It's Not What You Know, but Who You Know: the Role of Connections in Academic Promotions*

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Abstract

This paper analyzes the role of academic connections in promotions using evidence from centralized evaluations in Spain between 2002 and 2006. We find that candidates to associate and full professor positions have significantly better chances of success if they are (randomly) assigned to a committee that includes an evaluator from their own university or some other professional connection. In a committee with seven members, the presence of a connection is comparable to an improvement of candidate's research quality of half a standard deviation. The larger success rate of connected candidates cannot be explained by similarity in research interests, defined at very detailed level, or by information asymmetries in the assessment of future research quality. Our analysis illustrates the challenges that promotion systems face when adequate incentives are largely absent.

Keywords: academic promotion, academic inbreeding, evaluation bias

JEL Classification: I23, J45

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1 Introduction

There is little doubt that professional networks make it easier to develop a scientific career. If you are well connected, you are faster to get a comment on your work, a recent reference, an invitation to a workshop or a conference. All this might improve your research, it might help to get it better placed and to obtain a higher impact. The question is whether the effect of networks on one's career is limited to the enhancement of individual research productivity or whether in some cases networks may also serve as a platform for favoritism. In other words, do networks facilitate the development of one's career at the expense of a slower career progress of somebody else with a relatively better research quality? The answer to this question is crucial for the efficient design of promotion procedures.

In this paper we investigate the effect of two types of academic linkages: colleagues from the same institution and other professional connections. Academic inbreeding – the practice of selecting former students of an institution as members of its faculty – exists, with different degrees of intensity, in many countries of the world.[1] Its advantages and disadvantages have been under debate for at least one century. Charles W. Eliot, president of Harvard University between 1869 and 1909, argued that, 'it is natural, but not wise, for a college or university to recruit its faculties chiefly from its own graduates—natural, because these graduates are well known to the selecting authorities, since they have been under observation for years; unwise, because breeding in and in has grave dangers for a university."[2] In the European context, several studies observe that evaluation committees tend to prefer internal candidates, conditional on their observable research production (Perotti 2002, Combes et al. 2008, De Paola and Scoppa 2011). In addition to common affiliation, promotion decisions might also be affected by the existence of other pro-

[1]Among others, the existence of inbreeding has been documented in Italy (Perotti 2002), Spain (Cruz-Castro and Sanz-Menendez 2010) and Mexico (Horta et al. 2010).

[2]Charles W. Eliot, *University Administration*, Boston: Houghton Mifflin Co., 1908, p. 90. Some authors have provided empirical evidence supporting for this view. Eells and Cleveland (1935a, 1935b) and, more recently, Hargens and Farr (1973) and Eisenberg and Wells (2000) observe that inbred faculty in the US tend to have a lower scholarly productivity and outside professional recognition than comparable non-inbred faculty.

fessional linkages. Combes et al. (2008) show that the presence in the committee of a thesis advisor or a co-author is associated with a higher success rate.[3]

This evidence raises two questions. First, do connections really matter? The larger success of connected candidates might simply reflect that they are better in some dimension which is observable to evaluators, but not to the econometrician. Second, connections could matter for different reasons. Evaluators' preference for acquainted candidates may be due to cronyism, but it can also be the consequence of information asymmetries that hinder the evaluation of unknown candidates, or it may be driven by evaluators' preference for certain academic subfields. The exceptional evidence used in this paper allows us to consider these issues.

We analyze the role of academic networks using information from promotions between 2002 and 2006 in the Spanish university system.[4] Before 2002, Spanish public universities had a large degree of autonomy regarding hiring and promotion. This system was associated to the existence of inbreeding, generating public concerns about the potential existence of favoritism.[5] In order to increase meritocracy, in 2002 a system of centralized competitions known as *habilitación* was introduced by the government.[6] This procedure is relatively similar to promotion systems currently in place in other countries in continental Europe.[7] Candidates to full professor and associate professor positions have to be evaluated by a committee at the national level. Successful candidates can then apply for a position at the university level. Most importantly, the members of evaluation committees were selected out of the pool of eligible professors in the discipline using a random lottery.

[3]Universities' hiring decisions might also be affected by nepotism (Durante et al. 2011)

[4]The position of *catedrático de universidad* at a Spanish university may be considered equivalent to the position of full professor in a U.S. university. The category of *profesor titular de universidad* would be equivalent to associate professor; in Spain, the position of associate professor typically carries tenure.

[5]According to Cruz-Castro et al. (2006) in the nineties 93% of university tenure positions were assigned to internal candidates. Approximately 70% of these candidates had also done their PhD in the same university.

[6]Julio Iglesias de Ussel, vice-minister for Education and Universities, newspaper El País, November 5th, 2001.

[7]In France, professors are recruited through a centralized examination (*concours nationaux d'agrégation*). In Italy, the Moratti Law (2005) introduced a nation-wide qualification exam for candidates to university positions (*l'idoneità nazionale*).

The dataset includes information on approximately thirty thousand candidacies, thirty thousand eligible evaluators and one thousand evaluation committees. Each committee was composed by seven members. The identification strategy exploits the random assignment of evaluators to committees. This approach allows for the possibility that better connected candidates are, in many unobservable ways, better candidates. We find that institutional connections have a strong effect on candidates' probability of being promoted. Candidates have 43% more chances of being promoted if the committee includes, by luck of the draw, an (additional) member from their own university. Other professional connections tend to have a stronger effect. Candidates have 58% more chances of success when the evaluation committee includes candidate's thesis advisor, a member of the thesis committee, a co-author or somebody who had invited the candidate to participate in a thesis committee. The importance of professional connections varies over the career ladder. In exams to associate professor positions, the most important connections are thesis advisors and thesis committee members. In exams to full professor positions, the most relevant connections are co-authors and evaluators who had in the past invited the candidate to seat in the thesis committee of one of their students. The importance of networks is commensurate with the relevance of research quality. For instance, the presence of a colleague on the evaluation committee counts inasmuch as half a standard deviation increase in candidate's observed research production. The presence of a thesis advisor would be equivalent to one standard deviation increase in research quality.

There are in principle at least four possible explanations for the larger success of connected candidates. First, evaluators may have different criteria about what constitutes good research. As Schumpeter (1954) pointed out, "it is merely human nature that we overrate the importance of our own types of research and underrate the importance of the types that appeal to others."[8] Individuals that work in the same university or research network might share common research interests and,

[8]Schumpeter, Joseph A., *History of Economic Analysis*, London: George Allen and Unwin, 1954, page 20.

perhaps, a common view on which academic areas are relatively more valuable. In order to deal with this issue, we have collected very detailed information on evaluators' and candidates' research interests. According to our analysis, similarity in research interests affects positively promotion decisions, but it cannot explain the observed premium associated to connections.

Second, evaluators might be better informed about the research quality of acquainted candidates (Laband and Piette 1994, Li 2011).[9] As a result, in a tournament where only a few candidates are promoted, evaluators will (optimally) tend to hire their connections even when they have no innate preference for them (Cornell and Welch 1996). We examine whether candidates who were promoted by an acquainted evaluator exhibit a better post-examination performance relatively to other comparable promoted candidates. We do not find any significant difference, suggesting that in this context information asymmetries about candidates' future research productivity do not play an important role.

Third, our results may reflect the presence of information asymmetries in some dimension other than research. For instance, in exams to associate professor positions candidates were evaluated both on their research and on their teaching quality. Evaluators who are based at the same institution as the candidate may be better informed about candidate's teaching quality. We cannot estimate empirically how relevant is this hypothesis but, in order to fully explain the larger success rates of connected candidates, the relative importance of this unobserved dimension would have to be at least as important as candidates' observable research production. However, according to a survey completed by 1,294 eligible evaluators there exists no dimension of larger importance than research. In particular, eligible evaluators consider that publications in journals covered by ISI Web of Science is be the most important factor for promotion decisions (Buela-Casal and Sierra 2007).

[9]Laband and Piette (1994) show that journal editors' take advantage of their professional connections in order to identify and 'capture' high-impact papers for publication. Li (2011) examines how relationships between reviewers and applicants, as measured by citations, affect the allocation and efficiency of grant funding at the National Institutes of Health (NIH). She finds that related reviewers are better informed about the quality of proposals from related applicants but they are also biased in their favor.

Finally, our results may reflect the existence of cronyism. Evaluators would be willing to trade-off a relatively large number of candidates' publications in exchange for getting their acquainted candidate promoted. This hypothesis cannot be rejected by the data and is consistent with the anecdotal evidence that has been previously presented by a number of Spanish authors (e.g. Sosa Wagner 2005).[10]

In sum, the evidence suggests that the system of centralized examinations introduced in Spain in 2002 has not eliminated favoritism. Instead, it has randomized the probability of being favored. All in all, our analysis illustrates the challenges faced by promotion systems in a framework where evaluators lack adequate incentives.

The rest of the paper is organized as follows. Section 2 describes the institutional background and section 3 describes the data. In section 4 we explain the identification strategy, provide the empirical evidence and discuss possible explanations. Finally, in section 5 we summarize our results and discuss possible policy implications.

2 Institutional background

As it is generally the case in Europe, most university professors in Spain are based in public universities.[11] Between 2002 and 2006, when the system of centralized competitions known as *habilitación* was at work, candidates to full and associate professor positions were required to qualify in a national competition held at the discipline level.[12] Successful candidates could then apply for a position at a given university. During this period, the number of vacancies opened at the national level was very limited and the competition at the university level was almost absent.

[10] It is also consistent with an old saying from Spanish academia, according to which in order to obtain a promotion, "first, the main thing is to be acquainted with the committee; second, and very important, to have no opponent; last, and least, to know a little bit the topic." ("Lo primero y principal, conocer al tribunal; lo segundo y muy importante, no tener contrincante; lo último y secundario, saberse algo el temario"). We thank Víctor Fernández-Blanco for this quote.

[11] In Spain approximately 88% of university professors work in a public institution (Instituto Nacional de Estadística 2010)

[12] There are nearly two hundred legally defined academic disciplines. These disciplines were created in 1984 on the basis of "the homogeneity of its object of knowledge, a common historic tradition and the existence of a community of researchers" (R.D. 1988/84).

Thus, in practice, being accredited was generally equivalent to being promoted.

The time structure of examinations was as follows. First of all, universities reported the number of openings to the Ministry.[13] Then, the centralized competition was announced and during a period of twenty days candidates were allowed to apply. Once the list of applicants was settled, committee members were selected by random draw from the list of eligible evaluators. This list included those professors and researchers who were working in public institutions in Spain at the moment and who were officially recognized to have a minimum research quality in the discipline.[14,15] The selection was carried out by Ministry officials using a drum which contained as many balls as eligible evaluators.

Each committee was composed of seven members. In exams to associate professor positions, three evaluators were chosen from the list of eligible full professors (henceforth FP) and four evaluators were chosen from the list of eligible associate professors (henceforth AP). In the case of exams to FP positions, all committee members were chosen from the list of eligible FPs. The committee member with the longest tenure was appointed president and the exam was held at the university where the president was based.

Furthermore, seven evaluators were randomly assigned to form a *committee in reserve*. Their role was to replace evaluators in case somebody resigned from the committee. Evaluators could only resign under a very restricted set of reasons, and resignations happened very rarely: less than 3% of initially assigned evaluators were

[13]Even though the number of available accreditations was equal to the total number of openings requested by universities, these accreditations were not directly linked to university openings. Universities that had requested a position were not obliged to hire one of the candidates who were accredited in the following competition. Universities could postpone hiring decisions, or they could also hire a candidate who had been accredited in the past. In fact, very often universities opened a position once a local candidate had been accredited.

[14]The random assignment of evaluators to committees was subject to some minor constraints. Not more than one non-university researcher belonging to the Spanish Research Council (CSIC) was allowed to be selected as a member of the evaluation committee for a given exam. Similarly, not more than one emeritus professor was allowed to be selected as a member of a given evaluation committee. Therefore, in exams where the population of potential evaluators contained two or more researchers, or two or more emeritus professors, the expected committee composition should be computed taking into account this constraint. The details on these calculations are in Appendix B.

[15]The research quality requirement was based on the number of *sexenios* recognized to each professor. *Sexenios* are granted by the Spanish education authorities on the basis of applicants' academic research output in any non-interrupted period of a maximum of six years.

replaced. There are two main types of resignations. Professors were allowed to renounce if they were temporarily holding a high position in the public administration. As well, they should abstain from participating in the committee if they had a very close personal connection with one of the candidates.[16] With very few exceptions, most evaluators did not report such connections. For instance, according to our own calculations, out of 832 professors who were assigned to evaluate their on PhD student only 22 of them reported this relationship and resigned from the committee.

Competitions to FP positions had two qualifying stages. In the first stage each candidate presented her *résumé*. In the second stage candidates presented a piece of their research work. Additionally, exams to AP positions had an intermediate stage, in which candidates had to deliver a lecture on a topic from their syllabus. At each stage passing decisions were taken on a majority basis. At the end of the process the number of qualified candidates could not be larger than the total number of positions.

In 2006, the system of *habilitación* was replaced by a system known as *acreditación*, which is still in place. As in the system of *habilitación*, applicants are required to be accredited by a national review committee. However, under the new system, committee members are selected from the pool of professors who volunteer for the task, and there is no limit to the number of candidates who may receive the accreditation.

3 Data

We use data from three different sources. First, we have collected information on the participants and the outcomes of all exams to AP and FP positions that were held in Spain when the centralized system of examinations was in place (years 2002-2006). Second, we have gathered information on the research output of candidates and eligible evaluators from ISI Web of Science. Third, we use information on dissertations

[16] The law considers three main cases: (i) the evaluator has a personal interest in the matter, (ii) there is some kinship relationship, (iii) there exists a well known friendship (or enmity). Ley de Procedimiento Administrativo 30/1992, article 28, retrieved on February 7th 2012 at `http://www.boe.es/aeboe/consultas/bases_datos/doc.php?id=BOE-A-1992-26318`. We thank Anxo Sánchez for providing us this reference.

read in Spain since 1977. In Appendix A we provide a detailed explanation on how this data was collected. Below we describe the final database.

3.1 Exams

The dataset includes information on 967 exams, of which 465 are exams to AP positions and 502 are exams to FP positions. Table 1 provides descriptive information on the characteristics of these exams. There were on average five positions available per exam in AP exams, and three positions per exam in FP exams. The level of competition was similar: in both types of exams there was approximately one position per every seven candidates. Disciplines vary little in the degree of competition. The scarcest number of positions per candidate are in Mathematics and Physics (0.09-0.10 positions per candidate). The highest ratios can be found in the Humanities (0.14-0.16). Practically all positions opened were filled.

3.2 Evaluators

In order to be eligible as evaluators, professors are required to have a minimum level of research production. Around 80% of FPs and approximately 70% of APs qualified.[17] In total, in the period we study there were 7,963 eligible FPs and 21,979 eligible APs.

As shown in Table 2, the average eligible FP is 53 years old; eight years older than the average eligible AP. Women constitute 14% of FPs and 35% of APs. As expected, FPs have a larger research record than APs. On average, FPs have nine (single-authored equivalent) ISI publications and APs have five.[18] The quality of FPs publications is slightly better. FPs' publications receive, on average, 8 citations and they are published in journals with an Article Influence Score equal to 0.53; APs' publications receive around 7 citations each and their Article Influence Score is 0.50.

[17]Source: *Comisión Nacional Evaluadora de la Actividad Investigadora*, Memoria de los resultados de las evaluaciones realizadas de 1989 a 2005, 2005.

[18]In what follows we divide publications by the number of co-authors. For instance, two publications with two co-authors are equivalent to one single-authored publication.

Eligible FPs have supervised on average five doctoral students, while the average eligible AP has supervised only one student. Similarly, FPs have participated in almost five-times more PhD thesis committees than APs, 24 and 5 respectively.

We have also collected information on professors' research interests. In particular, we identify professors' areas of interest at a very detailed level based on the dissertations in which they have participated either as author, advisor, or committee members. In Spain each dissertation is classified by its author using the UNESCO International Standard Nomenclature for Fields of Science and Technology, which includes more than two thousand research categories.[19] For instance, Business and Economics is divided in one hundred different categories. Using this approach, we were able to obtain information on the research interests of 98% of eligible FPs and 96% of eligible APs. As an illustration, Table AA1 provides the research profile of the top ten economists based in Spain.

3.3 Candidates

During the period of our study there were 13,601 applications to FP positions, and 18,139 applications to AP positions. On average, candidates applied twice, either because they failed the first time, or because they tried to obtain a position in several related disciplines. As shown in table 2, candidates to FP positions tend to be older, there are less women among them, and they exhibit a better research record than candidates to AP positions. Applicants to FP positions have advised two students and they have participated in seven dissertation committees, whereas applicants to AP positions have not yet actively participated in the direction of doctoral students and a few of them have taken part in PhD committees. Based on their participation in PhD dissertations, including their own, we are able to obtain information on the research interests of 97% of candidates to FP positions and 84% candidates to AP positions.

In table 3 we report the correlation between the main candidates' characteris-

[19] Available at `http://unesdoc.unesco.org/images/0008/000829/082946eb.pdf`.

tics, pooling together information from exams to FP and AP positions.[20] Given that there exist relatively large differences across positions and across disciplines in the propensity to publish, cite, participate in dissertations, and time necessary to progress in the career, in what follows we normalize research indicators and age to have zero mean and unit standard deviation for candidates within each exam. We observe that more prolific candidates tend also to have higher research quality as measured by the number of citations per publication and journals' average Article Influence Score (table 3, block B-B). More productive candidates are also more likely to participate in students' supervision and evaluation. On average, older candidates do not have a better publication record, but they have participated more extensively in students' supervision and evaluation.

3.4 Links between evaluators and candidates

We consider several types of connections between candidates and evaluators. First, we focus on institutional connections. In exams to FP positions, we observe the affiliation of all candidates and evaluators. In these exams approximately one third of candidates had a colleague from their university sitting in the evaluation committee (Table 4, first row). In exams to AP positions, we observe evaluators' affiliation and, in 83% of the cases, we can identify candidates' PhD alma mater using the dissertations' database.[21] One third of these candidates were evaluated by a committee that included a colleague from their alma mater.

Second, we define several indicators of non-institutional professional connections between candidates and eligible evaluators: (i) the evaluator was the candidate's PhD thesis advisor, (ii) the evaluator was a member of her thesis committee, (iii) they have co-authored an academic article, or (iv) the evaluator has invited the candidate to sit in the thesis committee of one of her students (or vice versa). These personal connections are relatively less frequent than institutional ties (Table 4, rows

[20] Results are very similar if we disaggregate the table by position.

[21] As pointed out in section 2, it seems reasonable to presume that the large majority of these candidates are still based in the same institution where they graduated.

2-5). In exams to FP positions, approximately one in every thirty candidates was evaluated by a committee including their PhD advisor, one in every eight candidates by a member of their PhD thesis committee, one in nine was evaluated by a co-author and one in every seven candidates had been invited in the past by one of the committee members to seat in a PhD thesis committee (or viceversa). In exams to AP positions the picture is relatively similar, although in this case we observe a slightly lower number of personal connections.

3.5 Similarity in research interests

Evaluators may have specific ideas about which type of research is valuable. In order to measure the overlap in research interests between candidates and eligible evaluators, we define the variable *similarity in research interests* of two individuals as the degree of overlap between their research interests:

$$Similarity = \sum_d \left(\frac{S_d^{eval} + S_d^{cand}}{2} \right) I(S_d^{eval} > 0) I(S_d^{cand} > 0)$$

where $I(\cdot)$ is the indicator function and S_d^j is the share of subfield d in the individual's distribution of subfields as revealed by his/her activity as PhD thesis author, advisor, or committee member. For instance, consider an average eligible FP evaluator, who has participated in thirty dissertations, and assume that fifteen of them are in Labor Economics and fifteen in Econometrics. Consider also an average candidate to FP positions, who has participated in ten dissertations, and assume that five of them are in Labor Economics and five in Game Theory. Their degree of similarity would be equal to 0.5.

Not surprisingly, research similarity is correlated with various types of connections, such as the presence in the committee of the candidate's PhD advisor, a member of the thesis committee, or somebody who invited the candidate to participate in a thesis committee (Table 3, block C-C). Candidates carrying out mainstream research, i.e. candidates with relatively high overlap of research interests with eligible evaluators, also tend to publish more and they are more frequently involved in doctoral students' supervision and evaluation (Table 3, block C-B).

4 Empirical analysis

Our empirical analysis is structured as follows. First, we provide some descriptive information about the chances of success of connected candidates. Second, we present the identification strategy, which exploits the random assignment of evaluators to committees. Third, we estimate the (causal) effect of committees' composition on applicants' chances of being promoted. In order to get a better understanding of the magnitude of the effect, we compare the effect of connections on promotions with the effect of observable research quality. Finally, we explore several possible explanations for our results. In particular, we consider the possibility that evaluators might be more accurate at assessing the quality of acquainted candidates, and we account for differences in evaluators' preferences for certain research fields, defined at a very detailed level.

4.1 Are connected candidates more likely to be promoted?

Table 4 presents information on candidates' chances of success, depending on whether they had some connection in the evaluation committee. The presence of an acquainted evaluator is associated with larger success rates. When one of the evaluators is a colleague from the same university, the success rate of candidates is twice as large, both in exams to FP and AP positions. The success rate of candidates who happened to be evaluated by a committee including their PhD thesis advisor, a member of their thesis committee, a co-author, or an evaluator who had invited the candidate to sit in the thesis committee of one of her students (or vice versa) is between 50% and 100% higher than the success rate of candidates with no personal connections in the committee.

This descriptive evidence might be suggestive about the potential existence of evaluation biases, but it has no causal interpretation. The larger success rate of connected candidates might at least partially reflect that better connected candidates are on average of higher quality. In fact, we observe that candidates who have more co-authors in the pool of eligible evaluators or who are invited more often to sit on doctoral committees tend to be more productive in terms of research (Table 3, block C-B).[22]

4.2 The (causal) effect of connections on promotions

In order to identify the causal effect of having a connection in the committee, we compare the outcomes of candidates with a similar expected committee composition but who, as a consequence of the realizations of the random draws, are assigned to a committee with a different composition. For instance, one may think about the case of two candidates who apply to the same exam, each one has a connection in the set of eligible evaluators, but only one of these two evaluators happens to be (randomly) assigned to the actual evaluation committee.

The following model describes formally the causal relationship between candidates' probability of being promoted and the presence of connections in the evaluation committee:

$$y_{ie} = \beta_0 + \beta_1(S_{ie} - \mu_{ie}) + \epsilon_{ie} \tag{1}$$

where y_{ie} indicates whether individual i qualified in exam e and $(S_{ie} - \mu_{ie})$ is the shock to committee composition, i.e. the difference between the actual (S_{ie}) and the expected number of connections (μ_{ie}) of candidate i. β_0 is the average success rate and β_1 indicates the causal effect of an additional connection among evaluators on candidates' success.

The key assumption in our identification strategy is that the selection of com-

[22]Information on the connections between candidates and eligible evaluators allows us to calculate the expected number of connections in the committee for each candidate. The expected number of connections in the committee is essentially equal to the proportion of connections in the pool of eligible evaluators times 7. The details on the exact calculations are in Appendix B.

mittee members was random. More formally,

$$E[(S_{ie} - \mu_{ie}) \cdot \epsilon_{ie}] = 0 \quad (2)$$

In our analysis, we measure committee composition using the outcome of the initial random draw, which might be slightly different from the committee composition that ends up evaluating candidates.[23] Therefore, our analysis below provides the intention-to-treat effect. As shown in Table 3, these shocks have zero mean, confirming that there is no difference between the expected committee composition and the actual realization of the draw. As well, we do not observe any correlation between the shocks to committee composition and candidates' characteristics (Table 3, blocks D-B and D-C). The evidence is consistent with the assignment being indeed random.

Table 5 presents the estimation results for equation (1). We control for the number of available positions per candidate at the exam level in order to increase precision. Standard errors are clustered at the exam level, reflecting the fact that the shocks received by candidates in the same examination are not independent.

An additional colleague in the promotion committee leads to almost five percentage points increase in applicants' likelihood of success (column 1). This means about a 43% increase relative to the average success rate (about 11% of candidates are promoted). The presence of professional connections with committee members also has a strong positive effect (column 2). An additional professional connection with evaluators leads to about 58% increase in the likelihood of success. In column 3, we consider jointly the effect of professional connections and common affiliation. The coefficients are slightly lower, reflecting that common affiliation and other professional connections are interrelated, but both variables have still an independent and substantial effect on promotion outcomes.

[23]As pointed out in section 2, approximately 3% of evaluators drawn in the lottery where replaced, either because they were holding a position in the public administration or because they alleged a conflict of interest. As well, according to anecdotal evidence, some professors did not attend the exam (or part of it) without a proper justification.

Among the different types of professional connections, having an advisor on promotion committee has the strongest impact on success: it doubles candidates' chances of success (column 4). The effect of other professional connections is half as strong. The importance of different connections varies over the academic career. At the beginning of candidates' career, when candidates apply to AP positions, PhD advisors and PhD thesis committee members are the most important connections (columns 5). Later on, when candidates apply to FP positions, they benefit relatively more from the presence in the committee of a coauthor or a professor who had previously invited them to sit on the PhD committee of one of her students (column 6). The presence of a PhD advisor or a member of the PhD thesis committee is still helpful, but significantly less than in exams to AP positions.

As a robustness check, we also use a different identification strategy to estimate the effect of committee composition. Specifically, given that many individuals applied several times for promotion, we use a fixed-effects strategy. In other words, we examine the evaluations given to the same individual by different promotion committees. Note that this specification is less efficient, since it does not exploit all possible variation in the data. Its internal validity is also lower, as it limits the analysis to those individuals who participated in examinations more than once. Nevertheless, the estimates are statistically similar to the baseline estimation (column 7).

4.3 Candidates' quality

The above results suggest that connections have a strong effect on promotions. In order to get a better understanding of its magnitude, next we examine the relevance of a number of observable individual measures that proxy candidates' quality. In particular we estimate the effect of candidates' publications, the average number of citations per publication, the average Article Influence Score, the number of PhD students advised, and the number of participations in PhD thesis committees. We also control for (normalized) age since, conditional on productivity, younger candidates might have a larger potential.

Results are reported in Table 6. Candidates who score one standard deviation more than average in each one of these dimensions of research quality have approximately 7.5 percentage points (70%) more chances of success (column 1). The effect of observable research quality is commensurate with the effect of professional connections. We also observe that, conditional on their research output, older candidates have lower chances of promotion.

Our analysis may be subject to measurement error in publication record, induced by homonymity. Given that homonymity is expected to be less of a problem for individuals with unfrequent surnames, we also perform the analysis on the subsample of individuals with rare surnames (column 2). The estimated coefficients become slightly larger: in this subsample one standard deviation increase in all research indicators is associated to 9.1 percentage points higher chances of success, a magnitude which is similar to the effect of a PhD advisor on the committee.

4.4 Why do evaluators overrate connected candidates?

Connections increase candidates' chances of success. This is consistent with the existence of favoritism, where personal relationships between candidates and evaluators lead to subjective evaluations. However, this is not the only possible explanation.

4.4.1 Common research interests

Professors may differ in their criteria about which type of research is more valuable. If professors are segregated across universities and professional networks according to research interests, this might explain why evaluators prefer acquainted candidates. In fact, the correlation table reveals that evaluators who are connected to a candidate tend also to have similar research interests (Table 3). In order to account for a possible similar-to-me effect, we analyze the role of similarity between candidates' and evaluators' research interests, defined at a very detailed level. As shown in Table 7, the presence in the committee of an additional evaluator with similar research interests increases candidates' chances of success approximately by 2.5 percentage points (22%). However, similarity in research interests does not explain the effect of connections. Its inclusion in the model does not have any significant effect on the estimated impact of connections (columns 1 and 3).[24]

4.4.2 Information asymmetries

Information asymmetries might also mediate the effect of network connections. Evaluators may have better information about the quality of acquainted candidates' in dimensions that are not easily observable. For instance, thesis advisors, co-authors or members of the PhD thesis committee may be better informed about candidates' research pipeline or about how relevant was their contribution to co-authored papers. Information asymmetries may also be relevant in other dimensions. In exams to AP positions, candidates had to be explicitly evaluated on their teaching quality. Evaluators from the same institution may have better information on this respect.

While we cannot observe candidates' teaching quality, we can observe their research production and their participation in PhD committees, not only before, but also after the public examination. In order to test the existence of information asymmetries, we examine whether evaluators select acquainted candidates with a stronger potential in these dimensions. Specifically, we estimate the following model:

$$q_{ie}^{after} = \beta_0 + \beta_{\mathbf{1}}(\mathbf{S_{ie}} - \mu_{\mathbf{ie}}) + \beta_2 \mu_{ie} + \beta_3 q_{ie}^{before} + \epsilon_{ie} \quad (3)$$

where q_{ie}^{before} stands for promoted candidates' observable *quality* at the time of the evaluation, and q_{ie}^{after} represents candidates' *quality* in the three years following the promotion. We measure *quality* using a factor score which is computed as a linear combination of publications, citations per publication, average AIS, PhD theses advised, PhD committees and age, weighted by the estimated importance of each factor for promotion (Table 6, column 1). This quality indicator is normalized to

[24] Potentially, the UNESCO classification of research subfields, which includes about two thousand subfields, is not disaggregated enough to capture research similarity accurately enough. While we cannot reject formally this hypothesis, the fact that the available measure barely affects the estimated effect of connections, seems to suggest that the role played by research similarity is very limited.

have zero mean and unit standard deviation for all candidates in each exam.

The analysis is reported in Table 8. First, we compare the observable quality at the time of the evaluation of candidates that had a connection in the committee with other promoted candidates. Connected candidates tend to be significantly worse (column 1). Then, we compare the post-examination quality of promoted candidates (equation 3). The evidence suggests that evaluators are not promoting more promising candidates when choosing their acquaitances. Conditional on their pre-exam quality, candidates that were promoted by a connected committee do not appear to be any better in terms of their future productivity (column 2).

4.5 Are better or younger researchers less prone to favoritism?

Next, we explore whether the effect of connections varies with evaluators' characteristics. First, we consider evaluators' research quality. Theoretically, the sign of this effect is ambiguous. On the one hand, better researchers might potentially be more concerned about candidates' research quality. On the other hand, they might be more powerful at imposing their own candidates.

In column 2 of Table 9 we analyze whether committees with a larger research quality are less likely to promote connected candidates. Again, we compute evaluators' research quality as a linear combination of their quality at each observable dimension weighting each dimension by its estimated importance for promotion (Table 6, column 1). All committees tend to favor connections in a similar way, independently of their research quality. This result contradicts previous research by Perotti (2002), who argued that evaluators whose research quality is higher tend to be more meritocratic.

One might question whether favoritism is likely to vanish over time due to the generational change with younger cohorts of researchers being less likely to tolerate malpractices in evaluation. In column 3 of Table 9 we analyze whether the effect of connections varies across committees with different age. We do not observe any significant difference.

5 Conclusions

European countries are increasingly concerned with the efficiency of their universities (Aghion et al. 2010). In an attempt to strengthen meritocracy, in the last decade several countries have reformed the organization of academic hiring and promotion. The case of Spain is illustrative. Prior to 2002, Spanish public universities had a large degree of autonomy regarding promotion decisions. This system was characterized by widespread inbreeding (Cruz-Castro et al. 2006). In 2002 centralized examinations were introduced, reducing universities' autonomy. Under the new system, promotion decisions are taken by evaluation committees at the national level. Committee members are selected by random draw from the pool of all evaluators in the field that satisfied a minimum level of research quality.

Our analysis shows that, in centralized examinations, institutional and other professional connections have a significant impact on candidates' chances of success. Candidates have 43% more chances of being promoted if the seven-member committee (randomly) includes an evaluator from their own university. Candidates also benefit from the presence of other professional connections in the committee. They are 58% more likely to be promoted if the committee includes their thesis advisor, a member of their thesis committee, a co-author or a professor who in the past invited the candidate to sit on a thesis committee. The importance of each type of connection varies along the academic career. In exams to associate professor positions, candidates' chances of success are largest if the committee includes their thesis advisor or a member of their thesis committee. In exams to full professor positions, candidates benefit most from the presence of a co-author or a professor that had previously invited them to sit in a thesis committee.

We examine several possible explanations for the observed evidence. The premium that connected candidates enjoy cannot be explained by a potential affinity between candidates' and evaluators' research interests, defined at a very detailed level. As well, the evidence rejects the possibility that the premium arises because evaluators are better informed about the research potential of acquainted candidates. Conditional on their research record, candidates who were promoted by an acquainted committee do not turn out to be more productive in the future than other comparable promoted candidates. Another possibility is that the larger success of connected candidates reflects the presence of information asymmetries in some other relevant dimension. While we cannot discard this hypothesis, the importance of this unobserved dimension and the scale of these information asymmetries would have to be relatively large in order to fully explain the premium enjoyed by connected candidates.

The evidence might be also linked to the existence of cronyism. The magnitude of the effect would be very worrying. We observe that evaluators prefer promoting a colleague rather than another candidate whose research quality is half a standard deviation higher. The premium associated to other professional connections is even larger. Our study also shows that, contrary to a common belief, requiring that evaluators have a higher research quality does not reduce favoritism. Evaluators' age does not make any difference either.

There are several possible readings of these results. In order to decrease the relevance of connections, the government might want to enforce the declaration of conflict of interest in all academic hiring and promotion committees. However, this might not be enough. As it has happened already in the past, universities might still find a way to circumvent the rule. For instance, even if committee members are excluded from participating in the evaluation of acquainted candidates, reciprocity might easily arise as an equilibrium outcome. A more direct way to deter favoritism would be to forbid any inbreeding. For instance, in Germany a junior staff member cannot be promoted to a professorial position within the same institution. In a similar vein, several high-quality doctoral programs in Spain have absolute or near-absolute rules against providing their doctoral students with their first tenure-track appointment.[25] This system is costly for universities, as it forces them to "give

[25] Such rules have been explicitly adopted by the top Spanish Economics departments, including Universidad de Alicante, Universidad Autònoma de Barcelona, Universidad Carlos III and Universitat Pompeu Fabra.

up" their best candidates, but it effectively prevents favoritism towards local candidates. Alternatively, our work might be interpreted as additional evidence in favor of a radical change in the way higher education is organized in continental Europe. The analysis of Aghion et al. (2010) suggests that a combination of competition and autonomy would make European universities more productive. According to this view, the system might need to move from a system of rules to one of incentives, whereby it is in the self interest of universities to appoint and promote the most productive individuals (Perotti 2002). Our analysis does not provide a clear answer about which of these alternatives, more rules or incentives, would yield better outcomes. Nevertheless, it illustrates the limitations of a system of centralized examinations where evaluators do not internalize the consequences of their decisions.

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Table 1: Descriptive statistics – Examinations

	1	2	3	4
	Mean	Std. Dev.	Min.	Max.
	Full professor exams			
Positions per exam	2.92	1.78	1	12
Candidates per exam	27.09	17.98	3	132
Positions per candidate	0.13	0.07	0.02	0.67
Proportion of positions filled	0.98	0.09	0	1
Number of exams	502			
	Associate professor exams			
Positions per exam	4.74	4.71	1	25
Candidates per exam	39.01	34.82	3	270
Positions per candidate	0.14	0.08	0.02	0.67
Proportion of positions filled	0.96	0.15	0	1
Number of exams	465			

Table 2: Descriptive statistics – Eligible evaluators and candidacies

	1	2	3	4
	Eligible evaluators		**Candidates**	
	Full professor	Associate professor	Full professor	Associate professor
Female	0.14	0.35	0.27	0.40
	(0.35)	(0.48)	(0.44)	(0.49)
Age	52.90	44.98	46.40	37.46
	(6.41)	(7.82)	(6.50)	(6.55)
Tenure in position	12.94	10.36	11.68	n/a
	(8.20)	(6.59)	(5.74)	
Publications, weighted by co-authors	8.82	4.64	5.31	2.91
	(12.55)	(7.19)	(7.46)	(5.58)
Citations per publication	7.84	7.03	7.30	6.04
	(9.47)	(9.47)	(10.03)	(12.57)
Article Influence Score	0.53	0.50	0.49	0.44
	(0.53)	(0.51)	(0.50)	(0.51)
PhD students advised	4.85	1.09	1.76	0.20
	(5.07)	(1.98)	(2.52)	(0.81)
PhD committees	23.94	4.65	6.69	0.73
	(23.71)	(7.00)	(8.26)	(2.39)
Number of observations	49,199	61,052	13,601	18,139
Number of individuals	7,963	21,979	6,539	10,039

Notes: Mean values, standard deviations in parentheses. n/a - data not available.

Table 3: Correlation table

					A	B						C						D					
			Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
A	(1)	Promoted	0.11	0.32	1																		
B	(2)	Publications	-0.00	0.98	0.09***	1																	
	(3)	Citations per publication	-0.00	0.97	0.06***	0.29***	1																
	(4)	Average Article Influence Score (AIS)	0.00	0.93	0.05***	0.29***	0.53***	1															
	(5)	PhD theses advised	-0.00	0.94	0.06***	0.07***	0.00	-0.01	1														
	(6)	PhD committees	-0.00	0.98	0.07***	0.06***	0.00	-0.00	0.44***	1													
	(7)	Age	0.00	0.98	-0.04	-0.02	-0.07	-0.08	0.14***	0.21***	1												
C	(8)	(expected) Same university	0.47	0.61	0.07***	0.01	0.01**	0.01***	-0.02	-0.02	0.04***	1											
	(9)	(expected) PhD advisor	0.03	0.08	0.06***	-0.01	0.01**	0.02***	-0.05	-0.05	-0.11	0.19***	1										
	(10)	(expected) PhD committee member	0.11	0.18	0.06***	0.01**	0.02***	0.02***	-0.04	-0.04	-0.11	0.13***	0.40***	1									
	(11)	(expected) Link by invitation	0.09	0.23	0.09***	0.04***	0.01	-0.00	0.22***	0.18***	0.05***	0.08***	0.15***	0.18***	1								
	(12)	(expected) Coauthors	0.10	0.20	0.06***	0.24***	0.07***	0.10***	0.01	0.02***	-0.03	0.15***	0.19***	0.12***	0.25***	1							
	(13)	(expected) Common research interests	2.03	1.73	0.04***	0.01**	0.00	-0.01	0.01**	0.02***	-0.03	-0.06	0.14***	0.27***	0.15***	-0.03	1						
D	(14)	(shock) Same university	-0.01	0.57	0.09***	-0.00	-0.01	-0.00	0.00	-0.00	0.00	-0.05	0.00	0.00	0.00	0.00	0.01	1					
	(15)	(shock) PhD advisor	0.00	0.16	0.07***	-0.00	0.00	0.00	0.00	-0.00	0.00	0.00	-0.01	0.00	0.01	0.00	-0.01	0.22***	1				
	(16)	(shock) PhD committee member	0.00	0.30	0.05***	-0.00	-0.01	0.00	-0.01	-0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.13***	-0.03	1			
	(17)	(shock) Link by invitation	0.00	0.25	0.05***	0.01	-0.00	-0.00	0.00	-0.01	0.00	-0.01	0.00	0.00	0.02	0.00	0.01	0.13***	0.11***	0.07***	1		
	(18)	(shock) Coauthors	-0.00	0.26	0.06***	-0.01	-0.00	-0.01	-0.00	-0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.19***	0.24***	0.06***	0.15***	1	
	(19)	(shock) Common research interests	0.00	0.49	0.03***	-0.00	0.00	0.01	-0.01	-0.00	-0.01	-0.01	0.00	0.00	0.00	0.00	0.01	0.06***	0.07***	0.09***	0.10***	0.10***	1

Notes: The table includes information from candidates to full professor and associate professor positions. P-values are adjusted for clustering of standard errors for individuals in the same exam. * – p-value<0.10, ** – p-value<0.05, *** – p-value<0.01.

Table 4: Success rate, by committee composition

	1	2	3	4	5	6	7	8
	Full professor exams				**Associate professor exams**			
	N	Connection in the committee:			N	Connection in the committee:		
		Yes		No		Yes		No
		Proportion, %	Success rate, %	Success rate, %		Proportion, %	Success rate, %	Success rate, %
At least one colleague	13,601	32	16	8	15,085	33	17	9
PhD advisor	13,601	3	20	10	18,139	3	32	11
At least one PhD committee member	13,601	13	15	10	18,139	8	22	11
At least one coauthor	13,601	12	18	10	18,139	7	18	11
At least one connection by invitation	13,601	15	21	9	18,139	1	25	12
Research interests overlap 50% or more	13,231	30	12	10	15,196	37	15	12

Notes: The average success rate is 11% in full professor exams and 13% in associate professor exams. N is the number of non-missing observations.

Table 5: The effect of connections on candidates' success

	1	2	3	4	5	6	7
	All exams	All exams	All exams	All exams	FP exams	AP exams	All exams
Connections in committee (shock):							
Same university	0.048***		0.037***	0.034***	0.031***	0.035***	0.022***
	(0.004)		(0.004)	(0.004)	(0.005)	(0.005)	(0.006)
Professional link		0.064***	0.052***				
		(0.005)	(0.005)				
- PhD advisor				0.092***	0.038*	0.137***	0.082***
				(0.015)	(0.020)	(0.021)	(0.023)
- PhD committee member				0.040***	0.022**	0.062***	0.032***
				(0.007)	(0.010)	(0.011)	(0.011)
- Link by invitations				0.042***	0.046***	0.029	0.055***
				(0.009)	(0.010)	(0.036)	(0.013)
- Coauthors				0.033***	0.047***	0.013	0.035***
				(0.009)	(0.011)	(0.014)	(0.012)
Constant	0.112***	0.111***	0.112***	0.112***	0.106***	0.116***	0.111***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Individual dummies							Yes
Adjusted R-squared	0.041	0.042	0.046	0.047	0.045	0.050	0.248
Number of observations	28686	28686	28686	28686	13601	15085	28686

Notes: OLS estimates, standard errors clustered by exam are reported in parentheses. Coefficients indicate the percentage-points increase in the success rate associated to a (random) increase in the number of connected evaluators (in a seven-member committee). FP exams and AP exams stand for exams to Full and Associate Professor positions respectively. All regressions include the variable *positions per candidate* among controls, non reported.
* – p-value<0.10, ** – p-value<0.05, *** – p-value<0.01.

Table 6: The effect of quality on candidates' success

	1	2
	All candidates	Rare surnames
Connections in committee (shock):		
Same university	0.038***	0.038***
	(0.004)	(0.005)
Professional link	0.053***	0.060***
	(0.005)	(0.007)
(Pre-exam) Quality measures:		
Publications	0.022***	0.042***
	(0.002)	(0.005)
Citations per publication	0.011***	0.017***
	(0.002)	(0.003)
Average AIS	0.005**	0.004
	(0.002)	(0.003)
PhD theses advised	0.015***	0.014***
	(0.002)	(0.003)
PhD committees	0.022***	0.024***
	(0.002)	(0.003)
Age	-0.019***	-0.018***
	(0.002)	(0.003)
Constant	0.112***	0.113***
	(0.001)	(0.002)
Adjusted R-squared	0.066	0.075
Number of observations	28686	14556

Notes: OLS estimates, standard errors clustered by exam are reported in parentheses. Quality measures are normalized for candidates in the same exam. All regressions include the variable *positions per candidate* among controls, non reported. The subsample of individuals with "rare surnames" includes individuals whose paternal and maternal surname have a frequency inferior to 100,000 (source: Spanish Statistical Institute).
* – p-value<0.10, ** – p-value<0.05, *** – p-value<0.01.

Table 7: The effect of research similarity on candidates' success

	1	2	3
Connections in committee (shock):			
Same university	0.037***		0.037***
	(0.004)		(0.004)
Professional link	0.053***		0.051***
	(0.005)		(0.005)
Similarity of research interests		0.025***	0.015***
		(0.004)	(0.004)
Constant	0.115***	0.115***	0.115***
	(0.001)	(0.001)	(0.001)
Adjusted R-squared	0.047	0.035	0.048
Number of observations	26611	26611	26611

Notes: OLS estimates, standard errors clustered by exam are reported in parentheses. All regressions include positions per candidate among controls.
* – p-value<0.10, ** – p-value<0.05, *** – p-value<0.01.

Table 8: Candidates' future research quality

	1	2
	Pre-exam quality	Post-exam quality
Connections in committee (shock):		
Same university	-0.076**	-0.016
	(0.030)	(0.027)
Professional link	-0.060*	0.004
	(0.033)	(0.030)
Pre-exam quality		0.439***
		(0.019)
Constant	0.411***	0.213***
	(0.019)	(0.017)
Adjusted R-squared	0.014	0.192
Number of observations	3192	3192

Notes: OLS estimates, standard errors clustered by exam are reported in parentheses. All regressions include the variable *positions per candidate* among controls, non reported. "Quality" is a factor score computed as a linear combination of publications, citations per publication, average AIS, PhD theses advised, participation in PhD committees and age, weighted by the estimated importance of each factor for promotion, as reported in Table 6, column 1. By construction, the mean of "quality" is zero; variance is normalized to one. *Post-exam quality* corresponds to the three years following the examination.
* – p-value<0.10, ** – p-value<0.05, *** – p-value<0.01.

Table 9: The effect of connections on candidates' success, by committee characteristics

	1	2	3
Same university	0.037***	0.037***	0.037***
	(0.004)	(0.004)	(0.004)
Professional link	0.052***	0.052***	0.051***
	(0.005)	(0.005)	(0.005)
Same university * Committee's quality		0.004	
		(0.009)	
Professional link * Committee's quality		0.011	
		(0.014)	
Same university * Committee's age			-0.000
			(0.002)
Professional link * Committee's age			0.003
			(0.002)
Constant	0.112***	0.111***	0.111***
	(0.001)	(0.001)	(0.001)
Adjusted R-squared	0.046	0.046	0.046
Number of observations	28686	28686	28686

Notes: OLS estimates, standard errors clustered by exam are reported in parentheses. "Quality" is a factor score computed as a linear combination of publications, citations per publication, average AIS, PhD theses advised, participation in PhD committees and age, weighted by the estimated importance of each factor for promotion (Table 6 column 1). By construction, the mean of "quality" is zero; variance is normalized to one. All regressions include the variable *positions per candidate* among controls, non reported.
* – p-value<0.10, ** – p-value<0.05, *** – p-value<0.01.

Appendix A: Data Appendix

We have collected information from three different sources: (i) information on centralized examinations from the Ministry of Research and Science, (ii) individual research production from ISI Web of Science and (iii) information on doctoral dissertations from Teseo database. Below we describe the process of data collection in detail.

Ministry of Research and Science The system of centralized examinations known as 'habilitación' was in place between 2002 and 2006. Information on candidates' and evaluators' first name, last name, tenure and id number was retrieved from the website of the Ministry of Research and Science in July 2009 (`http://www.micinn.es`). In total, 1016 exams took place, around five per discipline. We restrict the sample in several ways. We exclude exams where the number of available positions was larger or equal than the number of candidates (two exams, both in Basque Philology) and disciplines where the number of potential evaluators was not big enough to form a committee (55 exams).[26] The final database includes 967 exams.

The actual age of individuals is not observable. Instead, we exploit the fact that Spanish ID numbers contain information on their issue date to construct a proxy for the age of native individuals on the basis of his/her national ID number. In Spain police stations are given a range of numbers that they then assign to individuals in a sequential manner. Since it is compulsory for all Spaniards to have an ID number by age 14, two Spaniards with similar ID numbers are likely to be of the same age (and geographical origin).[27] In order to perform the assignment, we first use registry information on the date of birth and ID numbers of 1.8 million individuals in order to

[26] In theses cases, unfilled seats in the committee were filled with professors from related disciplines.

[27] There are a number of exceptions. For instance, this methodology will fail to identify the age of those individuals who obtained their nationality when they were older than 14. Still, immigration was a very rare phenomenon in Spain until the late 1990s. Additionally, some parents may have their kids obtain an ID number before they are 14. This may be the case particularly after Spain entered in the mid 90s the Schengen zone and IDs became a valid documentation to travel to a number of European countries.

create a correspondence table which assigns year of birth to the first four digits of ID number (ranges of 10,000 numbers). To test the precision of this correspondence, we apply it to a publicly available list of 3,000 court secretaries, which contains both the ID number and the date of birth. In 95% of the cases the assigned age is within a three year-interval of the actual age. In order to minimize potential errors, whenever our age proxy indicated that an (candidate to) associate professor is less than 27 years old and a (candidate to) full professor is less than 35 years old, we assign age a missing value (around 5% of the sample). This proxy is not defined for non-Spaniards (less than 1% of the sample). We imputed the missing information on age assuming that individuals, for whom the age proxy is missing, have the same age as other individuals of the same academic rank in the same discipline.

The Ministry provides information on affiliation and on tenure in the position for eligible evaluators. Given that most candidates to full professor positions are themselves eligible evaluators in exams to associate professor positions, it is possible to obtain their affiliation by matching the list of eligible evaluators with the list of candidates. Using this procedure, we were able to obtain the information on affiliation for 93% of candidates to full professor positions. We obtained the information on affiliation at the time of the examination for the remaining 7% of candidates from the State Official Bulletin or directly from professors' CVs.

ISI Web of Science Information on scientific publications comes from Thompson ISI Web of Science (WoS).[28] WoS database includes over 10,000 high-impact journals in Science, Engineering, Medicine and Social Sciences, as well as international proceedings coverage for over 110,000 conferences. Out of these ten thousand journals, approximately two hundred are edited in Spain. For the purpose of this analysis, we considered all articles, reviews, notes and proceedings. We collected information on publications since 1972 by authors based in Spain. As well, we consider citations received by these publications before July 2009.

[28]We are grateful to the *Fundación Española para la Ciencia y la Tecnología* for providing us with access to the data.

The assignment of articles to professors is non trivial. For each publication and author, WoS provides information on the surname and on the initial (or, in some cases, initials). Homonymity problems may arise in the case of common surnames (i.e. Garcia, Fernandez, Gonzalez). Moreover, unlike most countries, in Spain individuals typically use two surnames (paternal and maternal) and sometimes also several first names. A paper authored by a Spanish author may include only the paternal or the maternal surname, or both surnames hyphenated. As well, Spanish authors may sign using their first name, their middle name, or both.

We use the following matching procedure in order to identify authors. First, we match publications to professors using ISI information on surnames and initials. We select the subsample of publications that have a unique match in our list of Spanish professors. This subsample includes 250,000 publications. Second, we use this subsample to create a correspondence table between the 240 scientific areas used by ISI to classify publications and the 190 scientific disciplines used by the Ministry of Education in order to classify professors. Specifically, we assign the ISI area to a given discipline (i) if the proportion of publications in the ISI area by professors from the scientific discipline exceeds 10% of the total number of publications in the discipline (or viceversa), or (ii) if in the cumulative distribution of publications belonging to the discipline, aggregated by ISI area and ordered by decreasing importance, the ISI area appears below the 50% threshold (or viceversa). The resulting correspondence table, available upon request, allows to match publications in ISI areas to the scientific areas defined by the Ministry of Education. On average, we assign five ISI areas to each discipline. Finally, using this correspondence table, we merge the ISI publication data with the list of professors using information on surnames, initials and discipline. If a given publication can be assigned to more than one possible match, the value of this publication is divided by the number of such possible matches. Less than 3% of publications were assigned to more than one individual. This figure is equal to 0.5% in the subsample of individuals with "rare surnames", i.e. individuals whose maternal and paternal surname has a frequency below 100,000 according to the Spanish National Statistical Institute.

Given that propensity to publish differs substantially across disciplines, we normalize the number of individual's publications to have zero mean and unit standard deviation among applicants to the same exam and among eligible evaluators of a given category in a given exam. The number of citations of each publication depends on time elapsed between the publication date and the date when the number of received citations is observed. Therefore, we first normalize the number of citations received by each publication subtracting the average number of citations received by Spanish-authored articles published in the corresponding ISI disciplinary area in the same year and then dividing by the corresponding standard deviation. Next, for each individual in our database we calculate the average number of normalized citations per publication. Finally, similarly to the number of publications, we renormalize the number of individual's citations per publication to have zero mean and unit standard deviation among applicants to the same exam and among eligible evaluators of a given category in a given exam. We treat individuals who have no ISI publications as if they had received zero citations.

The number of citations might be an inaccurate measure of publications' quality especially for recent publications. In addition to publications' citations, it might be useful to have a measure of the quality of journals. We collected information on the Article Influence Score (AIS) of ISI journals. We use information on AIS in 2007, the first year when it is calculated by ISI. AIS has several advantages over the standard impact factor. It takes into account the differences across journals in the propensity to cite. It also considers the "importance" of each citation, taking into account the quality of the journal citing an article. AIS does not consider journal self-citations.

Teseo database on doctoral dissertations Since 1977 PhD candidates in Spanish universities register their dissertation in the database TESEO, which is run by the Ministry of Education. We retrieved all the information available in this database from the website `https://www.educacion.gob.es/teseo` in May 2011. While registration is compulsory, according to Fuentes and Arguimbau (2010), TESEO includes information on approximately 90% of all dissertations read in Spain. We observe 151,483 dissertations. TESEO provides the identity and affiliation of dissertations' authors, advisors and committee members.

We match TESEO data with the list of candidates and evaluators. In exams to full professor positions we are able to find the dissertation of 71% of candidates and 41% of evaluators. In exams to associate professor positions we observe the dissertation of 83% of candidates and 70% of evaluators. Missing information may be due to the fact that (i) individuals did their PhD abroad, (ii) they defended their dissertation before 1977, (iii) there are spelling mistakes, (iv) the dissertation was not included in TESEO for unknown reasons (approximately 10% of all dissertations) or (v) there was a homonymity problem (in our dataset 0.1% of individuals share the same name, middle name, paternal surname and maternal surname).

Each thesis has been classified by its author using the UNESCO International Standard Nomenclature for Fields of Science and Technology. This is a system developed by UNESCO that includes more than two thousand six-digits categories.[29] 80% of dissertations provide this information. Approximately half of the authors select one six-digits category, 35% select two categories and 15% select three or more categories. There are on average around one hundred dissertations per category. We use this information to construct a measure of individuals research interests. In particular, we take into account every dissertation where an individual appears as an advisor, committee member or author. Using this approach, we were able to obtain information on the research interests of 98% of eligible full professors, 96% of eligible associate professors, 97% of candidates to FP positions and 84% of candidates to AP positions. Missing observations may be due to spelling mistake or to professors' absence from any PhD dissertation in Spain in the period considered (1977-2006). As an illustration Table AA1 provides the research interests of top ten Spanish economists.

[29]Available at `http://unesdoc.unesco.org/images/0008/000829/082946eb.pdf`

Table A1: Research interests of top economists in Spain

	1st Field	2nd Field	Number of dissertations	Author	Advisor	Evaluator
Jordi Gali	Monetary theory	Macroeconomic theory	22	0	9	13
Xavier Vives	Microeconomic theory	Finance and insurances sector	16	0	8	8
Manuel Arellano	Econometric models	Labor economics, theory and models	23	0	13	10
Fabio Canova	Economic Fluctuations	Macroeconomic theory	13	0	10	3
Juan Jose Dolado	Econometric models	Labor economics, theory and models	36	0	6	30
Andreu Mas-Colell	Microeconomic theory	Game theory	14	0	4	10
Antonio Ciccone	Macroeconomic theory	Economic growth theory	21	0	9	12
Albert Marcet	Macroeconomic theory	Econometric models; Fiscal policy and public debt; Monetary theory	31	0	16	15
Jose Manuel Campa	Finance and insurances sector	International trade theory	12	0	0	12
Diego Puga	International trade theory	Foreign trade; Production theory	8	0	0	8

Note: Top Economists in Spain, as of February 2012. This ranking is based on bibliographic data collected by RePEc. Retrieved at http://ideas.repec.org/top/top.spain.html on March 16th 2012.

Appendix B: The Expected Committee composition

In exams to FP positions, the expected number of connections in the committee is essentially equal to the proportion of connections in the pool of eligible FPs times seven (as there are seven evaluators in the committee). However, as explained in footnote 14, the random assignment of evaluators to committees was subject to a constraint: every committee could include at most one researcher from the Spanish Research Council (CSIC) and one emeritus professor. In case that a second individual belonging to one of these categories was drawn, the draw was not considered. Therefore, in exams where the population of potential evaluators containes two or more researchers, or two or more emeritus professors, the expected number of connections in the committee should be computed taking into account this constraint. This affects 387 of 967 exams.

First, we compute the probability that at least one researcher is drawn from the pool, p_R, and the probability that at least one emeritus professor is drawn, p_E. For FP exams these probabilities are:

$$p_R = 1 - \frac{\binom{R}{0}\binom{P+E}{7-0}}{\binom{P+E+R}{7}}, \quad p_E = 1 - \frac{\binom{E}{0}\binom{P+R}{7-0}}{\binom{P+E+R}{7}}$$

where R is the number of researchers in the pool, E is the number of emeritus professors and P is the number of eligible professors who are not emeritus. Once these probabilities are computed, it is possible to calculate for each candidate the expected number of connections in the committee:

$$\mu = p_R p_E (s_R + s_E + 5s_P) + p_E(1 - p_R)(s_E + 6s_P)$$
$$+ p_R(1 - p_E)(s_R + 6s_P) + (1 - p_R)(1 - p_E)7s_P$$

where s_j indicates the number of connections in group j and $j \in \{R, E, P\}$.

In AP exams, three evaluators are drawn from the pool of eligible FPs, and then four evaluators are drawn from the pool of eligible APs. The expected number of connections in the committee is generally equal to the proportion of connections among FPs times three plus the proportion of connections among APs times four. Again, in order to take into account the constraint on the randomization, analogously to the case of FP exams, we compute the probabilities that at least one researcher and at least one emeritus professor is drawn from each pool: p_R^{FP}, p_E^{FP}, p_R^{AP}, and p_E^{AP}). Then we compute the expected number of connections in the committee using the following formula:

$$\begin{aligned}
\mu = {} & [p_R^{FP} p_E^{FP} (s_R^{FP} + s_E^{FP} + s_P^{FP}) + p_E^{FP}(1 - p_R^{FP})(s_E^{FP} + 2s_P^{FP}) \\
& + p_R^{FP}(1 - p_E^{FP})(s_R^{FP} + 2s_P^{FP}) + (1 - p_R^{FP})(1 - p_E^{FP})3s_P^{FP}] \\
& + [(1 - p_R^{FP})(1 - p_E^{FP}) * [p_R^{AP} p_E^{AP} (s_R^{AP} + s_E^{AP} + 2s_P^{AP}) + p_E^{AP}(1 - p_R^{AP})(s_E^{AP} + 3s_P^{AP}) \\
& + p_R^{AP}(1 - p_E^{AP})(s_R^{AP} + 3s_P^{AP}) + (1 - p_R^{AP})(1 - p_E^{AP})4s_P^{AP}] \\
& + p_R^{FP}(1 - p_E^{FP}) * [p_E^{AP}(s_E^{AP} + 3s_P^{AP}) + (1 - p_E^{AP})4s_P^{AP}] \\
& + p_E^{FP}(1 - p_R^{FP}) * [p_R^{AP}(s_R^{AP} + 3s_P^{AP}) + (1 - p_R^{AP})4s_P^{AP}] + p_E^{FP} p_R^{FP} * 4s_P^{AP}]
\end{aligned}$$

where s_j^k is the proportion of connections in the pool of $k \in \{FP, AP\}$ professors belonging to group $j \in \{R, E, P\}$.

Appendix C: Heterogeneity across disciplines

In this section we provide descriptive information on candidates' characteristics by disciplinary groups. We also explore whether the role of connections varies across disciplines.

Table A2 provides information on the main characteristics of candidates. Candidates' degree of connectedness with potential evaluators varies across disciplines. Candidates in Engineering are twice more likely to have a colleague on the promotion committee than candidates in Mathematics, Physical or Life Sciences. Connectedness via other professional links is highest in Medicine.

Table A2: Candidates' characteristics, by disciplinary group

	1	2	3	4	5	6	7
	Physics and Mathematics	Engineering	Chemistry and Biology	Medicine	Social Sciences	Humanities	Law
Expected number of connections:							
Same university	0.38	0.76	0.31	0.49	0.48	0.54	0.24
Professional link	0.19	0.33	0.25	0.46	0.20	0.24	0.29
(Pre-exam) Quality measures:							
Publications, weighted by co-authors	5.89	5.24	8.74	6.78	0.82	0.52	0.13
Citations per publication	7.82	7.09	16.37	14.62	6.84	2.44	4.68
Average AIS	0.66	0.53	0.9	0.79	0.34	0.06	0.06
PhD theses advised	0.61	0.66	1.37	2.02	0.59	0.67	0.21
PhD committees	1.87	2.05	4.96	7.15	2.45	3.39	1.23
Age	38.54	38.84	42.89	45.39	40.16	43.09	39.43

Candidates' propensity to publish in journals indexed by ISI Web of Science also varies across disciplines. In Law, candidates have almost no publications, suggesting that ISI journals are not a common outlet for research in this discipline. Candidates in Social Sciences and Humanities have published less than one article (adjusted by the number of co-authors), whereas candidates in the rest of disciplines have published about five to nine articles.

Next, we analyze the relationship between candidates' observable quality measures and success. In order to account for differences in the propensity to publish and to cite, we normalize research indicators for candidates in the same exam. The number of articles published has a positive effect on candidates' chances of being promoted in all fields, with the exception of Law, where the effect is not significantly different from zero (Table A3). The number of citations per publication is positively correlated with the success in all disciplines, but this effect is not significant in Engineering, Humanities and Law. Article Influence Score is a good predictor of success only in Sciences. In scientific disciplines candidates that have published in journals with a higher Article Influence Score tend to be more successful. Mentoring of doctoral students and participation in thesis committees is also positively correlated with success in all disciplines.

Finally, we analyze whether the role of institutional and professional connections varies across disciplines. The effect of professional connections is statistically similar across all disciplines: acquainted candidates' chances of being promoted are four to six percentage points larger. The presence of a colleague in the committee has a different effect depending on the field. The effect is largest in Law (around ten percentage points) and is lowest in Physics and Mathematics (two percentage points). In other fields colleagues increase promotion rates by three or four percentage points.

Table A3: Determinants of promotion, by disciplinary group

	1	2	3	4	5	6	7
	Physics and Mathematics	Engineering	Chemistry and Biology	Medicine	Social Sciences	Humanities	Law
Connections in committee (shock):							
Same university	0.019**	0.027***	0.041***	0.042***	0.027**	0.042***	0.096***
	(0.009)	(0.008)	(0.010)	(0.010)	(0.011)	(0.007)	(0.015)
Professional link	0.056***	0.059***	0.041***	0.046***	0.060***	0.063***	0.042**
	(0.015)	(0.014)	(0.015)	(0.010)	(0.015)	(0.011)	(0.016)
(Pre-exam) Quality measures:							
Publications	0.028***	0.017***	0.021***	0.028***	0.030***	0.028***	0.004
	(0.006)	(0.006)	(0.006)	(0.006)	(0.009)	(0.006)	(0.005)
Citations per publication	0.017***	0.004	0.018***	0.017**	0.014*	0.005	0.005
	(0.005)	(0.005)	(0.006)	(0.007)	(0.008)	(0.007)	(0.007)
Average AIS	0.009**	0.002	0.014**	0.005	0.010	-0.001	-0.015*
	(0.004)	(0.006)	(0.007)	(0.006)	(0.008)	(0.007)	(0.007)
PhD theses advised	0.015***	0.009	0.020***	0.024***	0.012	0.012*	0.003
	(0.006)	(0.006)	(0.006)	(0.007)	(0.008)	(0.007)	(0.008)
PhD committees	0.011**	0.013*	0.024***	0.023***	0.030***	0.034***	0.017***
	(0.005)	(0.007)	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)
Age	-0.011**	-0.033***	-0.013**	-0.019***	-0.023***	-0.011**	-0.026***
	(0.004)	(0.004)	(0.006)	(0.005)	(0.004)	(0.005)	(0.005)
Constant	0.087***	0.118***	0.123***	0.104***	0.115***	0.138***	0.083***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
Adjusted R-squared	0.067	0.057	0.059	0.088	0.064	0.062	0.067
Number of observations	4670	4223	3698	3699	3634	5787	2975

Note: OLS estimates, standard errors clustered by exam are reported in parentheses. Quality measures are normalized for candidates in the same exam. All regressions include positions per candidate among controls.
* – p-value<0.10, ** – p-value<0.05, *** – p-value<0.01.