Publish or peer-rich? The role of skills and networks in hiring economics professors

Pierre-Philippe Combes, Laurent Linnemer, Michael Visser

GREQAM and CEPR, 2, Rue de la Charité, 13 236 Marseille cedex 02, France
CREST-LEI, 28 rue des Saints-Pères, 75007 Paris, France
ERMES-CNRS and Paris School of Economics, 26 rue des Fossés Saint-Jacques, 75005 Paris, France

Received 30 August 2006; received in revised form 19 April 2007; accepted 21 April 2007
Available online 15 June 2007

Abstract

This paper analyzes the determinants of success at the concours d'agrégation en sciences économiques. This is a centralized hiring procedure through which professors of economics are selected in France. Using detailed data from all concours held between 1984 and 2003, we focus on the role of the candidates’ publication records (number and quality of articles) and networks (defined as professional links between candidates and the jury members who take the recruitment decisions). Both sets of variables have statistically significant effects on the likelihood of getting hired. The effect of network connections is important in the sense that a substantial improvement of the publication record is needed to compensate for not being linked to the jury.

JEL classification: M510
Keywords: Employment; Hiring; Professional Network

1. Introduction

In France there is a long tradition of recruiting university professors in economics through a centralized examination procedure called the concours national d'agrégation en sciences économiques. The first one was held in 1897 and since then the concours has been organized...
practically every two years. It is a long selection procedure which consists in various academic lectures that the candidates have to give in front of a jury. The jury evaluates the candidates and decides who of them should be hired. The jury also ranks the successful candidates in order of preference. Once the jury has made its decision, the French Ministry of Education, which is in charge of organizing the concours, announces the list of universities with vacancies for professorships. It is then up to the selected candidates themselves to choose—one after the other and in the order of their ranking—in which university they wish to become professor.

The purpose of this article is to study the determinants of success in these recruitment examinations. We do this by analyzing the outcomes of all concours held between 1984 and 2003. We use information from administrative files of the Ministry of Education. For each concours these files record the number of professorships on offer, the names of all candidates and jury members, the names of the candidates’ Ph.D. advisors, the university where the candidates obtained their Ph.D., the workplace of candidates and jury members (at the date of examination), some socio-economic characteristics of the candidates (age, gender, nationality, etc.), and the hiring decisions of the jury. These data were matched with the EconLit database. This allowed us to determine the stock of publications of all candidates (at any point in time), and to define a quality index for each stock of publications. This quality index is the total number of pages published by a candidate (weighted by the prestige of the journals and the number of co-authors), divided by the number of publications. Finally, since the data are not anonymous, we could establish whether there were professional links between applicants on the one hand and jury members on the other. Specifically, we could define for each candidate the four following network indicators: the candidate’s Ph.D. advisor is in the jury; the candidate works in the same university as a jury member; the candidate holds a Ph.D. from a university in which a member of the jury works; the candidate’s Ph.D. advisor has published with a member of the jury. 1

In analyzing the success determinants, we focus on the role of two factors: the skills of applicants and their network connections. These factors are relatively well measured in our dataset. Indeed, skills or abilities of potential university professors can, arguably quite well, be measured via their publication records, and, as mentioned above, we have access to these records via EconLit. Also, although our four network variables do not capture all possible network effects (in particular they do not measure all sorts of personal and social connections—the key variables of interest in the social network literature—, see Ioannides and Loury (2004)), they are probably the most relevant ones in the academic world.

Another advantage of our dataset is that it contains information on the complete pool of applicants, not just the ones that were hired. Such pooled datasets are very rare and hard to obtain in practice. This is why most empirical studies on hiring use survey-based data in which employers are asked about the methods they use to fill their vacancies, and job seekers (or employees) are requested to indicate which strategies are (were) adopted in getting jobs. While these studies are very useful and informative, it was pointed out by Fernandez and Weinberg (1997) and others that survey data are not well suited to precisely analyze the determinants of hiring outcomes. This is so because surveys typically do not contain information on the complete set of candidates applying for a given job. What is required to uncover and identify the variables that affect hiring is, for each vacancy, the entire pool of applicants and the decision by the

---

1 A preliminary analysis of part of this dataset is given in Linnemer and Perrot (2004). Their study is based on the concours between 1984 and 2001 (results from the 2003 concours were not yet available), and they did not use the publication data from EconLit. Finally, their study is purely descriptive and does not include any statistical or econometric analysis.
employer about which candidate was eventually hired. To our knowledge only a few other studies besides ours had access to pooled data sources: Neumark, Blank, and Nort (1996), Goldin and Rouse (2000), and Petersen, Saporta, and Seidel (2000, 2005), who test for the presence of race and/or sex discrimination in hiring; Fernandez and Weinberg (1997) who analyze the impact of social networks on the likelihood of getting hired.2

The dataset and the particular market we are studying also have some drawbacks. One drawback is that the data do not record all variables that may influence jury decisions. In particular, candidates’ performances in the lectures (their quality of presentation, their ability to answer clearly and concisely, etc.) are not observed. To reduce the possible bias resulting from not observing these communication abilities, we include a set of control variables in the model (the socio-economic characteristics and other proxies for communication skills). Another drawback is that the market of economics professors is a highly specific and nonrepresentative market. Indeed, juries of the concours clearly have other objectives and use different criteria than recruitment officers of profit-maximizing firms. Furthermore, the institutions governing the concours are very different from those governing most hiring relations. Our empirical results have therefore little to say about hiring in general. However, the concours is not all that different from hiring procedures used in some other European countries. For instance, the concorso in Italy (see Checchi, 1999; Perotti, 2002) and the concurso de habilitación nacional in Spain (see Boletín Oficial del Estado, 11 April 2005, pages 12412–12414) are national selection processes for professors that are relatively similar to the concours. Even in countries where recruitment decisions are not based on nationwide exams but on bilateral negotiations between job candidates and universities (The Netherlands, the UK, etc.), our sort of network variables are likely to play a role in hiring decisions. Some lessons may therefore be drawn from the present study, although not at the most general level.

We use the so-called rank-ordered logit (ROL) model (see Beggs et al., 1981) to study the statistical impact of our explanatory variables on the rankings of professors. The parameters of the ROL model are estimated by maximizing the likelihood function. The method of statistical inference uses the information of both the candidates who succeeded in obtaining a professorship and those who failed. We show how the ROL model is related to a model for the marginal probability of success at the concours. With this model and the estimate of the ROL parameters, we can infer the impact of changes in the explanatory variables on the likelihood of success.

The empirical results show that publication records matter in the hiring of economics professors. Both the number of publications and their quality have a positive and significant impact on the probability of success. We also find that two out of four network variables turn out to have significant and positive effects: the variable capturing whether the Ph.D. advisor is in the jury, and the one indicating whether the candidate has the same university-affiliation as one of the jury members. The magnitude of the network effects turns out to be quite large compared to the impact of the publication variables. For instance, the effect of having one’s Ph.D. advisor in the jury is equivalent to the effect of 5 additional journal articles (the average candidate in the sample has 2.2 journal articles) or 9.7 additional pages (the average quality index in the sample equals 1.9 pages). Similarly, in case there is no jury member working in the same place as the candidate, 2.2 additional publications or 4.3 additional pages are needed to compensate for this disadvantage.

2 In a related literature, Hamermesh and Schmidt (2003) and Donald and Hamermesh (2006) use pooled datasets to study the factors affecting outcomes in elections (of Fellows of the Econometric Society, and of officers of the American Economic Association).
The plan of the paper is as follows. In the next section we give further details on the rules and organization of the concours and describe our dataset. Section 3 presents the model, Section 4 the estimation results, and the concluding remarks are in Section 5.

2. More about the concours and the data

In the French university system there are three main academic positions: maître de conférences (comparable to the position of assistant professor in the US), professeur de seconde classe (associate professor), and professeur de première classe (full professor). The purpose of the concours d’agrégation is to recruit professeurs de seconde classe. The concours exists not just in economics but also in five other disciplines: Law (3 fields), Political Science, and Business.

There are very few eligibility conditions: basically the concours is open to any candidate with a Ph.D. (regardless of the candidate’s nationality or the country where the Ph.D. was obtained).

The concours for economics professors is a long selection procedure. It starts with the publication of a text in the Journal Officiel (in the spring), wherein the Ministry of Education announces the opening of the recruitment, the number of professorships on offer (but not the names of the universities where the vacancies are), and the registration deadline (usually in June or July). Generally before this deadline expires, the Minister of Education nominates the president of the jury, who in turn chooses the six other members of the jury (but these names are generally not known before the end of registration). The actual examinations begin in September and last until May of the next year.

The concours consists of four successive examination stages called leçons (since 1999 the third one no longer exists). These leçons are lectures that the candidates have to deliver before the jury in Paris. In the first lecture the candidates have to present their own academic work, whereas the topics of the other three lectures are randomly chosen (see Linnemer and Perrot, 2004 for more details). After each leçon (except the third), a certain number of candidates is eliminated from the concours. Although the knock-out rates vary from jury to jury, the first leçon is generally the most eliminating (on average in our sample 49% of the initial pool of candidates was eliminated right after this first stage), and the last leçon is the least eliminating (11% of initial pool eliminated).

In May or June, some weeks after the last leçon, the jury declares who are the winners and ranks them in order of preference. Shortly thereafter, the locations of the university positions are revealed by the Ministry of Education, and it is then up to the winners to make their choices (the candidate ranked first is the first to pick a university, the candidate ranked second is the second to choose, and so on...).

The freshly nominated professors start their new job typically in September (i.e., about one year after the first leçon).

Note that the French recruitment system gives the universities no say at all in the hiring decisions: it is the Ministry of Education that decides where professorships are allocated, the juries who nominate the professors, and the winning candidates themselves who choose the

---

3 The typical French academic enters university shortly after obtaining a Ph.D., as maître de conférences (the recruitment process is nationwide but the hiring decisions are taken by universities), can be promoted thereafter as professeur de seconde classe (in economics and some other disciplines through the concours), and can finally be nominated as professeur de première classe by a national council of elected and nominated peers (this last career step is the same in all disciplines). There is an approbation period of one year but otherwise all positions are tenured.

4 In other disciplines like Mathematics, Physics, Sociology, ..., university professors are selected via more decentralized recruitment methods (essentially direct negotiations between candidates and universities).

5 Since the universities generally differ considerably in terms of prestige and attractiveness, the ranking which determines the order in which candidates may choose is important.
universities. Note also that since juries cannot really control where winners eventually become professors, jury members do not directly hire candidates for their own university.

Our dataset covers the 10 concours that were held between 1984 and 2003. Table 1 gives the number of candidates and positions in each of the concours. Note that the number of candidates has augmented a bit more than the number of professorships, so the degree of competition has somewhat increased during the sample period. In total 258 professorships were offered and 993 candidates took part in the 10 concours, implying an overall success rate of 26%.

Table 2 lists all the explanatory variables that will be used in the statistical analysis. The variables are grouped into three categories: the publication, network and control variables. For each variable the table gives some summary statistics and the number of observations for which the variable is known (993 meaning that the variable is known for all candidates in the sample). Fortunately there are very few missing observations in the dataset.

We start by describing our two publication variables. The first one is simply the total number of journal publications until one year after the concours. We count until one year after the concours because articles appearing shortly after the examinations are typically mentioned in the candidate’s CV as forthcoming (and thus known to the jury). The journals we consider are those referenced in EconLit. This database covers about 680 journals including about 40 journals publishing articles in French. EconLit does not reference all books (especially many books by French publishers are not listed). Moreover, it does not always reference the authors of each chapter in multi-authored books. Therefore we prefer not to include books in the analysis.

As Table 2 shows, on average over the 10 concours, the candidates have published 2.2 articles. The maximum number of publications is twenty-one and the minimum is zero (about 26% of the candidates have no publication referenced in EconLit at all). The proportion of candidates without a single publication, depicted by the solid line in Fig. 1, has declined over the sample period. The dashed line in Fig. 1 represents the proportion of candidates with no publication among winners. A comparison of the two curves shows that candidates with no publication have almost always

<table>
<thead>
<tr>
<th>Year</th>
<th>Candidates</th>
<th>Positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>65</td>
<td>20</td>
</tr>
<tr>
<td>1987</td>
<td>56</td>
<td>20</td>
</tr>
<tr>
<td>1989</td>
<td>83</td>
<td>25</td>
</tr>
<tr>
<td>1991</td>
<td>62</td>
<td>22</td>
</tr>
<tr>
<td>1993</td>
<td>91</td>
<td>30</td>
</tr>
<tr>
<td>1995</td>
<td>111</td>
<td>30</td>
</tr>
<tr>
<td>1997</td>
<td>133</td>
<td>30</td>
</tr>
<tr>
<td>1999</td>
<td>155</td>
<td>33</td>
</tr>
<tr>
<td>2001</td>
<td>130</td>
<td>33</td>
</tr>
<tr>
<td>2003</td>
<td>107</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>993</td>
<td>258</td>
</tr>
</tbody>
</table>

6 For example, the 1995 concours is the one that began in September 1995 (first leçon) and ended in May 1996 (last leçon), with winners starting their new job in September 1996. Note that there was a time interval of 3 years (instead of 2) separating the first two concours in the sample.

7 For example, for someone who participated in the 1993 concours the variable is defined as the sum of all articles published until december 1994.
been less successful than those with at least one published article. Conversely, Fig. 2 shows that the fraction of candidates with at least two articles has increased since 1984, and that such more prolific researchers were more frequently hired than candidates with less than two publications.

Our second publication variable is a quality index of the published articles. This index is defined as the ratio of the total CLpn score of a candidate to the number of publications (i.e. our first publication variable). The total CLpn score, introduced by Combes and Linnemer (2003) (see their first measure, page 1254), is the sum of all article-specific CLpn scores of the candidate. The CLpn score of a specific article is defined as the total number of pages of the article weighted by the prestige of the journal, and divided by the number of authors. The journal weights are such that the total CLpn score can be seen as the equivalent of the number of pages published by a candidate, alone, in a ‘top journal’. Table 2 indicates that the mean quality index in the data equals 1.9 pages.

---

### Table 2
Summary statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Min.</th>
<th>Max.</th>
<th>Nb. of known obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publication variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of pub.</td>
<td>2.233</td>
<td>2.44</td>
<td>0</td>
<td>21</td>
<td>993</td>
</tr>
<tr>
<td>Quality of pub.</td>
<td>1.937</td>
<td>2.247</td>
<td>0</td>
<td>16</td>
<td>993</td>
</tr>
<tr>
<td><strong>Network variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-Link</td>
<td>0.052</td>
<td>0.221</td>
<td>0</td>
<td>1</td>
<td>988</td>
</tr>
<tr>
<td>T-Link</td>
<td>0.397</td>
<td>0.489</td>
<td>0</td>
<td>1</td>
<td>988</td>
</tr>
<tr>
<td>P-Link</td>
<td>0.183</td>
<td>0.387</td>
<td>0</td>
<td>1</td>
<td>987</td>
</tr>
<tr>
<td>IA-Link</td>
<td>0.029</td>
<td>0.168</td>
<td>0</td>
<td>1</td>
<td>993</td>
</tr>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>35.598</td>
<td>5.693</td>
<td>27</td>
<td>63</td>
<td>983</td>
</tr>
<tr>
<td>Female</td>
<td>0.208</td>
<td>0.406</td>
<td>0</td>
<td>1</td>
<td>993</td>
</tr>
<tr>
<td>French</td>
<td>0.935</td>
<td>0.246</td>
<td>0</td>
<td>1</td>
<td>972</td>
</tr>
<tr>
<td>Academic</td>
<td>0.882</td>
<td>0.322</td>
<td>0</td>
<td>1</td>
<td>987</td>
</tr>
<tr>
<td>Ph.D. abroad</td>
<td>0.034</td>
<td>0.182</td>
<td>0</td>
<td>1</td>
<td>988</td>
</tr>
<tr>
<td>Position in Paris</td>
<td>0.484</td>
<td>0.5</td>
<td>0</td>
<td>1</td>
<td>988</td>
</tr>
<tr>
<td>Position in top-6 univ.</td>
<td>0.209</td>
<td>0.407</td>
<td>0</td>
<td>1</td>
<td>987</td>
</tr>
<tr>
<td>Ph.D. from top-6 univ.</td>
<td>0.461</td>
<td>0.499</td>
<td>0</td>
<td>1</td>
<td>988</td>
</tr>
<tr>
<td>First time</td>
<td>0.627</td>
<td>0.484</td>
<td>0</td>
<td>1</td>
<td>993</td>
</tr>
<tr>
<td>Ph.D. adv. nb. pub.</td>
<td>8.443</td>
<td>13.803</td>
<td>0</td>
<td>160</td>
<td>982</td>
</tr>
<tr>
<td>Ph.D. adv. qual. pub.</td>
<td>2.515</td>
<td>2.432</td>
<td>0</td>
<td>19.576</td>
<td>982</td>
</tr>
</tbody>
</table>

---

8 This comparison does not take into account that individuals in the full sample and those in the subsample of winners may differ in other respects (besides their publication records). The graphs are therefore nothing more than descriptive, but they intuitively illustrate the econometric results of the next section.


10 To illustrate our quality index, consider the example of a candidate with two journal publications. The first article has 24 pages, is written by the candidate alone, and is published in a journal with weight 1/12; the second has 36 pages, is written with two co-authors, and is published in a journal with weight 4/12. The CLpn score of the first article is $24 \times 1/12 \times 1/1 = 2$, and the CLpn score for the second is $36 \times 4/12 \times 1/3 = 4$. The total CLpn score thus equals $2 + 4 = 6$ pages, and the quality index is $6/2 = 3$ pages.
Fig. 1. No publications.

Fig. 2. Two publications or more.

Fig. 3. A-Link.
Next we turn to our four network variables. The first one, which we call A-Link, indicates whether the Ph.D. advisor of the candidate is in the jury or not. As Table 2 shows, on average over the 10 concours, 5% of the candidates had their advisor in the jury. As shown by Fig. 3, this proportion has declined during the sampling period (from 17% in 1984 to 3% in 2003). A comparison of the dashed and solid curves shows that candidates with their advisor in the jury had (in most concours) a better chance of winning than those who did not. The second variable, T-Link, is equal to one if the candidate holds a thesis from a university in which a member of the jury works. As it turns out, this happened in 40% of the cases. The dashed line in Fig. 4 is again mostly above the solid one, suggesting that candidates with a T-link had a relatively better chance of succeeding.

The third variable, P-Link, equals one if the candidate had the same workplace as one of the jury members. On average 18% of the candidates had such a link. Fig. 5 shows that this proportion was relatively stable across concours, and those with direct colleagues in the jury apparently had a much higher success probability than those who did not. Our last network variable, IA-Link, indicates whether at the time of the concours the candidate’s advisor had
published a scientific article (in a journal listed in the EconLit database) with one of the jury members. This last variable captures a more indirect connection between a candidate and jury members. For 3% of the candidates the indirect link existed. Fig. 6 does not show a clear trend in the proportion of IA-Linked candidates over time, nor does it suggest that those with the IA-Link were better off than those without one.

Finally, we describe our control variables. These variables may capture other characteristics that are important to jury members in their evaluation of the candidates. Some of the controls can be interpreted as indirect indicators for networks not fully captured by our four main network variables, while some other controls may reflect scientific skills not fully measured by our two publication variables. As Table 2 shows, the youngest candidate was aged 27 at the time of the concours, the oldest 63, and on average candidates were aged just over 35. The proportion of female candidates was on average 21% (this proportion has steadily increased from 8% in 1984 to almost 30% in 2003). The majority of candidates had the French nationality (94%) (foreign candidates mostly come from French-speaking countries such as Belgium). Most candidates held an academic position when they participated in the concours (88%). Only a handful of candidates (3%) obtained their Ph.D. abroad. Because candidates from outside Paris have often complained that they are disadvantaged (since for each leçon they must come to Paris), we also added a variable indicating whether the candidate’s workplace is in the greater Paris area or not. As the table shows, almost half of the candidates (48%) had their workplace in the capital or its suburbs. About 21% of the candidates held a position in what we define a top-6 French university and as much as 46% of the candidates received their Ph.D. from one of these top-6 universities. For 63% of the candidates it was the first time they participated in the examination.

---

11 A similar variable based directly on the publications of a candidate with a jury member could unfortunately not be used because joint papers (co-authored by candidates and jury members) are very rare in practice.
12 Those with an academic job are primarily Maître de Conférences, and some are Chargé de Recherche (position with the same level and status as Maître de Conférences, but without teaching obligations) at either the CNRS or the INRA (two national research institutes in France).
13 The top-6 is the group of 6 French universities whose economics departments have published the most articles in the period 1996–2003: Toulouse 1, Paris 1, Paris 9, Paris 10, Aix–Marseille 2, and Cergy. (Source: unpublished report by Combes and Linnemer (2005) for the Ministry of Education.)
Our two last control variables measure the publication records of the Ph.D. advisors of the candidates, which are defined exactly as the two publication variables of the candidates, except that the counting of articles is up to the *concours* year only. On average Ph.D. advisors have published 8.4 articles (almost four times more than the candidates themselves), and the average quality index equals 2.5 pages (30% more than the average index of candidates).

3. Rank-ordered logit model

This section presents the ROL model.\textsuperscript{14} It allows us to study which characteristics of the candidates can explain their rankings at the *concours d'agrégation*. The model was introduced in the econometrics literature by Beggs, Cardell, and Hausman (1981), and further studied by Hausman and Ruud (1987). It is also called the Plackett–Luce model in the biomedical literature, or the exploded logit model in the marketing literature.

We start by introducing some notations. Let $c_t$ denote the number of candidates at the *concours* in year $t$, and $p_t$ the number of professorships on offer in that year. Let $y_{it}$ be a binary variable equal to 1 if candidate $i$ wins a professorship at the *concours* in year $t$, and 0 otherwise. Recall that for the $p_t$ successful candidates we also observe their ranking, but that the ranking is unknown for the candidates who did not succeed in obtaining a professorship. Thus, when $y_{it}=1$, we observe the ranking, denoted $r_{it}$, but when $y_{it}=0$ this variable is unobserved (but we know in this case that $r_{it}>p_t$). Let the unobserved latent variable $y_{it}^*$ represent the aptitude (as seen by the jury) of candidate $i$ to successfully fulfill the tasks of an economics professor. We assume that

$$y_{it}^* = x_{it} \beta + \eta_t + \epsilon_{it}$$

(1)

where the vector $x_{it}$ contains the characteristics of the candidate (publication and network variables, control variables), $\beta$ is an unknown parameter vector, and $\eta_t$ and $\epsilon_{it}$ are error terms. Finally, let $x_t$ denote the matrix containing all the $x_{it}$’s.

The success indicator $y_{it}$ and the ranking $r_{it}$ are related to the latent variable $y_{it}^*$ in the following way: $y_{it}$ equals one if $y_{it}^*$ is among the $p_t$ highest latent variables in year $t$, and zero otherwise; $r_{it}$ is smaller than $r_{jt}$ if $y_{it}^* > y_{jt}^*$. Thus, candidate $i$ succeeds in year $t$ if his aptitude score is among the $p_t$ best scores assigned by the jury in that year, and $i$ is better ranked than $j$ if the former receives a better score from the jury than the latter. The error term $\epsilon_{it}$ captures variables affecting the aptitude of a candidate that are observed by the jury but unobserved by the econometrician, and $\eta_t$ includes all jury-specific variables (publication records of jury members, their scientific orientations, their socio-economic characteristics, etc.) that may influence the scores. We assume that $\epsilon_{it}$ is independent of $x_t$ and $\eta_t$ for all $i$ and $t$. It is furthermore assumed that the $\epsilon_{it}$’s are independently and identically distributed extreme value random variables. Thus the distribution function of $\epsilon_{it}$ is $Pr(\epsilon_{it}<u)=e^{-e^{-u}}$. No assumptions are needed about the relationship between $x_{it}$ and $\eta_t$.

Before presenting the estimation method we need to discuss the assumptions underlying the ROL model. The model first of all assumes that juries give (implicitly or explicitly) aptitude scores to candidates, and that hiring decisions are solely based on a comparison and ranking of these scores. Our model may therefore not be completely adequate if the aim of the jury is also to end up with a pool of winners that is in some sense representative (juries may for instance

\textsuperscript{14} The ROL model should not be confounded with the ordered logit model (see for example Wooldridge, 2002).
wish that selected candidates represent all fields of economics, or that there is a right balance between candidates from Paris and from outside of Paris, etc.). Note, however, that our model does not exclude the possibility that jury members evaluate candidates along several dimensions (publication records, communication abilities, math skills, knowledge of econometrics or economic theory, etc.) and that they assign separate grades for each dimension. What is needed in this case is that the different dimension-specific grades somehow add up to our single aptitude score. Another assumption is that the effect of the regressors, $x_{it} \beta$, and the effect of the composed error term, $\eta_t + \epsilon_{it}$, enter the score $y_{it}^*$ in an additive way. The additivity restriction is imposed in most applied econometric work, but we acknowledge that it is potentially restrictive. Yet another assumption is that our estimate of $\beta$ does not suffer from sample selection bias. In a framework à la Heckman (1979), this assumption requires that the error term in the participation equation is independent of $\eta_t + \epsilon_{it}$. Since we do not observe the nonparticipants (those who decided not to participate in the concours), we cannot test this last condition. Finally, some comments on the assumptions regarding the error terms in (1). The variables $\eta_t$ and $\epsilon_{it}$ should be independent, but $\eta_t$ and $x_{it}$ may be related in any arbitrary way. These hypotheses are unlikely to play an important role though since there are a priori no reasons to believe that jury-specific variables and (unobserved) characteristics of candidates are correlated. The crucial and potentially strong assumption is the assumption of independence between $\epsilon_{it}$ and $x_{it}$. This excludes the possibility that unobserved quality measures of candidates (in particular their performances at the leçons) are correlated with observed characteristics (in particular their network variables). Our error structure also excludes a framework wherein juries have imperfect information about candidates, and use certain observed characteristics (for instance the network or publication variables) to form beliefs about individuals. Our model cannot take such behavior into account since it would automatically generate a correlation between error terms and observable characteristics.

The parameter vector $\beta$ is estimated by maximum likelihood. To write down the likelihood function for the rank data, it is necessary to derive the contribution to the likelihood of each concours. The contribution of the $t$-th concours is the probability of observing a certain ranking of the successful candidates, and the fact that all unsuccessful candidates are ranked less well than the marginal winner (the candidate with rank $p_t$), conditionally on $c_t$, $p_t$, $x_{it}$, $\eta_t$. Given the assumptions on the error terms, Beggs, Cardell, and Hausman (1981) have shown that the $t$-th contribution to the likelihood function, denoted $l_t(\beta)$, can be written as $l_t(\beta) = \prod \exp(x_{it} \beta) \sum \exp(x_{jt} \beta)$. Note that the term $\eta_t$ has disappeared from the likelihood contribution. This explains why the effects of variables that are jury-specific cannot be identified and estimated. Note also the analogy with the Cox (1972) partial likelihood function for duration data.

Therefore jury-specific features were not listed in Table 2. Here is nevertheless some information. The juries were mainly made up of men: out of a total of 70 members (7 members per jury times 10 concours), 67 were men (95.7%). About half (53%) of the jury members worked in the greater Paris area, 43% in the rest of France, and 4% abroad. The 10 jury presidents were all male university professors, and on average they were aged 62. They had published on average 2.9 articles and the mean quality index was 2.4 pages. The other members of the jury were also primarily university professors, but on average they were younger (51.2 years). Their publication records were slightly better than those of the presidents: the average number of publications was 5.8 and the mean quality index 3.8 pages.
Table 3
Estimates of the ROL model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeff. (Std. err.)</th>
<th>Coeff. (Std. err.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publication variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of pub.</td>
<td>0.178** (0.022)</td>
<td>0.178** (0.024)</td>
</tr>
<tr>
<td>Quality of pub.</td>
<td>0.103** (0.023)</td>
<td>0.092** (0.024)</td>
</tr>
<tr>
<td><strong>Network variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-Link</td>
<td>0.706** (0.225)</td>
<td>0.891** (0.233)</td>
</tr>
<tr>
<td>T-Link</td>
<td>0.230 (0.152)</td>
<td>0.106 (0.190)</td>
</tr>
<tr>
<td>P-Link</td>
<td>0.433** (0.163)</td>
<td>0.391* (0.193)</td>
</tr>
<tr>
<td>IA-Link</td>
<td>−0.095 (0.390)</td>
<td>−0.513 (0.403)</td>
</tr>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>−0.492** (0.139)</td>
<td></td>
</tr>
<tr>
<td>Age squared</td>
<td>0.005** (0.002)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>−0.179 (0.163)</td>
<td></td>
</tr>
<tr>
<td>French</td>
<td>−0.025 (0.307)</td>
<td></td>
</tr>
<tr>
<td>Academic</td>
<td>0.401 (0.225)</td>
<td></td>
</tr>
<tr>
<td>Ph.D. abroad</td>
<td>1.111** (0.371)</td>
<td></td>
</tr>
<tr>
<td>Position in Paris</td>
<td>0.496** (0.167)</td>
<td></td>
</tr>
<tr>
<td>Position in top-6 univ.</td>
<td>0.067 (0.185)</td>
<td></td>
</tr>
<tr>
<td>Ph.D. from top-6 univ.</td>
<td>−0.220 (0.197)</td>
<td></td>
</tr>
<tr>
<td>First time</td>
<td>−0.230 (0.158)</td>
<td></td>
</tr>
<tr>
<td>Ph.D. adv. nb. pub.</td>
<td>0.016** (0.004)</td>
<td></td>
</tr>
<tr>
<td>Ph.D. adv. qual. pub.</td>
<td>0.048 (0.026)</td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td>993</td>
<td>993</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>−1094.853</td>
<td>−1033.073</td>
</tr>
<tr>
<td>(\chi^2)</td>
<td>106.08</td>
<td>229.639</td>
</tr>
</tbody>
</table>

Significance levels: *: 5% **: 1%.

The advantage of the ROL model is the simple analytic expression of the contribution \(l_t(\beta)\). Indeed, this term can be seen as the product of multinomial logit probabilities. For an independent sample of \(T\) concours the log-likelihood function is the sum of all log-contributions

\[
\log L(\beta) = \sum_{t=1}^{T} \log l_t(\beta) = \sum_{t=1}^{T} \sum_{i|y_i=1} x_i \beta - \sum_{t=1}^{T} \sum_{i|y_i=1} \left[ \log \sum_{j \neq y_i} \exp(x_j \beta) \right].
\]

(3)

The ML estimate of \(\beta\) is the unique maximum of the log-likelihood (since it can be shown that \(L(\beta)\) is globally concave in \(\beta\)). In the log-likelihood we replaced the few missing observations (see Table 2) by randomly drawing values from the empirical distribution functions of the variables.

4. Results

Section 4.1 presents the estimation results. We first estimate a specification that only includes our two sets of key variables and then we include control variables. Section 4.2 presents some implications of the estimates: we calculate how the probability of success at the concours varies with changes in our key variables, and the improvements in publication records necessary to compensate for an absence of networks connections.
4.1. Estimation results

First we present estimates of the ROL model without control variables (i.e., \(x_{it}\) includes the publication and network variables only). The estimation results can be found in the second and third columns of Table 3.\(^{16}\)

The coefficients of both publication variables are highly significant (p-values smaller than 1\%) and have, as expected, positive signs: increasing either the number of scientific publications or their quality augments the aptitude score, and thereby the chances of getting hired. Two of our network variables, A-Link and P-Link, have positive and highly significant effects. Thus, a candidate whose Ph.D. advisor is in the jury, or who works in the same place (university) as one of the jury members, has a significantly higher success probability.

The fact that network variables affect hiring probabilities may be a statistical artefact resulting from an omitted-variables problem. Such a problem arises if, in evaluating the academic skills of applicants, juries take other scientific quality indicators into account besides our two publication variables. The juries may for instance take into account the academic reputation of the candidate’s Ph.D. advisor, the current affiliation of the candidate (a top-6 university or not), the nature of the candidate’s job (academic or not), etc. There is also an omitted-variables problem if juries evaluate applicants not just on the basis of purely scientific criteria, but also on the basis of their pedagogic skills. Although such skills are not directly observed in our data, they may be captured indirectly by the variable indicating the nationality of candidates (the leçons have to be presented in French, and non-French applicants may therefore be disadvantaged), or by the variable indicating whether applicants participate in the concours for the first time (communication skills of first-time candidates may be less developed because of inexperience). If the omitted scientific indicators and pedagogic skills depend on the network or publication variables (thereby violating our assumption regarding the independence between error terms and explanatory variables), the estimates reported so far may be inconsistent. To address this issue, we re-estimate the ROL model, now including our control variables.

Results are in the fourth and fifth columns of Table 3. Both publication coefficients are still highly significant and positive. The results regarding the network variables also remain unchanged (except that the coefficient of P-Link is now significant at the 5\% level only). Thus, even after controlling for the publication records and a large set of control variables, networking influences hiring outcomes.\(^{17}\)

Looking at the results for the control variables, we see that the coefficients associated with age (negative sign) and age squared (positive sign) are highly significant, suggesting that relatively young candidates have a higher chance of succeeding at the concours (the marginal effect of age on the latent variable is negative until around 50 years, and slightly increases thereafter). This youth premium may be explained by the fact that younger candidates possibly have more stamina during the long and tiring examinations. Moreover, they may also be perceived as more flexible and more willing to integrate a new university. Holding a Ph.D. from a non-French university significantly increases the probability of getting hired. Given that in our sample the candidates with a non-French thesis attended relatively prestigious foreign universities, this results is not

\(^{16}\) ML estimates and estimated standard errors were obtained using the procedure Rologit in Stata (version 9).

\(^{17}\) This last result is reminiscent of the results obtained by Checchi (1999). He studies the concorso held in 1997–1998 and finds that his two network variables (one indicates whether the candidate comes from the same university as one of the jury members, and the other whether the candidate comes from a university with a vacancy) have positive significant effects on the hiring probability.
surprising. Working in Paris also significantly increases the success probability. The common belief among non-parisian candidates that they are discriminated against is not in contradiction with this result. The last variable with a significant effect is the number of publications of the Ph.D. advisor: a candidate who was supervised by a more productive researcher has a higher chance of getting hired. All other control variables are not significant at conventional significance levels: gender,\(^{18}\) nationality, the nature of the current job, whether the candidate works in a top-6 university, whether the Ph.D. is obtained at a top-6 university, whether the candidate participates for the first time, and the quality index of the advisor’s publications, do not matter in the hiring of economics professors.\(^{19}\)

A question of interest is to know whether the above publication and network effects vary with the publication profiles of jury members. To answer this question we calculated for each jury its total CLpn score (sum of the total CLpn scores of the seven members), and split the sample into two: one subsample containing the five \textit{concours} with the most prolific jury members, and one containing the five \textit{concours} with the least prolific juries.\(^{20}\) Table 4 lists the results for the two groups.\(^{21}\) They suggest that both types of juries take into account the number of publications. Yet, the quality of publications of the candidates influences the most prolific juries only. Therefore, low-CLpn juries appear to focus on the number of publications only, irrespectively of their quality. The second and third columns of Table 4 also show that high-CLpn juries are influenced by the link variables: A-Link and P-Link are still significant (although P-Link only at the 10\% level). However, as the fourth and fifth columns indicate, for the less prolific juries only A-Link is significant.\(^{22}\) This contrasts with the results of Perotti (2002) who shows that the higher the quality of the jury members (in terms of publications), the smaller the influence of networks.

In what follows we will interpret the estimates (model with control variables) as the causal effects of networks on the likelihood of getting hired. This hypothesis may be criticized. Indeed, it is possible that we still do not measure all variables that are important to jury members in evaluating candidates. Since the publication records of candidates are quite accurately measured and since our controls include many indirect indicators of scientific quality, it is likely that we observe all the relevant purely scientific variables. However, as mentioned above, juries also take into account the pedagogic skills of applicants, their capacity to quickly and adequately prepare the \textit{leçons}, their ability to give precise and clear answers, etc. Some of these features may well be captured by our control variables, but others are probably unobserved in the data. If the missing features are correlated with the network variables, our estimations may partly pick-up and reflect the impact of the missing variables, and then we would still have inconsistent estimates of the causal effects. Although we cannot exclude this possibility with certainty, the omitted-variable

---

\(^{18}\) This contrasts with the results obtained by Ginther and Kahn (2004). They find that women in the United States and Canada are less likely to become tenured economics professors.

\(^{19}\) Following Ginsburgh and van Ours (2003) (who find that the ranking of musicians in the Queen Elisabeth piano competition is affected by the order in which they perform), we have estimated the ROL model with a variable indicating the order of appearance in the first \textit{leçon}. This variable was not significant and did not change our main results. We also tried a specification in which our two top-6 indicators were replaced by appropriate university-specific dummies (one for each French university). Most of these dummy variables were not significant and, again, our results were unchanged.

\(^{20}\) The high-CLpn group thus includes all 5 juries with a total CLpn score above the median score of the 10 juries.

\(^{21}\) In the second subsample there is hardly any variation in the variable IA-Link and it is therefore not included in the list of regressors. Note that the estimated coefficients measure the effects of regressors on aptitude scores. They do not measure the effects on success probabilities or expected ranks. In this sense the results from the two samples are not strictly comparable.

\(^{22}\) P-Link becomes significant, however, when T-Link is omitted from the model.
bias may not be such an important problem in our case. Indeed, given the manner in which jury presidents are chosen, it seems unlikely that their former Ph.D. students or current colleagues have better pedagogic skills (not captured by our control variables). Similarly, there is no reason to believe that the other jury members (chosen by the president) have former Ph.D. students or colleagues who are in some way better at preparing and presenting the leçons. Thus it seems plausible to assume that our network indicators are independent from the missing features of candidates, and in turn that our network estimates have causal interpretations.

### 4.2. Implication of the estimates

The estimated coefficients reported in the previous subsection represent the marginal effects of the explanatory variables on the latent aptitude score. Since the latent score does not have a well-defined unit of measurement, the magnitudes of these marginal effects are not easy to interpret. To

---

23 As mentioned in Section 2, the jury presidents are chosen by the Minister of Education. Officially, in successive concours, a president from the greater Paris area should alternate with a president from outside this area. Furthermore, the president selected by the Minister should in principle be the eldest of the top-echelon professors.
facilitate the interpretation of the estimation results, we now study two sorts of implications of our estimates.

First we analyze, in Table 5, by how much a candidate without observed professional links has to augment the number or quality of scientific publications in order to have the same success probability as a (otherwise identical) candidate with network connections. That is, given two hypothetical candidates i and i’ (who are identical except that i’ is linked to the jury and i is not), the table lists the additional number of publications (second column) or the additional quality index (third column) necessary for i to have the same probability of succeeding as i’. To calculate the increments in Table 5 we use the fact that, *ceteris paribus*, i and i’ have the same chance of succeeding in year t if the necessary adjustment in the publication record of i is such that the adjusted aptitude score of i equals \( y_{it}^* \). For instance, if the Ph.D. advisor of i’ is in the jury, i needs \( \beta \text{A-Link}/\beta \text{nb. of pub.} \) additional publications to have the same success probability as i’ (\( \beta \text{A-Link} \) and \( \beta \text{qual. of pub.} \) are the coefficients associated with the variables A-Link and number of publications). Replacing the coefficients by their estimates (see Table 3), we find that the estimation of the necessary adjustment equals 5 publications. Similarly, if the advisor of i’ and at least one of the direct colleagues of i’ are in the jury, the quality index of i needs to increase by \( (\beta \text{A-Link} + \beta \text{P-Link})/\beta \text{qual. of pub.} \) pages to put both candidates on the same level (\( \beta \text{P-Link} \) and \( \beta \text{qual. of pub.} \) representing the coefficients associated with P-Link and the quality index). On replacing the coefficients by the ROL estimates, we find that the resulting estimation equals 14 pages. All other estimations in the table are obtained in the same way, and the reported 95% confidence intervals are calculated using the delta method.\(^{24}\)

Table 5 shows that the estimates of the additional number of publications are significant at the 5% level.\(^{25}\) The number of publications needed to compensate for not being connected to the jury ranges from 2.2 (the counterbalance of (A-Link,P-Link) = (0,1)) to 7.2 ((A-Link,P-Link) = (1,1)). The estimates of the additional quality index are also significant except when (A-Link,P-Link) = (0,1). The table shows that not having one’s Ph.D. advisor in the jury can be offset by 9.7 additional pages, and not having one’s Ph.D. advisor and university colleague in the jury can be counterbalanced by 14 additional pages. These numbers are quite high given that candidates have on average published 2.2 articles and the equivalent of 1.9 ‘top journal’ pages (see Table 2).

Next we analyze how the explanatory variables affect the probability of succeeding at the *concours*. For this purpose we let \( x_{it} \) be the matrix when \( x_{it} \) is omitted from \( x_t \), and define the success probability of candidate i in year t:

\[
p(c_t, p_t, x_{it}, x_{-it}; \beta) = \text{Pr}(y_{it} = 1 | c_t, p_t, x_{it}, x_{-it})
\]

\[
= \text{Pr} \left( \sum_{j \neq i} 1 \{ y_{it}^* - y_{jt}^* > c_t - p_t | c_t, p_t, x_{it}, x_{-it} \} \right)
\]

\[
= \text{Pr} \left( \sum_{j \neq i} 1 \{ (x_{it} - x_{jt}) \beta > \epsilon_{it} - \epsilon_{jt} | c_t - p_t | c_t, p_t, x_{it}, x_{-it} \} \right)
\]

where 1 \{ \cdot \} is the indicator function. The success probability is simply the probability that the latent score of i is larger than the scores of at least \( c_t - p_t \) other candidates. When the number of positions offered, \( p_t \), equals one, \( p(c_t, p_t, x_{it}, x_{-it}; \beta) \) corresponds to the well known multinomial

\(^{24}\) Note that neither the other characteristics of i (equal to those of i’) nor the characteristics of i’’s competitors (equal to the characteristics of the competitors of i’) need to be specified to calculate the compensations.

\(^{25}\) When (A-Link,P-Link) = (0,1), the confidence interval just overlaps zero. In fact the p-value in this case is 0.053, so the 5% level is almost attained.
logit probability. For large values of $p_t$ (as in the data) we did not manage to obtain an explicit expression for the success probability, and we therefore approximate it using simulations.\footnote{For given $c_t$, $p_t$, $x_{it}$, $x_{it'}$, and $\beta$, we draw $c_t$ independent error terms from the extreme value distribution $(\varepsilon_1, \ldots, \varepsilon_{c_t})$, and define $p^t(c_t, p_t, x_{it}, x_{it'}; \beta) = \left(\sum_{i=1}^{c_t} \frac{1}{(x_{it'} - x_{it})^p} \exp\left(\frac{x_{it'} - x_{it}}{\varepsilon_1 - \varepsilon_i}\right) \right)^{-1} \left(\sqrt{\frac{c_t}{\pi}}\right)$ (the approximation in simulation $s$). Replicating this procedure $S$ times, the probability (4) is approximated by the empirical average $\frac{1}{S} \sum_{s=1}^{S} p^s(c_t, p_t, x_{it}, x_{it'}; \beta)$. The number of replications is $S = 10000$.}

Table 6 reports the simulated success probabilities. For each $t$ we arbitrarily pick out a candidate $i$. In the formula for the success probability, $x_{it}$ is replaced by the actual regressor values of all competitors of $i$ in year $t$, and $\beta$ is replaced by the ML estimate reported in Table 3 (the specification which includes all control variables). Similarly, $c_t$ and $p_t$ are replaced by the actual number of candidates and professorships in concours $t$. Regarding the explanatory variables $x_{it}$, the $t$-th take different values in the table (not necessarily corresponding to the actual regressor values of $i$). In the second column, all continuous variables in $x_{it}$ are replaced by average values of all observations in the $t$-th concours (for example, the actual age of $i$ is replaced by the average age of all candidates in year $t$). All indicator variables in $x_{it}$ are chosen such that the (hypothetical) candidate $i$ is a male candidate, of French nationality, with an academic job, with a Ph.D. obtained in France (but not from a top-6 university), working outside Paris (but not in a top-6 university), participating for the first time in the concours, and without professional connections (all link variables equal to zero).

The second column thus reports the success probability for a reference candidate. The other columns give success probabilities after changing some of the values in the explanatory variables of the reference candidate. We only consider changes in the key variables (the two publication variables and the two significant link variables). For example, under the column headed “A-Link=1,P-Link=0”, we give the success probabilities of an applicant who has the same features as the reference candidate except that this applicant’s Ph.D. advisor is in the jury. Similarly, the numbers under the column headed “Quantile nb. pub.=.75th” are the probabilities of the applicant who is identical to the reference candidate except that the number of articles published by this applicant equals the .75th quantile of the distribution of publications in year $t$ (for the reference candidate this variable equals the mean). Finally, the numbers under the column headed “Quantile qual. pub.=.25th” correspond to the probabilities of the candidate who is similar to the reference candidate except that this applicant’s quality index equals the .25th quantile of the distribution of quality indices in year $t$. We have not calculated the variances of the simulated success probabilities.

The second column in Table 6 shows that the success probability of the reference candidate varies between 0.08 (2003) and 0.25 (1991), and on average it equals 0.17. Looking at the next three columns, it turns out that the chances of succeeding at the concours increase substantially when the reference candidate is in some way linked to the jury. For instance, in 1987, the likelihood of getting hired augments from 0.22 to 0.31 if a university colleague is in the jury, to 0.46 if the Ph.D. advisor of the reference candidate is a jury member, and to 0.58 if both link variables are active. On average, the success probability of the reference candidate more than doubles if the advisor is part of the jury,
and almost triples if both the advisor and a direct colleague are in the jury. Looking at the remaining columns, we see that modifying either the number of publications or their quality has relatively little impact on the success probability of the reference candidate. For example, on average, augmenting the number of publications from the mean to the 0.90th quantile increases the likelihood of success from 0.17 to just 0.26. Similarly, the average success probability increases to only 0.21 following an augmentation of the quality index from the mean to the 0.90th quantile.

5. Conclusion

This paper studies the outcomes of the concours d'agrégation en sciences économiques, the French examination procedure to recruit economics professors. The main finding is that, after controlling for the publication records of candidates and a large set of control variables, our network variables significantly affect the probability of getting hired. In line with the viewpoint of many opponents of the French hiring method, our results suggest that candidates who have professional links with jury members have, other things equal, a much higher chance of being nominated than candidates with no links. The network effects are important in the sense that unconnected candidates must substantially improve their publication records in order to have the same success probability as candidates with network connections.

The question that remains to be answered is: why do jury members favor candidates with whom they have professional connections? It may be that jury members favor former Ph.D. students and junior colleagues because they share scientific interests and beliefs about what constitutes good research. Another possible answer is that those who take the hiring decisions overestimate the qualities of connected candidates. Overestimation of quality may be quite natural

27 Since the earliest concours it has been suggested by critics of the system that the probability of success depends (too much) on the professional connections of candidates. For example, back in 1903, when a disciple of Léon Walras (who himself worked in Lausanne at that time) did not succeed in obtaining a professorship, some economists argued that the candidate was turned down not because of a lack of scientific quality, but because the jury was against the mathematical approach to economics and wanted to block the “Lausanne school” (see Flandreau, 2004 and Le Van-Lemesle, 2004). Similarly, one century later, the jury members of the 2003 concours were accused of having primarily selected candidates who shared their ideological and political viewpoints (see Legendre and L’Horty, 2004). After several severe attacks in the national press, the deputy Minister of education intervened on behalf of the jury at the French National Assembly (March 2, 2004).
and human. Ph.D. advisors and their students often closely interact during the process of the thesis, which may lead the former to get an upwards-biased picture of the latter. Similarly, direct colleagues often discuss together and work on common teaching projects, which may result in colleagues having (too) favorable opinions of each other. Yet another possibility is that jury members are conscious of real quality levels, but nonetheless deliberately push candidates who are linked to them. The French recruitment method is such that juries have practically no control over where winning applicants finally end up, so the chance that a given candidate is nominated in the university where a given jury member works is slim. The cost of pushing known but possibly less qualified candidates may therefore be low for jury members.

References


