a significant and positive effect on the promotion prospects of economists teaching in French universities. In order to obtain a more complete picture of the influence of former Ph.D. supervisors, a further variable was added: whether or not a candidate's Ph.D. supervisor was a member of another jury. This variable can affect decisions in two ways. First, Ph.D. supervisors in another jury could inform candidates about promotion criteria and competition rules, without giving direct support. Second, as only well-known academics are asked to sit on juries, being a member of a jury is an indicator of a Ph.D. supervisor's reputation.

Finally, the annual publication record of each candidate before and after the selection process[3] was examined as a proxy for productivity. Records included three types of publication: (a) articles in international journals (collated from the *Econlit* and *Business Source Premier* electronic databases); (b) articles in French journals, collated from the author lists for all the abstracts published by the main French business studies journals; (c) books, collated from the French National Library's electronic database. The three types of publication take into account the full range of publications without recourse to journal-ranking systems. A publication score was calculated on the basis of the number of articles published weighted according to the prestige of the journal (using the *Science Citation Index*). The number of articles and/or books published by a candidate before and after the selection process was also weighted according to the number of years between the candidate's Ph.D. and the selection process, and according to the number of years between the selection process and 2007.

Table 1 presents all the variables that were used in the econometric analysis.

[3] Evaluations are based on publication scores calculated before and after the *concours*. A second pre-*concours* publication score was also calculated based on the number of publications published up until one year after the *concours*, in order to take into account the fact that candidates' CVs include forthcoming publications, which are therefore known to the jury (Combes *et al.*, 2008). This measure of publication scores did not have a statistically significant effect on the results.

Table 1: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Publication differential before and after the selection process					
Total differential	478	-0.236	0.945	-8.556	3.864
Differential for international journals	478	-0.001	0.367	-3.250	3.015
Differential for French journals	478	-0.204	0.561	-2.818	2.667
Differential for books	502	-0.687	3.591	-27	23
Differential for quality-weighted publications	478	-0.015	0.056	-2.134	2.009
Promotion success	502	0.420	0.494	0	1
Control variables					
Number of positions/Number of candidates	502	0.419	0.160	0.241	0.846
Male	502	0.765	0.424	0	1
Age when Ph.D. awarded	483	31.342	5.049	19	59
Number of years between Ph.D. and the selection process	485	6.666	4.377	0	26
Number of previous applications	502	1.452	0.756	1	9
Ph.D. from Paris 9	479	0.142	0.349	0	1
Ph.D. supervisor on the jury	461	0.204	0.403	0	1
Ph.D. supervisor on another jury	461	0.735	0.442	0	1

On average, 42% of candidates were promoted. Table 2 shows the differences between promoted and non-promoted professors. The promotion process appears to favor candidates who have more rapid careers (that is to say, they obtain their Ph.D. younger and go through the selection process sooner after obtaining their Ph.D.), who obtained their Ph.D. from the University of Paris 9, who have published more, and who were examined by a jury that included their Ph.D. supervisor. Unlike previous research into academic careers (Ginther and Hayes, 1999, 2003), we did not find a large gender effect.

These descriptive findings were used to calculate the probability of successfully completing the *concours d'agrégation*, and then to evaluate the effect of promotion on publication scores.

Table 2: Profiles of promoted and non-promoted candidates

	Non-promoted candidates	Promoted candidates
Number of candidates/Number of positions	0.391	0.458
Male	0.756	0.777
Age when Ph.D. awarded	32.007	30.462
Number of years between Ph.D. and the selection process	7.626	5.377
Number of previous applications	1.498	1.389
Ph.D. from Paris 9	0.121	0.169
Ph.D. supervisor on the jury	0.198	0.211
Ph.D. supervisor on another jury	0.779	0.678
Publication scores before the selection process	0.564	1.100

Table 3 presents publication differentials before and after the selection process for all candidates. Annual productivity scores are lower after the *concours* for all types of publication, and the total differential is –0.236. However, this differential is greater for promoted candidates than for non-promoted candidates (-0.302 and –0.187, respectively).

Table 3: Publication scores and promotion

	Non-promoted candidates	Promoted candidates	Total
Publication differential (total)	-0.187	-0.302	-0.236
Publication differential (international journals)	0.012	-0.017	-0.001
Publication differential (French journals)	-0.180	-0.235	-0.204
Publication differential (books)	-0.268	-1.265	-0.687
Quality publication differential	-0.007	-0.029	-0.015

These descriptive statistics seem to argue in favor of the Peter Principle. However, such simple observations can be biased, as promoted and non-promoted candidates have different profiles. In order to avoid selectivity bias, kernel-matching methods (see previous section) were used to estimate counterfactual publication scores for the promoted and non-promoted candidates. These scores were then used to determine unbiased productivity differentials.

IV- The effect of promotion on productivity scores: matching estimates

1- Results of the matching strategy

These descriptive statistics provide evidence in favor of the Peter Principle. However, as such comparisons may be biased, an empirical procedure was used to obtain unbiased estimates of publication-score differentials (see Section II). The results of the two steps of the analysis - the calculation of propensity scores (the probability of achieving promotion via the *concours*) and the calculation of publication differentials using kernel-matching methods - are presented below. In order to analyze the results in more detail, four different sub-groups, based on gender and cohorts (before and after 1996), were examined in addition to the full sample.

Table 4 presents the results of the first step.

Table 4: Probability of being promoted – propensity scores

	Full sample		Male		Female		Cohorts before 1996		Cohorts after 1996	
	Coef.	Standard error	Coef.	Standard error	Coef.	Standard error	Coef.	Standard error	Coef.	Standard error
Number of positions/Number of candidates	2.102	0.433***	2.367	0.492***	1.647	0.977^{ns}	2.944	0.627***	1.585	0.836*
Male	0.058	0.159^{ns}					0.745	0.351**	-0.114	0.188^{ns}
Age when Ph.D. awarded	-0.077	0.016***	-0.094	0.019***	-0.042	0.034^{ns}	-0.105	0.027***	-0.068	0.021***
Number of years between Ph.D. and the selection process	-0.087	0.019***	-0.114	0.023***	0.001	0.045^{ns}	-0.120	0.031***	-0.087	0.028***
Number of previous applications	-0.034	0.110^{ns}	-0.044	0.124^{ns}	0.007	0.268^{ns}	-0.140	0.199^{ns}	0.038	0.139^{ns}
Ph.D. from Paris 9	0.116	0.190^{ns}	0.095	0.238^{ns}	0.215	0.327^{ns}	0.445	0.343^{ns}	-0.044	0.235^{ns}
Ph.D. supervisor in the jury	1.142	0.353***	1.311	0.409***	1.014	0.765^{ns}	1.043	0.596*	1.409	0.479***
Ph.D. supervisor in another jury	-1.260	1.332^{ns}	-1.357	1.381^{ns}	-1.289	1.730^{ns}	-1.304	1.570^{ns}	-1.436	1.446^{ns}
Publication scores before	0.476	0.097***	0.440	0.109***	0.685	0.237***	0.487	0.159***	0.373	0.130***
Constant	2.704	0.689***	3.507	0.817***	1.028	1.430^{ns}	2.780	1.115***	3.005	0.971***
Log Likelihood	-241.738		-178.493		-58.941		-89.615		-146.021	
Observations	445		340		105		188		257	
	Mean	Standard error	Mean	Standard error	Mean	Standard error	Mean	Standard error	Mean	Standard error
Propensity score	0.439	0.249	0.439	0.263	0.437	0.236	0.413	0.283	0.457	0.243
Number of blocks	5		5		5		5		5	
Balancing hypothesis	ok		ok		ok		ok		ok	

NB: ***: significant at 1%, **: significant at 5%, *: significant at 10% and ns: non significant

In terms of the results for the control variables, the coefficient for the number of positions/number of candidates ratio is significantly positive, suggesting that the lower the competition, the higher the probability of success. The results also show that youth is an advantage, as candidates who obtain their Ph.D. at a young age and candidates who apply for promotion soon after obtaining their Ph.D. have a greater chance of being promoted. In line with Combes *et al.* (2008), significant effects were found for past productivity and network connections. In the case of network connections, the probability of being promoted appears to be higher for a candidate whose Ph.D. supervisor is on the jury, but this is not the case if the supervisor is a member of another jury. Hence, peer-rich effects seem to be more important than information or reputation effects. In addition, despite its reputation, a Ph.D. from the University of Paris 9 has no effect on the probability of being promoted. It is also interesting that there was no significant effect of gender, which is in marked contrast to other studies of promotion in academia (Ginther and Hayes, 1999, 2003; Long *et al.*, 1993). In fact, the problem facing females in French academia seems to be more of a "sticky floor" than a "glass ceiling", as females are severely under-represented among candidates for promotion, although they have the same success rate as men when they do apply. The non-significant effect of gender has also been reported for the field of economics (Combes *et al.*, 2008).

Similar results were obtained for most of the sub-samples. These results were used to estimate propensity scores. The candidates were divided into five homogenous blocks. As each of these blocks has a valid balancing hypothesis, the publication scores of non-promoted candidates could be used to estimate counterfactual propensity scores for promoted candidates (and *vice versa*). Kernel matching was used to estimate the unbiased differentials in publication scores before and after the *concours d'agrégation* for both successful and unsuccessful candidates.

The results of these estimates are shown in table 5. Publication differentials were estimated for promoted and non-promoted candidates for all publications (column 1), for articles in international journals (column 2), for articles in French journals (column 3) and for books (column 4). We estimated the impact of promotions on publication scores for the full sample and for the four sub-samples.

Table 5: Publication-score differentials before and after promotion

	(1) Total differential	(2) Differential for international journals	(3) Differential for French journals	(4) Differential for books	(5) Differential for quality weighted publications
Promoted candidates					
Full sample	0.209 (0.180)^{ns}	-0.006 (0.146)^{ns}	0.179 (0.089)**	-0.428 (0.696)^{ns}	0.056 (0.113)^{ns}
Male	0.247 (0.212)^{ns}	-0.027 (0.153)^{ns}	0.190 (0.115)^{ns}	-0.670 (0.764)^{ns}	0.071 (0.121)^{ns}
Female	0.130 (0.223)^{ns}	0.214 (0.172)^{ns}	0.101 (0.143)^{ns}	0.362 (0.641)^{ns}	0.042 (0.099)^{ns}
Cohorts before 1996	-0.032 (0.225)^{ns}	-0.248 (0.166)^{ns}	0.254 (0.196)^{ns}	-0.422 (0.121)^{ns}	-0.014 (0.056)^{ns}
Cohorts after 1996	0.299 (0.219)^{ns}	0.127 (0.118)^{ns}	0.105 (0.135)^{ns}	-0.613 (0.388)^{ns}	0.089 (0.124)^{ns}
Non-promoted candidates					
Full sample	-0.233 (0.102)**	-0.019 (0.036)^{ns}	-0.145 (0.069)**	-0.428 (0.619)^{ns}	-0.137 (0.055)***
Male	0.247 (0.195)^{ns}	0.027 (0.151)^{ns}	0.190 (0.129)^{ns}	-0.670 (0.726)^{ns}	-0.108 (0.089) ^{ns}
Female	-0.330 (0.148)**	-0.033 (0.050)^{ns}	-0.251 (0.112)**	0.362 (0.593)^{ns}	-0.097 (0.102)^{ns}
Cohorts before 1996	-0.240 (0.156)^{ns}	-0.034 (0.037)^{ns}	-0.178 (0.120)^{ns}	-0.422 (1.253)^{ns}	-0.046 (0.208)^{ns}
Cohorts after 1996	0.299 (0.216)^{ns}	0.127 (0.123)^{ns}	0.105 (0.125)^{ns}	-0.613 (0.362)*	-0.124 (0.091)^{ns}

NB1: Bootstrapped standard errors (obtained after 500 replications) are given in brackets.

NB2: ***: significant at 1%, **: significant at 5%, *: significant at 10% and ns: non significant

The results presented in table 5[4] suggest that being promoted does not lead to a substantial decline in publication scores. Most of the results for the promoted candidates were not significant. Exceptions to this rule are articles in French journals for the full sample, for which the estimated differential is even positive.

[4] Alternative matching methods (nearest neighbor matching, radius matching) provide similar results for the full sample (see Appendix 1).

Kernel-matching estimates for candidates who are denied promotion gave negative differentials; that is to say, candidates denied promotion publish significantly less after the selection process. This result is most apparent for females, for articles in French journals, and for the publication of books by the most recent cohorts.

These results clearly contradict the Peter Principle, as publication scores do not decrease for promoted candidates, but they do decrease for candidates who are denied promotion. This result can be explained by the particularities of the French university system.

Although French assistant professors and full professors officially carry out different tasks, in reality, in all but the largest universities, both ranks fulfill similar roles. Consequently, most of the skills required to obtain promotion from the assistant professor rank are the same as the skills required to successfully carry out the role of full professor. Hence, any Peter Principle effects due to over-promoting people to jobs for which they are less suited are likely to be less marked in French academia than they are in other contexts (see, for example, Faria, 2000).

Another explanatory factor for the Peter Principle is the disappearance of incentives after promotion. However, any reduction in incentives for French academics is likely to be minimized by the fact that most newly promoted full professors have to move to a new university. As a result, they have to integrate a new research department, develop new contacts and build a reputation. The resulting peer pressure may limit free-rider behavior and maintain overall productivity. In addition, because successful candidates choose their preferred location according to their ranking, the least well ranked may be required to go universities they would not otherwise have chosen. Full professors who are unhappy with their posting can subsequently apply for a transfer. Such transfers are more likely to be accorded to professors with good publication scores, thereby providing another incentive to be productive.

The decrease in productivity recorded for assistant professors who are denied promotion may be due to the fact that the *concours* is the main route to promotion. As failure at the selection process can be viewed as the end of any likelihood of promotion, being denied promotion may lead to a major decrease in motivation and therefore to lower publication scores. This effect may be reinforced by the facts that assistant professors in France are civil servants with guaranteed job security and that low productivity will not result in sanctions. In addition, unsuccessful candidates for the *concours d'agrégation* who decide to try and obtain promotion through the decentralized procedure (direct negotiations with universities) are likely to focus on administrative duties, as such tasks are a major promotion criterion in this

procedure. As administrative duties are highly time-consuming, they tend to substantially reduce publication scores.

In summary, the results do not show any change in publication scores for French business studies professors who are promoted to full professor rank via the *concours d'agrégation*; therefore, there is no evidence for a Peter Principle effect. However, 58% of candidates for promotion are unsuccessful and this failure leads to a significant reduction in productivity, suggesting that the promotion process may have deleterious effects.

2- Results of the sensitivity analysis

A sensitivity analysis was carried out to determine the robustness of the matching estimates when the CIA is not satisfied; that is to say, when the probability of being promoted is not random within each cell defined by the observables, x. This might happen if there are differences between promoted and non-promoted people in terms of unobservable abilities. Therefore, it is essential to test the reliability of the CIA. This was done using the method developed by Ichino *et al.* (2008). A summary of the reasoning on which this sensibility analysis is founded is presented below (based on Rosenbaum and Rubin, 1983, Rosenbaum, 1987 and Imbens, 2003). Suppose CIA is not satisfied given x, but would be respected if it included an additional binary confounding factor, U, which can measure some unobservable ability components.

We thus have: $E[P_0 / C=1, x] \neq E[P_0 / C=0, x]$, but: $E[P_0 / C=1, x, U] = E[P_0 / C=0, x, U]$.

Following Rosenbaum and Rubin (1983), the distribution of U is fully specified by the choice of four parameters, given by:

$$s_{ij} = \Pr(U=1 / c=i, I(P > p^*) = j) = \Pr(U=1 / C=i, I(P > p^*) = j, x)$$

with $i, j \in \{0,1\}$ and where I is the indicator function and p^* is the median of the distribution of the publication scores, P [5].

Parameters s_{ij} give the probability that $U=1$ in each of the four groups defined by the promotion status and the outcomes. To give a simple example, people who have $U=1$ are

[5] As outcomes are a continuous variable, a binary transformation of P was used to define the parameters s_{ij} (Nannicini, 2007). Tests using other values for p^* (mean, 25th and 75th centiles) showed that the results of the sensibility analysis are not affected by this choice.

denoted skilled people. Thus, s_{11} can be defined as the fraction of skilled candidates among those who are promoted $(C=1)$ and who publish more than the median.

Once a distribution for U has been chosen, U can be simulated in the data. The first step is to define the values of the parameters (Ichino *et al.,* 2008), s_{ij}. This can be accomplished in two different ways: (1) Values for each s_{ij} can be arbitrarily chosen, for example: $s_{11}=s_{10}=s_{01}=s_{00}=0.5$, which defines a neutral confounder. (2) U can be calibrated to mimic some important observable covariates. For example, suppose that the distribution of U is similar to the distribution of gender. The academic promotions dataset shows that 79% of the individuals who are promoted and who have a higher publication score than the median are male. Hence, s_{11} is set at 0.79, that is to say 79% of people in the sample are skilled and have $U=1$. Finally, it is implicitly assumed that promoted people are more "skilled" than the controls (non-promoted people).

Both techniques enable a value of U to be attributed to each individual, according to which of the four defined groups he/she belongs to. The simulated U is then used as an additional covariate to estimate new propensity scores and the kernel matching estimates[6]. A comparison of the estimates obtained with and without the additional variable indicates the extent to which the initial results are robust to this particular failure of the CIA.

Table 6 presents the results of this sensitivity analysis for the global differential in publication scores[7] for (a) promoted candidates and (b) non-promoted candidates.

In table 6a, each row of the first four columns gives the four probabilities, s_{ij}, which define the distribution of the unobservable abilities components, U, by promotion status and outcome. Column 5 gives an estimate of the outcome effect of U, noted Γ; that is to say, the effect of skill on the outcome for non-promoted people, after controlling for observables, x. Similarly, column 6 presents the selection effect of U, noted Λ; that is to say, its impact on the probability of being promoted (taking into account covariates x). Table 6b has a similar structure to table 6a.

The first row of table 6a indicates the initial matching estimate of the global publication differential before and after promotion. The second row gives the simulated matching estimate using a neutral confounder. The other rows present simulated estimates, calibrated U to match the distribution of some specific covariates.

[6] See Ichino *et al.* (2008) for details on computing standard errors of the simulated kernel matching estimates.

[7] The results of the sensibility analysis for detailed types of publications are not presented here but are available upon request. The CIA was found to be plausible for all types of publications.

Table 6: Sensitivity analysis

a) Promoted candidates

	Fraction of $U=1$ by promotion status and outcome				Outcome effect (Γ)	Selection effect (Λ)	Matching estimator	Standard error
	s_{11}	s_{10}	s_{01}	s_{00}				
Baseline matching estimator	0.00	0.00	0.00	0.00	-	-	0.209	0.180^{ns}
Neutral confounder	0.50	0.50	0.50	0.50	1.32	1.04	0.207	0.189^{ns}
Confounder-like								
Male	0.79	0.76	0.78	0.73	1.41	1.23	0.206	0.185^{ns}
Ph.D. from Paris 9	0.18	0.16	0.12	0.13	1.09	1.60	0.208	0.175^{ns}
Ph.D. supervisor on the jury	0.69	0.67	0.75	0.81	0.75	0.60	0.204	0.175^{ns}
Ph.D. supervisor on another jury	0.22	0.20	0.21	0.18	1.28	1.11	0.209	0.181^{ns}

a) Non-promoted candidates

	Fraction of $U=1$ by promotion status and outcome				Outcome effect (Γ)	Selection effect (Λ)	Matching estimator	Standard error
	s_{11}	s_{10}	s_{01}	s_{00}				
Baseline matching estimator	0.00	0.00	0.00	0.00	-	-	-0.233	0.102**
Neutral confounder	0.50	0.50	0.50	0.50	1.28	0.98	-0.231	0.100**
Confounder-like								
Male	0.78	0.73	0.79	0.76	1.30	0.88	-0.233	0.097**
Ph.D. from Paris 9	0.12	0.13	0.18	0.16	1.36	0.73	-0.230	0.101**
Ph.D. supervisor on the jury	0.75	0.81	0.69	0.67	1.30	1.82	-0.239	0.104**
Ph.D. supervisor on another jury	0.21	0.18	0.22	0.20	1.30	0.95	-0.231	0.103**

NB1: U defines a binary confounding factor, which is not observed and s_{ij} denotes the fraction of $U=1$, by promotion status and publication score. On the basis of these parameters, a value of U was simulated and used to estimate a kernel-matching estimator (after 1,000 repetitions).

NB2: ***: significant at 1%, **: significant at 5%, *: significant at 10% and ns: non significant

The results of the sensitivity analysis for promoted candidates (table 6a) when the distribution of U is in turn comparable to the distribution of gender are examined below. After controlling for observable covariates, skills were found to increase the publication score for non-promoted people ($\Gamma = 1.41 > 1$) and the probability of being promoted ($\Lambda = 1.23 > 1$). If the CIA is not respected when it is attributed these characteristics, the matching estimator is equal to 0.206. This indicates that the potential confounder U behaves like the gender dummy. It explains only 1.44%[8] of the baseline estimate and remains statistically non-significant. Similarly, when the distribution of U is assumed to mimic the distribution of other observable binary covariates, all these variables were found to affect the outcome and the selection effects. However, for the promoted people, the simulated matching estimator was always very close to the baseline estimate and always non-significant.

Similarly, the results of the sensitivity analysis for non-promoted people (table 6b) indicate that the simulated matching estimators do not strongly differ from the baseline estimates and remain statistically negative, whatever the type of distribution chosen for U.

All these simulations support the robustness of the matching estimates, whatever the distribution chosen for *U*. Although unobservable abilities influence the outcome and selection effect, they do not seem to affect the estimate of the publication-score differentials before and after promotion.

IV- Conclusion

The present research represents the first attempt to empirically test whether or not the productivity of French university professors decreases when they are promoted from assistant professor to full professor. According to the Peter Principle, promotion would be expected to lead to a decrease in productivity and failure to obtain promotion would be expected to lead to an increase in productivity. An original and rich dataset was constructed in order to test these predictions for professors in the field of business studies who were promoted or denied promotion via the *concours d'agrégation*, which is the main procedure for promoting university professors in this field in France. This dataset was used to compare the publication scores of promoted professors with counterfactual publication scores; that is to say, with the publication scores they would have had if they had not been promoted. As counterfactual productivity cannot be observed, this evaluation had to overcome the problem

[8] $(0.209 - 0.206) / 0.209$

of selectivity bias. This was done by applying kernel-matching methods. The results clearly contradict the predictions of the Peter Principle, as promotion from assistant professor to full professor was found to have no significant effect on publication scores. Conversely, failure to achieve promotion seems to lead to a marked decline in productivity. A sensitivity analysis (carried out according to the method described by Ichino *et al.*, 2008) supported the robustness of the matching estimates, whatever the distribution chosen for *U*.

The data show that promotion to full professor rank does not lead to a Peter Principle effect. Nevertheless, Peter and Hull's (1969) conclusion that "things always go wrong" may still apply to business studies professors in French universities – because the *concours d'agrégation* is the main route to promotion, and because 58% of candidates for promotion are unsuccessful, failure to achieve promotion may lead to a decrease in productivity for the majority of professors. Furthermore, the promotion procedure seems to be rather counter-productive, not because of the selection process itself, but because of a lack of other promotion opportunities. In order to maintain promotion opportunities, and hence incentives to be productive, the French university system's promotion procedure needs to be substantially reformed, particularly in the field of business studies.

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Appendix 1: Publication score differentials before and after promotion

	(1) Kernel matching	(2) Nearest-neighbor matching	(3) Radius matching
Promoted candidates			
Full sample	0.211 (0.191)^{ns}	0.089 (0.142)^{ns}	0.184 (0.139)^{ns}
Non-promoted candidates			
Full sample	-0.234 (0.103)**	-0.221 (0.124)*	-0.228 (0.113**)

NB: Standard errors are given in brackets. For kernel matching, bootstrapped standard errors (obtained after 1,000 replications) were estimated.