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Gender and Promotions: Evidence from Academic Economists in France *

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Abstract

We exploit the unique features of the promotion system for French academics to examine the causes of the promotion gap between men and women. Promotions occur through national competitions for which we have information on candidates and on those eligible to be candidates. We find that gender has no significant effect on candidates promotion rates. In contrast, women have a lower probability to be candidates, which is not driven by differences in the objective costs or rewards of the contest. A possible interpretation of our results is that women are less willing than men to participate in contests, in line with recent experimental evidence.

JEL Classification: J16, J7, I23

Key words: gender gaps, promotions, academic labour markets

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1 Introduction

Despite the rapid increase in female educational attainment over the last decades, the labour market outcomes of men and women still differ in terms of wages and seniority. The literature on gender wage gaps is vast, but differences across genders in promotions have received much less attention. These gaps can be large. For example, Bertrand and Hallock (2001) find that women account for only 2.5 percent of top executives in US firms. Gobillon, Meurs and Roux (2015) show for France that the gender gap in the probability of being an executive increases along the wage ladder from 9% to 50%. Differences in characteristics account for a large proportion of the gap, with the remaining fraction being usually attributed to preferences or discrimination.[1] Measuring the role played by these two aspects has proven difficult. This paper uses the particular features of the French academic system, namely the fact that promotions occur through national contests, to look at various causes for the lower promotion rates of females and discriminate among them.

The observed promotion rates may be due to lower success rates of female candidates or to them being less likely than men to seek promotion. In the US and the UK academic systems or in private sector jobs only information on actual promotions is available, while the list of applicants tends not to be known.[2] In France, academic promotion occurs through a national contest or *concours,* with the lists of applicants being publicly available at the time of the *concours*. Moreover, because academics are public servants, we have information on those holding junior positions which constitute the pool of 'potential applicants'. We can hence examine not only whether gender affects a candidate's promotion probability, but also whether it impacts the decision to be a candidate.

Using data for academics has important advantages. Unlike in many private sector jobs, where a promotion is associated with longer hours and a requirement for greater availability outside normal working hours, academics have similar obligations and constraints at all hierarchical levels. Even if more senior academics tend to be involved in university administration and outside responsibilities such as participating in committees, seeking funding or performing editorial activities, these activities are to a large extent voluntary. They are not 'required' by the promotion and not performing them would not imply that the individual is demoted. Female associate professors should thus not feel more constrained in terms of combining career and family duties by becoming full professors, and there is hence no obvious reason why they would prefer not to be promoted. Male and female academics are also likely to have rather homogeneous labour market attachment, as argued by Kahn (1995), removing one of the reasons often branded to justify lower promotion rates for females. A further advantage of these data is that, unlike for most types of jobs, the key consideration in actual promotion decisions, an individual's productivity (publications), can be observed and thus controlled for by the researcher.

In this context, we consider several potential causes of the unexplained component of pro-

[1] For an overview of work on gender wage gaps see Blau and Kahn (2000). On one hand of the spectrum, Goldin and Rouse (2000) provide evidence of discrimination against women, on the other, Ichino and Moretti (2009) trace gender gaps to biological differences.

[2] An exception is the analysis of auditions for orchestra membership and promotion in Goldin and Rouse (2000).

motions gaps. On the one hand, women may be less likely to be promoted conditional on having applied, and this could be due either to discrimination or poor performance during the *concours*. On the other, female academics may have a lower propensity to apply for promotion than males, which could be explained by the requirements of the contest being more costly for women, to their facing a different trade-off between salaries and department prestige, or simply to an unwillingness to enter the contest. The special features of the French academic system, such as a national salary scale and the existence of several categories of academics with different requirements during the contest and upon promotion, allow us to test for these hypotheses.

We use data for academic economists in France over the period 1991 to 2008, and find lower promotion rates for women, which are partly but not completely explained by the age structure and publication records. We then consider separately the determinants of the likelihood to enter a promotion *concours* and the probability of being promoted conditional on having entered the *concours*. We find no significant effect of gender on the latter, thus rejecting the idea that females underperform in contests, and providing no support to the presence of discrimination against women. In contrast, being a woman has a substantial negative effect on the likelihood to enter the *concours*.

We explore several potential explanations for this difference. We find no evidence that either a different trade-off between income and department prestige nor the cost undertaking the *concours* and the mobility implications associated with it (see below) are the causes of the gender gap. The results seem to indicate that women are less willing than men to enter competitions for promotion, and this could be due either to different attitudes towards contests or to the expectation of being discriminated against. When we look at features of each year's *concours,* we find evidence consistent with both aspects.

Our contribution is twofold. First, the paper adds to the literature examining the different rates of promotion across genders; see, amongst others, Lazear and Rosen (1990), Winter-Ebmer and Zweimuller (1997) and Goldin and Rouse (2000). Several papers use data on academics to try to understand gender gaps in labour markets, dating back to the seminal work of Cole and Cole (1973). Early on, empirical analyses identified both lower wages and lower promotion rates for female economists; see Johnson and Stafford (1974) and Farber (1977). More recent work, such as Ginther and Hayes (1999) and Ginther and Kahn (2004), indicates that in the US salary gaps are explained by differences in academic rank, while promotions to tenure and to full professor rank are still affected by gender even after controlling for research output and demographic characteristics. Some studies claim a decline in the promotion gap over time, while others find that it is large even in recent decades; see McDowell, Singell and Ziliak (2001) and Ginther and Kahn (2004). Evidence for the UK by Blackaby, Booth and Frank (2005) indicates that there are both gaps in promotions and in within-rank pay across genders, and their findings suggest that these are partly due to differences in the outside offers received by men and by women, while Sabatier (2010) documents the existence of a promotion gap in France.[3] Most of this literature has considered the US and the UK, which have an academic labour market with much greater wage and promotion flexibility than those found in most European countries. Our paper examines whether promotion gaps also exist in a labour market that operates in an

[3] A number of recent analyses focus on the effect of the sex of committee members on female promotions; see, for example, Lavy (2008) and Bagues and Esteve-Volart (2010).

entirely different way, with salaries being fixed at the country-wide level and promotions being decided by national committees and not by the department where the individual is employed.

The paper also provides evidence on female attitudes towards competition in an actual labour market and hence adds to the growing body of work that has addressed this question but which has so far been mainly based on experimental evidence. This literature has proposed an alternative explanation for women's poorer performance in labour markets. Recent work finds that women tend to be less likely to enter competitions and tend to perform worse in competitions than men; since promotions to top jobs tend to be highly competitive, such behaviour could explain why we observe fewer women in these jobs. Our conclusions are partly supportive of what the experimental literature has found. In line with the results in Niederle and Vesterlund (2007), Niederle and Vesterlund (2011) and Gupta, Poulsen and Villeval (2013) we find that once we control for observed productivity, women are less likely than men to enter the *concours* and that this difference does not depend on the objective costs associated with the contest. In contrast, the finding that women are as likely to be promoted conditional on being a candidate can be interpreted as a lack of evidence for the underperformance in contests found by Gneezy, Niederle and Rustichini (2003).

The paper is organised as follows. After describing the French academic system, section 2 examines the possible reasons why women are less likely to be promoted. Section 3 describes the data, an exhaustive panel of academic economists in France over the period 1991 to 2008. Our results are presented in section 4, while section 5 concludes.

2 Why are there so few female professors?

2.1 The French academic system

The French academic system has a number of features that we intend to exploit to test possible causes of the low rate of promotion of females in academia. We start this section with a description of the French system, and turn next to the various hypotheses.

There are two types of academic positions in France. The most common are university positions, where the individual is a professor with a substantial teaching load. There exist also a number of public research instances, of which the largest is the Cnrs, that have pure research positions.[4] Researchers in this category are hired by the Cnrs, who pay their salaries, but are attached to a university and are hence located in its economics department just like the university professors are. Researchers have the possibility to undertake some teaching and they participate in department life in the same way as standard professors.

For all types of position there is an entry level category equivalent to assistant professor, termed 'Rank B', which includes the *maître de conférences* positions at the university and the *chargé de recherche* at the Cnrs. The individual can then be promoted to 'Rank A', the equivalent to full professor, a position denoted *directeur de recherche* at the Cnrs. Both rank A and rank B positions are tenured, which implies that an individual who does not get a promotion

[4]Cnrs stands for *Centre National de la Recherche Scientifique*. There are other instances, such as the *Institut National de la Recherche Agronomique*, which accounts for about 5% of the academic economists in France. Unfortunately we have not been able to obtain the list of candidates for promotion for those and hence will not include them in our analysis.

can spend her/his entire career in a 'junior', i.e. rank B, position. Because of this possibility, we will term the two types of positions 'rank B' and 'rank A', rather than junior and senior. The promotion from rank B to rank A entails a substantial salary increase and a much steeper slope for salaries over time. The salary scales are identical for university professors and researchers and set by the Ministry of Higher Education and Research.[5]

Promotions take place through a national contest, a *concours*, and are thus not decided by the department in which the individual holds her/his current position.[6] Participation in this contest is public information, and at the end of it a list with the ranking of those that have undertaken it is published. The fact that departments do not make promotion decisions is important for our purposes. In a system in which there is a positive correlation between prestige and promotion threshold, women could choose to select into less prestigious department because promotion is easier in those, and hence the measured gap would underestimate the actual promotion gap. A second feature of the French system is that there is no relationship between department prestige and salaries. Academic salaries are determined according to a national scale based on rank, and rank is decided at the national level.[7] There is thus no reason to prefer being employed in a less prestigious department since salaries are the same across universities and the threshold for promotion is set nationally.

Members of the national committees that decide on promotion are academic economists, drawn from various universities in the country and areas of expertise. Committees tend to be large and represent a wide spectrum of universities, not necessarily the most prestigious. Because members of these committees have to be of the full professor rank and because of the age distribution of the population of academics, there is a strong male dominance in these committees. Committees change regularly, every two to four years depending on the particular instance.

The requirement of the *concours* differs across the two academic tracks. For university professors the contest, termed *concours d'agregation*, is biannual and entails four stages over, approximately, a 6-month period. It includes a research seminar, and three oral exams both in the candidate's field and in economics in general, one of which consisted of preparing in 24 hours a lecture on a topic randomly drawn by the applicant from a lengthy predetermined list. The *concours* hence takes time and requires substantial preparation outside the candidates field of expertise. In contrast the effort involved in the Cnrs promotion *concours* is minimal. The candidate simply declares him/herself a candidate for a position as *directeur de recherche* (DR) and submits a vitae and research proposal to the committee. This *concours* takes place annually.

There is a second difference in terms of the costs involved in the two systems. For university professors, a list of open positions is published and at the end of the *concours* candidates choose, sequentially and starting with the highest ranked, which department to join. When promoted,

[5]Within each broad rank, A and B, there are subranks that affect salary. Subrank promotion is also decided by a national committee, although the cost here is minimal, with application for a promotion requiring filling a form and submitting a vitae. Promotion to a higher subrank does not involve change of department, the number of promotions is not fixed ex ante, and the list of candidates is not public knowledge.

[6]Some internal promotions exist for individuals that have undertaken substantial administrative tasks at the university, but they are rare. See Combes, Linnemer and Visser (2008) for more details.

[7]Some departments pay, out of their own funds, an extra salary on top of the one paid by the university/cnrs. This practice is, however, restricted to only a few members in a handful of departments.

the individual is usually not able to stay in the university where s/he held a rank B position and has to move to a different department.[8] After three years s/he is allowed to move to another university, if the latter wishes to recruit her/him, including the university where s/he held the rank B position. For researchers, academics that are promoted can choose to stay at the university where they are or move to another department. The university does not need to have an open position for them since the researchers' salary is always paid by the Cnrs.

It is obvious that promotion is very costly for university professors. There is a cost that in principle is gender-neutral, the cost of preparing the various exams. The *agregation* also involves a substantial cost ex post both because of the geographical mobility involved in being promoted to full professor, but also because the individual faces considerable uncertainty about where s/he will be eventually recruited if successful. Since candidates seeking to become full professor are typically between 30 and 40 years of age, the process occurs at a moment in the life-cycle when family constraints are likely to be substantial. If women are less geographically mobile than men, then the cost is likely to be greater for them.

There are hence two differences between the *agregation* and the Cnrs *concours*. First, the former involves substantial costs that do not exist for the later. Second, performance during the contest only matters in the *agregation*, as in the Cnrs the committee bases the decision on the vitae without meeting the candidates.[9]

2.2 Discrimination, differences in payoffs or self-selection?

Although a substantial literature has examined the promotion gap across genders, a clear explanation is still lacking. Women may be less likely to be promoted either because they apply for promotion less often than men or because of a lower probability of being promoted conditional on being a candidate. These differences may in turn have three possible causes: discrimination, differences across genders in the costs of or rewards from promotion, and different attitudes in and towards the promotion process itself.

Existing work has had difficulty in testing these different hypotheses. Part of the problem is the fact that, generally, there exists no record of who applied for promotion or of who could have applied. It is hence impossible to know whether the higher probability of men to hold a senior position is due to a lower conditional probability of success of women or to their lower propensity to apply. Moreover, even if data on applications were available, the trade-off that exists in the Anglo-Saxon academic system between prestige of the department and promotion thresholds makes it difficult to assess the possible causes of a lower application propensity. In contrast, the French system presents a number of features that will allow us to evaluate the various hypotheses.

To understand the possible mechanisms in operation consider the following model of promotion. Suppose that individual i is a candidate for promotion at time t. The (conditional)

[8] In our sample, 80% of those promoted through the *agregation* have a new affiliation after their promotion.

[9] A question that we have not addressed is whether the degree of competition is greater for university professors or for researchers. On the one hand, a much smaller number of researchers are promoted each year in the Cnrs than in the *concours d'agregation.* On the other, although the list of candidates and rankings are available on internet for both, the *agregation* solicits much greater interest from the academic community, with results at each stage being widely followed and discussed, which increases the preasure on candidates. It is hence difficult to argue that one or the other contest is more competitive.

probability of success of individual i at time t, denoted $\Pr_j(S,i,t)$, is given by $\Phi\left(X'_{it}p_j\right)$, where $\Phi\left(.\right)$ is a function of individual characteristics, X'_{it}, and p_j is the associated vector of coefficients. The subscript $j = u, r$ denotes whether the model applies to data for university professors or researchers.

We assume the following specification:

$$X'_{it}p_u = p_{u0} + p_0^f\ \delta_i + p_{u1} \times Output_{it} + p_{u2} \times Effort_{it} \quad (1)$$

$$X'_{it}p_r = p_{r0} + p_0^f\ \delta_i + p_{r1} \times Output_{it} \quad (2)$$

The variable δ_i is a dummy taking the value 1 for females. The two individual variables determining the probability of success in the contest are the individual's research output, $Output_{it}$, and his/her effort, $Effort_{it}$ which matters only for the university track.

The first possible explanation for the promotion gap across genders is simply that those making the promotion decisions discriminate against women, in which case $p_0^f < 0$ and measures the gender gap in promotion due to discrimination, which we assume to be the same across tracks. Female candidates may also be less likely to succeed if they tend to underperform in contests, as shown by Gneezy et al. (2003). Obviously, effort cannot be observed so we suppose that $p_{u2} \times Effort_{it} = p_{u2} + p_{u2}^f\ \delta_i$, with $p_{u2}^f < 0$ if women exert lower effort. We can hence write

$$X'_{it}p_u = p_{u4} + p_{u4}^f\ \delta_i + p_{u1} \times Output_{it} \quad (3)$$

where $p_{u4}^f = p_0^f + \ p_{u2}^f$ captures both the effect of discrimination and of effort, and $p_{u4}^f\ \leq p_0^f$.

Alternatively, women may differ in the costs of and rewards from promotion and this can make them less willing to apply for promotion, causing 'self-selection' out of the promotion race. The decision whether to be a candidate is determined by a comparison between individual costs and benefits from entering the contest. An individual will be a candidate if and only if the expected cost, C_{ij}, is lower than the product of the expected probability of success, $\widetilde{\Pr}_j(S,i,t)$, and the value of being promoted, V_{ijt}. That is, if

$$C_{ij} < \widetilde{\Pr}_j(S,i,t) \times V_{ijt} \quad (4)$$

We suppose that costs are given by

$$C_{iu} = c_0 + c_0^f\ \delta_i + (c_1 + c_1^f\ \delta_i)\ \times Time + (c_2 + c_2^f\ \delta_i) \times Moving \quad (5)$$

$$C_{ir} = c_0 + c_0^f\ \delta_i \quad (6)$$

where the terms c_0 and c_0^f capture any psychological or subjective costs incurred when taking part in a contest, and for the university track (but not for researchers) there are additional costs due to the time required to prepare the contest, $Time$, and the expected probability of moving place of residence, $Moving$. Since none of these costs can be observed, we express the cost for professors as $C_{iu} = c_{u0} + c_{u0}^f\ \delta_i$, where $c_{u0} = c_0 + c_1 \times Time + c_2 \times Moving$ and $c_{u0}^f = c_0^f + c_1^f \times\ Time + c_2^f \times\ Moving$. Then $c_{u0}^f \geq c_0^f$, as the costs of taking part in the contest are at least as large for professors as for researchers.

In the US system, there is no reason why women may have different objective costs of pro-

motion from men. In contrast, in the French system, there may be differences across the sexes: the opportunity cost of time could be higher for women if they undertake a disproportionate amount of domestic work, while differences in intra-household bargaining power could make it harder for female than for male professors to impose the cost of moving on their families.

Women may also choose not to apply for promotion because they are less inclined to compete in tournaments than men, as indicated by experimental evidence; see Niederle and Vesterlund (2007), Niederle and Vesterlund (2011) and Gupta et al. (2013) as well as the discussion in Bertrand (2011). Given the competitive nature of most promotions, if women are less inclined to enter competitions, then they will apply less often than men even if the objective costs and benefits are the same. This difference is captured by the term c_0^f, which would be positive if the subjective costs of competing are higher for women than for men.

Turning to the expected value of being promoted, we suppose it to take the form

$$V_{iut} = v_0 + (v_1 + v_1^f \ \delta_i) Income_t + (v_2 + v_2^f \ \delta_i) \times (Dept_{it+1} - Dept_{it}) \quad (7)$$

$$V_{irt} = v_0 + (v_1 + v_1^f \ \delta_i) Income_t \quad (8)$$

The intrinsic value of the promotion is given by v_0, which we assume is common across sexes and tracks. The variable $Income_t$ captures the increase in income associated with promotion, while the dummy $Dept_{it}$ has a value of 1 if the candidate is in a top department. The last term hence captures the cost to those passing the *agregation* of moving from a top to a less good department, which is not present for researchers. Men and women may have different preferences over department prestige and income. Suppose that women have a lower marginal utility of income because, often, they are the second earner in the household, then $v_1^f < 0$. Women could also have stronger preferences for department quality, which would be captured by $v_2^f > 0$. In either case, women would be less willing to trade-off department quality for income and this would make female professors in top departments less likely to apply for promotion than males.[10]

Lastly, consider the expected probability of being promoted. Let $\widetilde{\Pr}_j(S,i,t) = \Phi\left(X'_{i(g)t}\widetilde{p}_j\right)$ where all the coefficients $\widetilde{p}_j$ are now those the agent believes to apply, which may differ from the true coefficients. Any variable that makes this expected probability lower, will reduce the likelihood of an individual seeking promotion. If, for example, women believe that they will be discriminated against, i.e. that $\widetilde{p}_0^f < 0$, then they will be less likely to apply for promotion than men irrespective of whether they are actually discriminated.

In this context, it is possible to test the various hypotheses by examining both the probability of succeeding in the promotion contest and the probability of being a candidate, and by exploiting the differences between the implications of promotion for university professors and for researchers. We do so as follows:

Discrimination: Discrimination is captured by $p_0^f < 0$, and implies a negative impact of being female on the conditional probability of promotion in the two tracks.

Underperformance in contests: Underperformance in contests implies $p_{u4}^f < p_0^f$, that is, a more negative coefficient on gender for professors than for researchers.

[10] See McDowell et al. (2001) for a discussion concerning the US, where more prestigious departments also have tougher promotion thresholds making it difficult to understand the reasons behind the promotion gap.

Higher objective cost of promotion: If women were not trying to get promoted because of the cost of mobility, then $c_{u0}^f > c_0^f$, i.e. there would be a more negative effect of being female on the probability of applying for promotion for professors than for researchers.

Differences in preferences about prestige and salary: This effect implies that female professors will be less willing to apply for promotion if they are in a top department than if they are not. Because promotion does not require changing department for researchers, we would expect to find no differences in the probability of applying for promotion for female researchers across departments.

Expected discrimination: To examine whether women's belief that they will be discriminated against affects their propensity to seek promotion, we proxy expected discrimination by the fraction of rank A professors that are women in a particular year, as a greater fraction could be interpreted by candidates as weaker discrimination. A positive effect of this variable interacted with being female would indicate that women's decision to seek promotion responds to the observed promotion rate of women in the past.

Unwillingness to participate in contests: Women may also be less willing to take part in contests because of a subjective cost of competing captured by $c_0^f > 0$. Our data does not allow for a direct test of this hypothesis.

2.3 Empirical specification

To start with, we follow the existing literature and suppose that the probability of individual i being rank R at year t is given by

$$\Pr_j(R, i, t) = \Phi\left(X_{it}'\beta_j\right) \tag{9}$$

where the two states R are being rank A or not, and $\Phi(.)$ denotes the logistic density function. The term $X_{it}'\beta_j$ in equation (9) is

$$\begin{aligned} X_{it}'\beta_j &= \beta_{j0} + \beta_{j0}^f\ \delta_i + \beta_{j1}\ Age_{it} + \beta_{j2}\ Age_{it}^2 + \beta_{j3}\ Pub_{it} \\ &\quad + \beta_{j4}\ Pub_{it} \times Quantity_{it} + \beta_{j5}\ Pub_{it} \times Quality_{it} \end{aligned} \tag{10}$$

implying that the probability of promotion is a function of age Age_{it} and its square, whether or not the individual has published in Econlit-classed journals (i.e. whether s/he is a 'publisher' measured by the dummy Pub_{it}), the number of publications and the average quality of these publications, denoted respectively $Quantity_{it}$ and $Quality_{it}$, both measured in logs (see below for the exact measurement). With δ_i being a dummy for females, β_0^f measures the differences in promotion probability for men and women with the same characteristics. We would have liked to control for characteristics of the individual's family life, such as whether s/he is married and the number and ages of children, but such data were not available.[11]

Consider next the probability that individual i applies for promotion (i.e. takes the *concours*)

[11] In the light of existing evidence, this is likely not to be a major omission; for example, Ginther and Kahn (2004) find that having children has only a weak effect of the promotion probabilities of female economists in the US and none on their productivity.

at time t, which we assume to be

$$\Pr_j(C, i, t) = \Phi\left(X'_{it}\gamma_j\right) \tag{11}$$

where the two states C are being a candidate for promotion or not and

$$\begin{aligned} X'_{it}\gamma_j &= \gamma_{j0} + \gamma^f_{j0}\ \delta_i + \gamma_{j1}\ Age_{it} + \gamma_{j2}\ Age^2_{it} + \gamma_{j3}\ Pub_{it} \\ &+\gamma_{j4}\ Pub_{it} \times Quantity_{it} + \gamma_{j5}\ Pub_{it} \times Quality_{it} \\ &+\gamma_{j6}\ Dept_{it} + \gamma^f_{j6}\ \delta_i\ Dept_{it} \end{aligned} \tag{12}$$

The dummy $Dept_{it}$ has a value of 1 if the candidate is in a top department (see below for the definition) and will capture whether individuals in top departments are less likely to apply for promotion because of the mobility costs involved.

Lastly, the probability of success in a *concours* conditional on being a candidate is given by

$$\Pr_j(S, i, t|\, C_{it} = 1) = \Phi\left(X'_{it}\alpha_j\right) \tag{13}$$

where the two states S are succeeding or failing in the *concours* (i.e. being promoted or not), C_{it} is a dummy that takes the value one if the individual applied for promotion, and

$$\begin{aligned} X'_{it}\alpha_j &= \alpha_{j0} + \alpha^f_{j0}\ \delta_i + \alpha_{j1}\ Age_{it} + \alpha_{j2}\ Age^2_{it} + \alpha_{j3}\ Pub_{it} \\ &+\alpha_{j4}\ Pub_{it} \times Quantity_{it} + \alpha_{j5}\ Pub_{it} \times Quality_{it} \\ &+\alpha_{j6}\ Dept_{it} \end{aligned} \tag{14}$$

Obviously, the qualities that lead to promotion conditional on applying are also those that make a potential candidate apply, hence it is not possible to run a selection model.

Equations (9) and (10) capture the mechanism usually examined in the literature on academic promotions. Assuming that the estimated coefficient $\widehat{\beta}^f_{j0}$ is different from zero, we can then estimate the other two models to see to what extent the difference in the probability of being rank A is due to women being less likely to enter the *concours* or to them having a lower success rate in the *concours* than men. That is, we are interested in whether γ^f_{j0} and α^f_{j0} are significantly different from zero, as well as in the differences between the coefficients estimated for the two tracks.

3 The Data

Our sample consists of the entire population of French academic economists provided by the French Ministry of Higher Education and Research and the Cnrs for the years 1991 to 2008. For each individual we have information on age, rank, publication stock (see below) and department. We keep only individuals that are in departments larger than 4 full-time equivalent academics, which removes economists that are isolated in universities without real economics departments. Those (few) individuals for whom some of the individual characteristics (age or position for instance) are missing are also excluded.

In order to examine separately the determinants of the probability of applying for promotion

and the likelihood to succeed in the *concours*, we use the list of candidates that applied to and those who succeeded in becoming a rank A university professor or a rank A Cnrs researcher (DR). For professors we have the lists of candidates to promotion and actual promotions for the nine biannual *concours* taking place from 1992 to 2008, while for researchers we have the thirteen annual *concours* between 1996 and 2008.

Although all academic economists of rank B the year prior to the *concours* are eligible for promotion, it is important to consider how to define potential candidates. Two issues are relevant. First, it is possible for Cnrs researchers to take the *agregation*, and some individuals in our dataset do so. In contrast, although it is in principle possible for rank B university professors to apply for a rank A Cnrs position, there are in our data no such individuals. This is probably due to the fact that few promotions are available each year (between 2 and 4) and they are perceived as being internal promotions for those already in the Cnrs. We will hence consider both those that hold a rank B position as professors or at the Cnrs as potential candidates for the *agregation* but only those with a Cnrs rank B position as potential candidates to promotion to DR. The second question is how to deal with older candidates, who may have characteristics that may make them choose not to apply for promotion (poor publication record, unsuccessful past applications, low unobserved ability, etc.). In order to avoid having in our pool an increasing number of candidates unlikely to apply we introduce age limits. We hence consider as potential candidates for the *agregation* all rank B economists aged between 28 and 49, and as potential candidates for the Cnrs promotion the Cnrs rank B economists aged between 34 and 55.[12] The lower bounds are given by the age of the youngest candidate in each *concours*, while the upper bounds imply that we consider 97% and 91% of the candidates to the *agregation* and the Cnrs promotion, respectively. These bounds yield 7,209 observations for the *agregation*, while we have 1,004 observations for candidates susceptible to apply for Cnrs promotions.[13]

We define two categories of department, somewhat equivalent to the division in the US between the top-50 and other departments. France has a substantial number of national academic publications in French, and hence we define prestigious departments as those that have the largest research output in international journals (see Appendix A for details). For this reason, we will term them 'international' departments and the rest 'national' departments. The international departments account for about one third of the academics each year.

3.1 Measuring research output

Our key explanatory variable is an individual's research output, and we measure the output of individual i at date t by her/his cumulative publication record between the first year for which we have an observation for that individual and date t.[14] Publication records are measured as weighted sums of publications. All publications come from the EconLit database, which includes more than 560,000 papers published in more than 1200 journals between 1969 and 2008. We merge the data on publications with the list of French academics that includes individual

[12] Robustness analysis indicates that all our results hold with different upper bounds, and the results without age limits are available at Bosquet, Combes and Garcia-Peñalosa (2013).

[13] The difference in the number of observations is mainly due to the fact that the Cnrs acounts for a small fraction of academics.

[14] As an alternative, we have computed degressive publication scores, with older publications having a smaller weight than recent ones. Measuring research output this way does not change our results.

characteristics (position, department, age, gender), merging by surname and initial, and then correct manually for those individuals having the same name and initial. Three dimensions enter the weighted scheme of publications: the quality of journals, the number of authors and the publication's relative number of pages.

We measure the quality of publications using the journals weighting scheme proposed by Combes and Linnemer (2010). Two different degrees of convexity in the distribution of journals' weights are proposed and we use the most convex one (i.e. the one that most values quality), but our results are unchanged when we use the least convex one. We divide each publication by the number of authors, a standard practice in the literature, and weight by the number of pages to capture the idea that longer articles contain more ideas, considering an article's length relative to the average length in that journal the same year.

The output of individual i at date t is then a weighted sum of her/his articles a published between the first year in which s/he published an article, t_0, and date t, so that

$$y_{it} = \sum_{a \in [t_0, t]} \frac{W(a)}{n(a)} \frac{p(a)}{\bar{p}} \tag{15}$$

where $p(a)$ is the number of pages of article a, $\bar{p}$ is the annual average number of pages of articles in the journal, $n(a)$ the number of authors of the article, and $W(a)$ the weighting scheme for journals. Each individual receives three scores: a dummy equal to 1 if s/he has at least on publication in an EconLit-listed journal, the quantity of single-author-equivalent published articles, $\sum_{a \in [t_0, t]} 1/n(a)$, and the average quality of her/his articles, defined as y_{it} divided by the quantity.

3.2 Descriptive statistics

Table 1: Percentage rank A by gender in 2008

rank A	Total	%	Women	%	Men	%
	Total sample					
0	1425	67.7	512	83.0	913	61.4
1	680	32.3	105	17.0	575	38.6
	University professors (91% of population in 2008)					
0	1321	69.0	477	83.5	844	62.8
1	593	31.0	94	16.5	499	37.2
	Cnrs Researchers (9% of population in 2008)					
0	104	54.5	35	76.1	69	47.6
1	87	45.5	11	23.9	76	52.4

Table 1 gives the decomposition of our sample in terms of institutional affiliation and rank for the most recent year in our data, 2008. There were 2,105 (Cnrs and university) academic economists in France that year, and the vast majority of the population consists of university professors, with researchers accounting for only 9% of the total. Women account for 29% of observations, and they are over-represented amongst university professors and under-represented

amongst researchers, where they account for only 24% of the population. This difference could be due to the fact that obtaining a position as a researcher tends to require a stronger publication record than for university positions and, as we will see below, women tend to have a weaker research output than men.

Slightly under a third of the population hold a rank A position, with the fraction being lower for university professors (31%) and higher for researchers (45.5%). Note that the data do not seem to indicate that women choose a career path that offers higher average promotion rates, which would counterbalance negative discrimination. Our data shows that feminisation is lower for researchers, which have a higher promotion rate, indicating that there is no selection of this type taking place. The gender promotion gap is large, 22 percentage points on average, and is smaller for university professors than for researchers (21 and 29 points, respectively).

Table 2: Descriptive statistics of potential candidates

	Univ', panel 1992-2008				Cnrs, panel 1996-2008			
	Min.	Max.	Mean	Std. err.	Min.	Max.	Mean	St. err.
				Women				
Prob. Candidate	0	1	0.078	0.268	0	1	0.129	0.336
Prob. Promotion	0	1	0.023	0.151	0	1	0.019	0.136
Age	28	49	37.9	5.6	34	55	42.4	5.9
Publisher	0	1	0.60	0.49	0	1	0.75	0.43
Quantity	0	15.0	1.13	1.63	0	15.0	2.53	2.94
Quality	0	62.5	0.52	3.18	0	33.7	1.52	5.04
Prob. Int. Dept.	0	1	0.31	0.46	0	1	0.54	0.50
				Men				
Prob. Candidate	0	1	0.125	0.331	0	1	0.181	0.385
Prob. Promotion	0	1	0.047	0.211	0	1	0.047	0.212
Age	28	49	39.5	5.7	25	55	40.9	7.8
Publisher	0	1	0.64	0.48	0	1	0.87	0.34
Quantity	0	21.2	1.59	2.22	0	16.6	3.18	2.98
Quality	0	54.7	0.62	3.30	0	86.5	2.72	7.62
Prob. Int. Dept.	0	1	0.28	0.45	0	1	0.56	0.50

Int. Dept. = international department; see Appendix A for details. Productivity measures (quantity and quality) are in levels. We take their logs in the regression analysis. There are 7,209 observations from 1,853 individuals and 1,004 observations from 181 individuals in the university and Cnrs samples respectively. These correspond to 617 women (2,617 observations) and 1,236 men (4,592 observations) in the university sample and 58 women (318 observations) and 123 men (686 observations) in the Cnrs sample.

Table 2 reports some descriptive statistics for the sample of potential candidates. We have 7,209 observations, including a total of 1,853 academics. The panel is unbalanced as individuals enter the pool of potential candidates (usually when they get their PhD) and exit it either because they are promoted or because they leave academia or the country over our sample period, with the average number of observations per individual being 3.9. The probability of being a candidate to the *aggregation* is 7.8% for women and 12.5% for men, while for researchers these figures are 12.9% and 18.1%. The (unconditional) probabilities of being promoted on a given year are small, 4.7% for men, and 2.3% and 1.9% for women, depending on the track. The table indicates that some of these differences are likely to be explained by differences in observable characteristics. In our sample, the probability of publishing in EconLit journals is

64% and 60% for men and women, respectively. This figure is not large, but it is important to bear in mind that our publication criteria is stringent, especially given the strong tradition in France to publish books and the large number of national journals, some of which are not in EconLit. The quality of publications is somewhat higher for men (0.62 compared to 0.52), while the quantity of publications is 41% higher for men. For the sample of researchers, we find a higher probability of being a publisher but a greater gender gap (87% for men but only 75% for women), and a particularly large difference in the quality of publications.[15]

The definition and construction of our two categories of departments is detailed in Appendix A and Table 10 gives the list of 'international departments'. The last lines in the two panels of Table 2 indicate that the one aspect in which women seem to fare better than men is affiliation: in the larger sample 31% of women are in international departments, while only 28% of men are. When we focus only on researchers we find no difference in affiliation across the genders.

4 Results

4.1 The promotion of academic economists

We start by examining the determinants of being rank A for the entire population, which are reported in Table 3. In order to run regressions equivalent to those found in the literature on promotions in academia, where only outcomes are observed, we construct a sample that includes all rank A and rank B academics for each of the years that we will be using latter on to estimate the probability of being a candidate and of being promoted conditional of being a candidate. This gives us a sample of 20,154 observations. We can thus estimate the probability of *holding* a rank A position. All specifications include year fixed effects. In column (1), only time fixed effects and gender are included in the logit model, with the gender dummy being equal to 1 for women. The marginal effect on gender is significant at the 1% level and large at -0.233, implying an odds ratio of 0.31.[16] Including age reduces the effect on gender to -0.162, indicating that a large fraction of the difference in promotion is indeed due to the fact that the sample of women is younger than that of men. Column (3) includes our three measures of research output: whether or not the individual publishes, the quantity of publications and their quality. All three are highly significant and increase the probability of promotion.

Once we control for research output, the effect of gender falls to -0.057, about a quarter of the initial one, indicating that the lower promotion rate for women is to a large extent due to them having published less. The effect is nevertheless still strong: being a woman reduces the probability of promotion almost as much as having one rather than two single-authored publications. The effects we obtain are comparable to those found for the US. Ginther and

[15] Obviously some of the differences in research output are due to the age structure of the two populations, but Bosquet and Combes (2013*b*) show that even when controlling for age women have worse publication records. Women are sometimes also found to be cited less than men. This is the case in political sciences, as shown by Maliniak, Powers and Walter (2013), while for publications in biomedical and exact sciences, Kelchtermans and Veugelers (2013) find that women have a lower probability of reaching top citations but once they do they are as likely as men to stay there. In contrast, the data we use exhibits no gender gap in citations once research output is controlled for; see Bosquet and Combes (2013*a*).

[16] This values is obtained from $exp(-1.182)$, -1.182 being the coefficient associated to the -0.233 marginal effect.

Table 3: Likelihood to hold a rank A position: panel 1992-2008, marginal effects

	(1) logit	(2) logit	(3) logit	(4) logit	(5) probit	(6) OLS
Women	-0.203^a	-0.149^a	-0.055^a	-0.051^a	-0.049^a	-0.045^a
	(0.014)	(0.017)	(0.017)	(0.018)	(0.017)	(0.017)
Age		0.021^a	0.016^a	0.016^a	0.016^a	0.011^a
		(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Age^2		-0.000^b	0.000	0.000	0.000	0.000^a
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Publisher(Pub)			0.309^a	0.320^a	0.318^a	0.323^a
			(0.026)	(0.027)	(0.026)	(0.021)
Pub*Quantity			0.147^a	0.150^a	0.151^a	0.178^a
			(0.008)	(0.008)	(0.008)	(0.009)
Pub*Quality			0.035^a	0.038^a	0.038^a	0.034^a
			(0.004)	(0.004)	(0.004)	(0.004)
Cnrs				-0.101^a	-0.095^a	-0.110^a
				(0.021)	(0.022)	(0.028)
Women*Cnrs				-0.020	-0.018	-0.009
				(0.060)	(0.059)	(0.055)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
pseudo-R^2	0.039	0.125	0.362	0.367	0.366	0.394
Observations	20154	20154	20154	20154	20154	20154
log-likelihood	-12565	-11437	-8335	-8275	-8286	-8657

Standard errors clustered by individuals between brackets. ^{a}, ^{b}, ^{c} Significant at the 1%, 5% and 10% level, respectively. Pseudo-R^2: McFadden's R^2, R^2 for OLS regression.

Kahn (2004) find a raw gender gap of -0.213, which falls to -0.130 once age and publication records are included, indicating that differences in publications across genders explain a greater fraction of the gap in France than in the US.

Column (4) includes a dummy for being a researcher and its interaction with Women, and indicates that the negative effect of being a woman on seniority is stronger for the Cnrs, although this term is insignificant. Columns (5) and (6) report the estimations of a probit and an OLS model, respectively, and indicate that the result that women are less likely to be promoted are robust to the use of those specifications. There is however no robust evidence of a difference between the two tracks, with the coefficient on Women*Cnrs being insignificant.

The result that women have lower promotion rates than men contrasts with evidence on affiliation. Table 11 in Appendix B examines the likelihood for an individual to be in an international department, using the same explanatory variables as above. Women are more likely to be in a prestigious department than men, and the effect of being a woman on the probability of being in an international department is large.[17] These results are surprising. As argued by Lazear and Rosen (1990), it is hard to understand why women would be discriminated against in promotions but not in other labour market experiences. In fact, in many instances the evidence tends to indicate that women have a lower probability of both being promoted and

[17]The positive effect of being female on the likelihood of being in an international department may have three causes. The first is positive discrimination when departments consciously try to increase their female faculty. A second is unobservable abilities, such as organisational skills or teaching ability, which could be, on average, higher amongst female than male academics, specially since fewer women than men enter academia (see Petrongolo and Olivetti (2008) on selection and gender). Lastly, a strong female presence could be the result of joint offers made to couples by top departments.

being hired, as for example in the case of top US orchestras; see Goldin and Rouse (2000). This does not seem to be the case for academic economists, and raises the question of whether the low promotion rate of female academics has a cause other than discrimination.

4.2 Decomposing outcomes

4.2.1 Gender differences in success in the *concours*

The limitation of our analysis so far is that it uses only outcomes and hence we do not know whether lower observed promotions are the result of a lower likelihood to apply for promotion or lower success in obtaining the promotions. We hence examine the two separate steps. We start by considering what determines success in the contest conditional on being a candidate, and then move to the determinants of the decision to enter the contest.

The determinants of success in the promotion contests are assumed to be gender and the three variables measuring publications. We also include a dummy that captures whether the individual was, at the time of application, in an international department. This variable could measure unobserved ability –e.g. being a good teacher– or the positive effects that being in a more stimulating academic environment could have on the preparation of the *concours*. There are as well externalities due to having colleagues who are also preparing the *agregation* since candidates often work together and share the burden of preparing lectures on the various topics. Lastly, in the regression for the *agregation* we include a dummy for whether the candidate holds a position other than rank B university professor in economics (i.e. the candidate is in the Cnrs, in another field such as mathematics, comes from abroad, etc.).

The results, reported in the first four columns of Table 4, indicate that research output is the key determinant of the probability of success both in the *agregation* and the Cnrs *concours*. In the former all three measures of research output have a significant coefficient, while for the Cnrs promotion only quantity and quality matters. This is consistent with the fact that there is a stronger selection for those joining the Cnrs than for those following the standard university track, implying that the latter are more likely to be non-publishers. Being in an international department has a positive impact on the probability of passing the *agregation*, in line with our arguments before, while it has no impact on the probability of being promoted in the Cnrs contest.

Turning to our coefficient of interest, the impact of being female on the probability of success conditional on being a candidate for promotion, there is a negative but not significant difference across the genders. In fact, the probability of success in the *agregation* is 24.8% for men and 24.1% for women, and hence not significantly different. The coefficient is insignificant both for the raw probabilities and also when we control for individual characteristics, for professors and researchers. Gender simply does not matter.

To interpret this result consider first the Cnrs *concours*. Recall that the *concours* consists of submitting a vitae and a research proposal. The candidate does not 'perform' in front of the committee taking the promotion decision, hence the only reason why we would expect to find a negative coefficient on women would be discrimination. We can then interpret the insignificant coefficient as a lack of evidence of *ex post* discrimination against women in the contest. This does not mean that discrimination does not matter, since expectations of discrimination may

Table 4: Likelihood to be promoted conditional on applying, marginal effects

	Agreg' 1992-2008		Cnrs 1996-2008		Agreg': selected candidates 1992-2008			
	All candidates		All candidates		"Admissibles"		Close to threshold	
	(1) logit	(2) logit	(3) logit	(4) logit	(5) logit	(6) logit	(7) logit	(8) logit
Women	-0.007	-0.018	-0.068	-0.053	0.044	0.040	0.097	0.103
	(0.032)	(0.027)	(0.050)	(0.052)	(0.054)	(0.056)	(0.079)	(0.084)
Age		-0.018^{c}		-0.044^{c}		-0.033		-0.042
		(0.010)		(0.023)		(0.025)		(0.039)
Age^2		-0.000		0.001		0.001		0.002
		(0.000)		(0.001)		(0.001)		(0.002)
Publisher(Pub)		0.155^{a}		-0.016		0.112		0.142
		(0.049)		(0.121)		(0.093)		(0.138)
Pub*Quantity		0.091^{a}		0.077^{b}		0.032		-0.024
		(0.019)		(0.038)		(0.040)		(0.061)
Pub*Quality		0.047^{a}		0.032^{b}		0.031^{b}		0.024
		(0.006)		(0.014)		(0.013)		(0.021)
Int. Dept.		0.090^{a}		0.018		0.130^{a}		0.117
		(0.030)		(0.063)		(0.044)		(0.075)
Other		-0.030				0.008		0.008
		(0.033)				(0.069)		(0.105)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
pseudo-R^2	0.015	0.183	0.018	0.161	0.015	0.056	0.005	0.025
Observations	970	970	258	218	336	336	198	198
log-likelihood	-531	-441	-123	-92	-201	-192	-137	-134

Standard errors clustered by individuals between brackets. ^{a}, ^{b}, ^{c} Significant at the 1%, 5% and 10% level, respectively. Int. Dept. = international department; see Appendix A for details. Other: non-French Assistant Professors positions in economics, as well as Cnrs and Inra researchers, and assistant professors from other disciplines.

have an *ex ante* effect on women's choices and hence on observed outcomes, as discussed above.

In the case of the *agregation*, interpreting the coefficient is more complicated as it captures both potential biases in the committee and the actual performance of the candidate during the oral exams that we cannot observe. A negative and significant coefficient could then be due to either discrimination or underperformance by women, as in the experiments performed by Gneezy et al. (2003). Our results find no evidence of either discrimination against or underperformance by women.

The absence of a gender gap in the conditional promotion probability in the two tracks can also be due to discrimination being offset by over-performance or that, more generally, selection is an issue. Since fewer women are candidates than men, as we will see below, it is possible that they are drawn from the top of the distribution and hence that their unobserved ability is higher than that of men. The insignificant coefficient could then be the result of opposing effects canceling out: higher unobserved ability of women and discrimination against them.

To try to control for this, we perform two further tests exploiting the fact that for the *agregation* contest we have information on which individuals passed each stage of the competition, as well as the final rank. At the various stages of the competition, a number of candidates are eliminated, and after the penultimate stage a list of candidates that are *admissibles* is provided by the jury. These candidates then undertake the final test, after which a ranking of all *admis-*

sible candidates is provided and, if p positions are available that year, the top p candidates are promoted.

The first test focuses on *admissible* candidates only. Since at this stage a substantial number of candidates have been eliminated, if selection implies that the unobserved quality of male candidates is lower than that of female candidates, focusing on the 'best' should eliminate the (predominantly male) bottom tail of the distribution. Columns (5) and (6) of Table 4 present those regressions and indicate that there is no difference between men and women in either the raw rate of passing the last step of the context or the one obtained after controlling for output. Not surprisingly, only the quality of publications matters at this stage. To make our sample even more comparable, we construct from the final ranking of candidates a list of individuals close to the threshold. To do so we take, for each year, the n *admissible* candidates that did not get promoted and the n lowest-ranked candidates that did get promoted and rerun the same regression equations. If discrimination against women were taking place, it would be likely to appear in this reduced sample of candidates with similar observable (and probably close unobservable) characteristics. The last two columns of Table 4 show that, if anything, women are *positively* discriminated although the coefficient is not significant.

4.2.2 Likelihood to enter the *concours*

We turn now to the determinants of the likelihood to enter the *concours*. The results are reported in Table 5. The unconditional probability of applying is lower for women than for men both for university professors and researchers (column 1), and the negative impact of being female is even larger once we include individual characteristics, the marginal effect being -0.036 for professors and -0.107 for researchers. As expected, research output has a strong effect on the likelihood of being a candidate in either of the *concours*, with quality having a stronger effect for researchers. Being in an international department is significant only in the case of professors, where it tends to increase the probability of being a candidate. This may be due to the fact that, as we saw earlier, being in a top department has a positive effect of the probability of success; potential candidates may anticipate this and hence be more likely to apply if they are in those departments. An additional effect may come from peer pressure to pass the *concours*. Removing this variable from the analysis has no impact on the other estimated coefficients.

The results indicate that women have a lower likelihood to enter the contest for promotion. In terms of magnitude, being a woman is equivalent to decreasing the number of single-authored publications by around 0.6 for the university professors and 1 for the Cnrs researchers,[18] or to decreasing the quality of publications by 87% and 113% of its standard deviation, for the university professors and the Cnrs researchers, respectively.[19]

In order to try to understand what lies behind the gender gap in seeking promotion, we examine whether the effect of gender differs between the two types of positions. Since the costs of the *agregation* contest are substantially larger than those of applying for promotion at the Cnrs, the coefficient on women should be higher for university professors than for researchers if

[18]The regression coefficients on gender and quantity in the regressions for the likelihood to apply for the *agregation* and to apply for a Cnrs promotion are, respectively, -0.467, 0.730, -0.938 and 0.915.

[19]The coefficients on gender and quality in the *agregation* and the Cnrs promotion regressions are, respectively, -0.467, 0.165, -0.938 and 0.256, and 3.25 is the standard deviation of the average quality of publications in our sample.

Table 5: Likelihood to apply for a promotion: marginal effects

	Agreg', panel 1992-2008				Cnrs, panel 1996-2008			
	(1) logit	(2) logit	(3) probit	(4) OLS	(5) logit	(6) logit	(7) probit	(8) OLS
Women	-0.048^a	-0.036^a	-0.040^a	-0.040^a	-0.104^a	-0.107^a	-0.101^a	-0.089^b
	(0.008)	(0.008)	(0.008)	(0.009)	(0.037)	(0.034)	(0.034)	(0.039)
Age		0.005	0.003	-0.009^b		0.110^a	0.108^a	0.097^a
		(0.004)	(0.004)	(0.004)		(0.019)	(0.018)	(0.017)
Age^2		-0.001^a	-0.000^a	0.000		-0.003^a	-0.002^a	-0.002^a
		(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
Publisher(Pub)		0.129^a	0.129^a	0.149^a		0.107	0.098	0.113^c
		(0.020)	(0.019)	(0.016)		(0.076)	(0.074)	(0.060)
Pub*Quantity		0.059^a	0.058^a	0.065^a		0.114^a	0.105^a	0.110^a
		(0.007)	(0.007)	(0.008)		(0.030)	(0.029)	(0.032)
Pub*Quality		0.013^a	0.014^a	0.017^a		0.032^a	0.030^a	0.031^b
		(0.003)	(0.003)	(0.004)		(0.010)	(0.010)	(0.012)
Int. Dept.		0.022^b	0.023^b	0.024^b		0.018	0.022	0.020
		(0.010)	(0.010)	(0.010)		(0.046)	(0.046)	(0.045)
Cnrs		-0.122^a	-0.120^a	-0.183^a				
		(0.004)	(0.004)	(0.014)				
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
pseudo-R^2	0.017	0.199	0.194	0.120	0.039	0.208	0.201	0.179
Observations	7209	7209	7209	7209	1004	1004	1004	1004
log-likelihood	-2427	-1978	-1990	-1338	-479	-395	-398	-401

Standard errors clustered by individuals between brackets. ^{a}, ^{b}, ^{c} Significant at the 1%, 5% and 10% level, respectively. Int. Dept. = international department; see Appendix A for details. Pseudo-R^2: McFadden's R^2, R^2 for OLS regressions.

differences across the genders in these costs where holding back potential female candidates. The first column of Table 6 hence runs a difference-in-differences regression where we have pooled together the data for the two *concours*. We interact all variables with a dummy taking the value 1 for the Cnrs *concours* to allow for different impacts across the two tracks, our coefficient of interest being women interacted with this dummy.[20] The coefficient is negative but insignificant at the 10% level, implying that the effect of gender on the likelihood to enter the promotion contest is not higher for standard professors than in the research track. This result indicates that the time-cost of preparing the *agregation* and the implications in terms of mobility are not the main reason why women are less likely than men to apply for promotion.

As we discussed earlier, if women have a stronger relative preference for department prestige, they may choose not to apply for promotion in order to stay in an international department. Since promotion implies mobility for university professors, if females cared more about department quality they would be less willing to move –and hence to pass the *agregation*– whenever they are in an international than in a national department. In contrast, for researchers promotion does not require changing department and we expect to find no effect of department of origin on the likelihood of seeking a promotion.

We hence run again the regressions for the likelihood to apply for promotion and include an interaction between being a woman and being in a top department. If the trade-off between rank (i.e. income) and department quality differed across the genders, this would be captured

[20]To save space, other interacted terms are not reported but are available upon request.

by a negative coefficient on being in a top department for female professors but not for female researchers.

Table 6: Differences across tracks and departments: likelihood to apply for a promotion, marginal effects

	All	Agreg', panel 1992-2008	Cnrs, panel 1996-2008
	(1)	(2)	(3)
	logit	logit	logit
Women	-0.037^a	-0.049^a	-0.112^b
	(0.009)	(0.009)	(0.057)
Age	0.012^a	0.005	0.109^a
	(0.004)	(0.004)	(0.018)
Age^2	-0.001^a	-0.001^a	-0.003^a
	(0.000)	(0.000)	(0.000)
Publisher(Pub)	0.140^a	0.129^a	0.107
	(0.021)	(0.020)	(0.076)
Pub*Quantity	0.062^a	0.059^a	0.114^a
	(0.007)	(0.007)	(0.030)
Pub*Quality	0.014^a	0.013^a	0.032^a
	(0.003)	(0.003)	(0.010)
Int. Dept.	0.026^b	0.009	0.015
	(0.011)	(0.012)	(0.050)
Cnrs*Women	-0.021		
	(0.025)		
Women*Int. Dept.		0.042^c	0.010
		(0.022)	(0.104)
Cnrs		-0.122^a	
		(0.004)	
Interacted terms	Yes	No	No
Time FE	Yes	Yes	Yes
pseudo-R^2	0.196	0.200	0.208
Observations	8213	7209	1004
log-likelihood	-2410	-1974	-395

Standard errors clustered by individuals between brackets. ^{a}, ^{b}, ^{c} Significant at the 1%, 5% and 10% level, respectively. Int. Dept. = international department; see Appendix A for details. Interacted terms: all variables interacted with applying to the Cnrs contest.

The marginal effects obtained from these regressions are reported in the second and third columns of Table 6. Being in an international department does not affect the likelihood of female researchers applying for promotion, while it has a positive effect on whether females enter the *agregation*. For male university professors, the department of origin seems not to matter. This indicates, first, that the effect on being in an international department we obtained earlier is driven by the effect on women in top departments. Second, note that when we consider together the two effects, that of women and that of women interacted with international department they roughly cancel out. This seems to indicate that, for university professors, women in top departments are as likely as men to enter the *concours*. In contrast, women in national departments and those with a research position have a lower probability of being candidates for promotion.

Our results indicate that there is a substantial difference in the likelihood that men and women academics apply for promotion. The negative and significant coefficient is robust to different specifications of the model, such as the probit and OLS. We also run (not reported) a

random effects model to deal with unobserved heterogeneity, as well as a duration model where we estimate time to first application for promotion. Both yielded equivalent results, indicating a lower propensity of women to seek promotion. This gap appears both for professors and researchers despite the differences in the costs and implications of promotion, indicating that neither the direct costs associated with the *concours* nor differences in the way in which men and women trade-off income and department quality are the causes of the gender gap in seeking promotion.

In order to gauge the importance of women's lower propensity to apply for promotion, we perform a Oaxaca decomposition. Given the difficulty of interpreting decomposition stemming from logit regressions, we perform the decomposition using the OLS regressions in Table 5, columns (4) and (8). For professors in our sample, the raw gender gap in the probability of being promoted in a given year to rank A amounts to 2.4 percentage points. Although this magnitude seems small, the probability of being promoted in a given year is only 4.7% for men. As we have seen, this difference is driven by the decision to be a candidate, with an average male probability of being a candidate of 12.5% and that for women being 4.7 percentage points lower, i.e. gender reduces the likelihood to apply for promotion by 38%. In the Cnrs, the annual raw probability of promotion is 60% lower for women than for men, and the raw probability of being a candidate over 29% lower.

Table 7: Oaxaca decomposition of the likelihood to apply

	Agregation		Cnrs	
	$\Delta \Pr(C)$	%	$\Delta \Pr(C)$	%
Total gap	.046	100	.104	100
Women	.040	86	.089	86
Characteristics	.006	14	.015	14
Age	-.013	-29	-.006	-6
Total outcome	.024	52	.021	21
Publisher	.014	30	.014	13
Quantity	.012	27	.021	20
Quality	-.002	-5	-.013	-12
International Department	-.001	-2	-.001	-1
Cnrs	-.003	-7	.	.

To get rid of time fixed effects, the decomposition is made for each year separately before averaging over the full sample, with the number of observations per year as weights.

The two first column of Table 7 present the Oaxaca decomposition for the probability of being a candidate to the *agregation*, based on column (4) of Table 5. Columns (3) and (4) present the same decomposition for the probability of being a candidate to a DR position at the Cnrs. For both tracks, the gender gap in the probability of being a candidate is driven by the direct effect of gender, which amounts to 86% of the overall gap. The rest is due to better characteristics of men, with a positive contribution of research output which is partly compensated by the lower age of women.[21] Both decompositions hence imply that the application gap comes mainly from

[21]Interestingly, when we look at the three components of research output we see that for both groups women

the direct effect of being female, with their lower publication record accounting for between 21 and 52% of the gap, and being partly offset by women being younger and in better departments.

4.3 Networks and the competitive environment

4.3.1 Network effects

One possible reason for differences in the likelihood of seeking a promotion is that there is some individual variable that we have so far ignored and which has an impact on the actual (or perceived) probability of success. A candidate explanation are research networks or groups of coauthors. The idea that networks are important in obtaining jobs and achieving promotions is widespread in the literature, and the issue has been addressed for promotions in academia; see McDowell and Smith (1992) for the US, Combes et al. (2008) for France and Zinovyevay and Bagues (2012) for Spain. Coauthor networks have been shown to differ across genders, with females having fewer coauthors and a lower fraction of male coauthors; see McDowell and Smith (1992) and Boschini and Sjögren (2007). If women have smaller or less efficient networks, then this may affect the expected outcome and hence the payoff from entering the competition for promotion. Potential reasons for this effect are that a candidate who has a member of her/his network in a promotion committee has a higher likelihood of success, but also that with a larger network the candidate's work may be better known and cited, or that this could provide extra information about how to best prepare for a *concours*. As a result, the gap that we find between men and women could be due to differences in coauthors and networks, and hence including these variables would have an effect on the coefficient on gender.

In order to test this hypothesis, we construct for each individual two measures of networks. Our measures are based on coauthorship, obviously an imperfect measure of actual networks, but one that is quantifiable with the EconLit data. Our first measure is the size of an individual's network, defined as the total number of different coauthors the researcher has had over his/her publishing lifetime; the second is the fraction of network members that are men. More than in other contexts, academic networks are highly endogenous, with research output and affiliation being both causes and consequences of an individual's network size, and patterns of network formation have been shown to differ across the genders; see Boschini and Sjögren (2007). Moreover, being a candidate for promotion can increase networks, especially in a system where individuals are often candidates several years, and as a result any effect we find has to be interpreted with care.

Table 8 reports the regressions for the likelihood of entering the promotion contest for the two tracks, to which we have added network variables. Both variables have positive coefficients although only the proportion of men is significant at the 5 or 10% level, depending on the estimation procedure. For university professors, the coefficients on gender barely change as compared to our earlier specifications, while in the case of researchers the coefficients are somewhat less negative than in previous specifications (for the logit it goes from -0.107 in Table 5 to -0.100). That is, gender differences in networks do not seem to explain the lower propensity of women to seek promotion. The reason is probably that differences is network size across

are less likely to be publishers and, especially, have fewer publications, but they exhibit the same or a higher quality of publications than men.

Table 8: Network effects: likelihood to apply for a promotion, marginal effects

	Agreg', panel 1992-2008			Cnrs, panel 1996-2008		
	(1) logit	(2) probit	(3) OLS	(4) logit	(5) probit	(6) OLS
Women	-0.035^a	-0.038^a	-0.039^a	-0.100^a	-0.094^a	-0.081^b
	(0.008)	(0.008)	(0.009)	(0.033)	(0.034)	(0.038)
Age	0.004	0.002	-0.009^b	0.109^a	0.107^a	0.096^a
	(0.004)	(0.004)	(0.004)	(0.019)	(0.019)	(0.017)
Age^2	-0.001^a	-0.000^a	0.000	-0.002^a	-0.002^a	-0.002^a
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Publisher(Pub)	0.116^a	0.113^a	0.131^a	0.044	0.024	0.027
	(0.021)	(0.020)	(0.019)	(0.078)	(0.076)	(0.068)
Pub*Quantity	0.058^a	0.057^a	0.066^a	0.106^a	0.099^a	0.104^a
	(0.007)	(0.007)	(0.008)	(0.030)	(0.030)	(0.033)
Pub*Quality	0.012^a	0.012^a	0.015^a	0.025^b	0.023^b	0.022^c
	(0.003)	(0.003)	(0.004)	(0.010)	(0.010)	(0.012)
Int. Dept.	0.021^b	0.022^b	0.024^b	0.022	0.023	0.021
	(0.010)	(0.010)	(0.011)	(0.045)	(0.045)	(0.044)
Cnrs	-0.122^a	-0.121^a	-0.183^a			
	(0.004)	(0.004)	(0.014)			
Pub*Network size	0.006	0.009	-0.000	0.026	0.025	0.038
	(0.009)	(0.009)	(0.012)	(0.029)	(0.029)	(0.037)
% Men in Network	0.021^c	0.023^b	0.028^c	0.093^c	0.100^b	0.091^c
	(0.011)	(0.011)	(0.014)	(0.049)	(0.049)	(0.049)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
pseudo-R^2	0.201	0.196	0.120	0.222	0.215	0.191
Observations	7209	7209	7209	1004	1004	1004
log-likelihood	-1974	-1985	-1334	-388	-391	-393

Standard errors clustered by individuals between brackets. ^{a}, ^{b}, ^{c} Significant at the 1%, 5% and 10% level, respectively. Int. Dept. = international department; see Appendix A for details. Pseudo-R^2: McFadden's R^2, R^2 for OLS regressions.

genders are minor and not statistically significant. There is a greater gap in the fraction of men in the network, which are 70% for females in the agregation sample and 80% for males, and although it is significant the effect of this variable is moderate and hence its inclusion barely affects the coefficient on gender.

4.3.2 The competition's environment

Our final test consists of examining whether the environment under which the competition takes place affects men and women differently. We consider two variables. The first is the proportion of women amongst rank A professors in the year of the competition, which can act as a proxy for 'perceived discrimination'. This variable has increased steadily over the period, going from 8.9% in 1992 to 15.2% in 2008. The other variable is the number of available positions as professor, which is usually known before the decision to be a candidate is taken, and fluctuates between 15 and 33.

Since the effects of these variables can be identified only over the time dimension of the data we consider only the *concours d'agregation* for which we have a much larger number of observations. Because we are exploiting the time dimension of the data we cannot include time fixed effects as well as the variables of interest for the entire population. We hence consider two

specifications. One includes time fixed effects and our two variables of interest interacted with the female dummy, which allows us to see whether effects differ across the genders but not to identify the impact on men. Alternatively, we substitute the fixed effects by a time trend and estimate the impact of these variables for both men and women.

Table 9: The competition's environment: likelihood to apply for a promotion, *agregation*, panel 1992-2008, marginal effects

	Agreg', panel 1992-2008				Cnrs*
	(1) logit	(2) logit	(3) logit	(4) logit	(5) logit
Women	-0.143^a	-0.127^a	-0.137^a	-0.038^a	-0.067^a
	(0.045)	(0.045)	(0.045)	(0.007)	(0.022)
Age	0.005	0.005	0.005	-0.006	0.040^a
	(0.004)	(0.004)	(0.004)	(0.004)	(0.013)
Age^2	-0.001^a	-0.001^a	-0.001^a	-0.000	-0.001^a
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Publisher(Pub)	0.128^a	0.128^a	0.128^a	0.115^a	0.034
	(0.020)	(0.019)	(0.020)	(0.017)	(0.044)
Pub*Quantity	0.059^a	0.059^a	0.059^a	0.042^a	0.058^a
	(0.007)	(0.007)	(0.007)	(0.006)	(0.019)
Pub*Quality	0.013^a	0.013^a	0.013^a	0.013^a	0.018^a
	(0.003)	(0.003)	(0.003)	(0.002)	(0.006)
Int. Dept.	0.022^b	0.022^b	0.012	0.021^b	0.023
	(0.010)	(0.010)	(0.012)	(0.009)	(0.028)
Cnrs	-0.122^a	-0.122^a	-0.122^a	-0.113^a	
	(0.004)	(0.004)	(0.004)	(0.004)	
Time trend		-0.016^a			
		(0.005)			
% Women rank A		0.020			
		(0.014)			
Women*% Women rank A	0.010^c	0.009^c	0.009^c		
	(0.006)	(0.005)	(0.006)		
Avail.Pos.		0.003^a			
		(0.001)			
Women*Avail.Pos.	-0.000	-0.000	-0.001		
	(0.001)	(0.001)	(0.001)		
Women*Int.Dept*Avail.Pos.			0.001^c		
			(0.001)		
Already applied				0.151^a	0.564^a
				(0.019)	(0.072)
Women*Already applied				0.021	-0.062
				(0.019)	(0.048)
Time FE	Yes	No	Yes	Yes	Yes
pseudo-R^2	0.200	0.199	0.201	0.247	0.414
Observations	7209	7209	7209	7209	1004
log-likelihood	-1975	-1977	-1973	-1858	-292

Standard errors clustered by individuals between brackets. ^{a}, ^{b}, ^{c} Significant at the 1%, 5% and 10% level, respectively. Int. Dept. = international department; see Appendix A for details. * panel 1996-2008.

Table 9 presents the estimated regressions. Column (1) indicates that the fraction of women amongst rank A professors has a greater effect on women than on men, and our specification with a time trend implies that this variable has no significant effect on men but a positive and significant one for women. This is consistent with the idea that perceived discrimination is a potential cause for females' lower propensity to apply for promotion. In contrast, the number

of available positions has no differential effect across the genders, as seen in column (1).

In column (2) we try to identify the effects for both men and women. We can see that the number of females amongst rank A professors has no effect on the decision to seek promotion of men, while a greater number of available positions increases the likelihood of being a candidate, capturing the idea that more positions imply a greater probability of being promoted and hence encourages individuals to apply. The coefficient is not significantly different across genders.

To further explore this aspect we ask whether all groups of women behave in the same way. A possible division is between women who are in a national and those in an international department. Women in different types of departments may react differently towards competition because of unobserved characteristics. Column (3) indicates that there is indeed a difference in the coefficients on the number of available positions for the two groups, with women in international departments being more responsive to the number of positions available. A possible interpretation of this result is that women in international departments are less self-confident than males and hence are more likely to decide not to seek promotion when the number of positions available is small.

Lastly, we examine whether past rejections affect the decision to enter the contest. The last two columns on Table 9 look at this question by adding to our core regression a dummy for whether the individual has entered the previous *concours*, using data for both tracks. The variable has a positive and highly significant coefficient, probably measuring unobserved ability, but the dummy interacted with gender is not significant. Other specifications, for example with the number of times the individual has already seek promotion, also yielded results with no differences across the genders in the impact of past experience. That is, past lack of success in the promotion contest does not seem to affect differentially the decision of whether to apply again.

5 Conclusions

This paper has used data for promotions amongst academic economists in France to look at the attitudes of women during and towards contests. We have information both on who was a candidate for promotion and who could have been a candidate, which allows us to test different hypotheses about the reasons that cause women's lower promotion rates.

On the one hand, women may be less likely to be promoted conditional on having applied, and this could be due either to discrimination or underperformance during the promotion contest. On the other, female academics may have a lower propensity to apply for promotion than males. This could in turn be caused by the requirements of the contest being more costly for women, their facing a different trade-off between salaries and department prestige, or an unwillingness to enter the contest. The features of the French academic system, such as a national salary scale, the need to go through a national contest in order to be promoted, and the existence of several categories of academics with different requirements during the contest and upon promotion, allow us to test for these hypotheses.

We find that there is no significant difference between men and women in their probability of success, but that the later are less likely than the former to enter contests. Moreover, our results indicate that neither the differential cost of promotion nor the trade-off between income

and department quality are behind these differences.

There are two possible explanations for our findings. One is that although women are not discriminated against during the contest they believe they will be, and hence decide not to enter the competition for promotion. The data points at this as a partial cause of gender differences, with women being more likely to apply the more females there are amongst top-rank academics. The alternative explanation is that women are less willing than men to enter contests, in line with the experimental evidence provided by Gneezy et al. (2003), amongst others. When we try to assess the impact of the competition's environment, we find that, women in top departments are particularly sensitive to the number of available positions in a given year, which could be seen as a stronger reaction to the perceived degree of competition.

Our results have two main implications. On the one hand, they provide a link between laboratory evidence and behaviour observed in actual markets. They indicate that patterns of behaviour, namely women's lower propensity to take part in contests, can be observed in actual labour markets and have important consequences for observed outcomes. On the other, they raise the question of what type of policy intervention can help increase female promotion rates. The evidence in Gneezy et al. (2003) indicates that differences in contest participation seem to be partly driven by women being less confident than men. Building confidence is a process that is difficult and probably starts in early childhood, but changes in the way in which deciding whether to enter a competition occurs could facilitate women's probabilities of climbing up the rank ladder. For example, a system of mentoring whereby junior faculty are assigned a mentor that 'proposes' them as candidates for promotion may incite more women to apply. Alternatively, creating a system in which the default is that an individual will be considered for promotion after x years and s/he has to opt out instead of opting in, could also be a way of overcoming the differences in confidence across the genders.

Appendix

A Definition of international departments

Academia in France is organised around 'research centers', with a university potentially having several research centers in economics. We have defined 'departments' either by an economics department when it is the single affiliation where economists are found in a given university (which corresponds to the majority of cases), or by the aggregation of all research centres where there are economists in the university. We performed robustness checks by looking at research centres rather than departments, and obtained consistent results (available upon request). However, our notion of slightly aggregated economics departments better matches the reality of French academic research and hence we have focused our discussion of the results on this concept.

We define 'international departments' as departments with the highest research output, measured by both the total stock and average stock of publications per member of the department in EconLit journals. The cutoff point for top departments is arbitrary. We choose our cutoff at each point in time so as to have 35% of the total population in the top department category. Since departments may change their status over time, we considered as international departments for the entire sample period those departments which are more often than not in the top department category.

Table 10: List of international departments

Cepremap	1991	2004
Crest	1993	2008
Ecole Polytechnique	1991	2008
Ehess-Ens (Delta)	1991	2004
Enpc (Ceras, Latts)	1991	2004
Hec	1995	2008
University Aix Marseille 2-3	1991	2008
University Cergy	2005	2008
University Cergy-Paris 10	1991	2004
University Clermont 1	1991	2008
University Nancy 2-Strasbourg	2006	2008
University Paris 1	1991	2004
Paris School of Economics	2005	2008
University Paris 10	2005	2008
University Paris 9	1991	2008
Toulouse School of Economics	1991	2008

The last two columns give the first and last date at which the departments are observed in the sample, respectively. Note that some departments have been merged, as for instance the Cepremap, the Ehess-Ens and the University Paris 1 to form the Paris School of Economics from 2005.

B Likelihood to be in an international department and to hold a rank A position by category

Table 11: Likelihood to be in an international department and to hold a rank A position by category, 1992-2008, marginal effects

	International department					Rank A	
	All (1) logit	All (2) logit	All (3) logit	Univ. (4) logit	Cnrs (5) logit	Univ. (6) logit	Cnrs (7) logit
Women	0.021	0.022	0.068^a	0.071^a	0.101	-0.064^a	-0.101^c
	(0.021)	(0.021)	(0.022)	(0.022)	(0.067)	(0.017)	(0.052)
Age		-0.009^a	-0.008^a	-0.008^a	-0.011	0.011^a	0.071^a
		(0.003)	(0.003)	(0.003)	(0.011)	(0.002)	(0.009)
Age^2		0.000^a	0.000^a	0.000^a	0.000	0.000	-0.001^a
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Publisher(Pub)			0.190^a	0.197^a	0.107	0.324^a	0.064
			(0.027)	(0.028)	(0.089)	(0.028)	(0.067)
Pub*Quantity			0.053^a	0.049^a	0.080^b	0.147^a	0.148^a
			(0.011)	(0.011)	(0.035)	(0.009)	(0.018)
Pub*Quality			0.049^a	0.047^a	0.063^a	0.041^a	0.039^a
			(0.005)	(0.005)	(0.014)	(0.004)	(0.010)
Cnrs			0.168^a				
			(0.036)				
Women*Cnrs			0.039				
			(0.062)				
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
pseudo-R^2	0.015	0.017	0.097	0.056	0.121	0.347	0.464
Observations	17466	17466	17466	14848	2618	14848	2618
log-likelihood	-11077	-11056	-10158	-8578	-1557	-6212	-954

Standard errors clustered by individuals between brackets. ^{a}, ^{b}, ^{c} Significant at the 1%, 5% and 10% level, respectively.

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