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HOW DOES THE GOVERNANCE OF ACADEMIC FACULTIES AFFECT COMPETITION AMONG THEM?

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How does the governance of academic faculties affect competition among them?*

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Abstract

We analyze competition among academic faculties for new researchers. The value to individual members through social interaction within the faculty depends on the average status of their fellow members. When competing for new members, existing members trade off the effect of entry on average status of the faculty against the reduction in teaching load that can be bought if no entry takes place and the entrant's wage is saved. We show that the best candidates join the best faculties but that they receive lower wages than some lower-ranking candidates. Endogenizing the governance structure of the faculties, we show that the aggregate surplus of a faculty is maximized if a decision-making rule is implemented that makes the *average* faculty member pivotal. Our main policy implication is that consensus-based faculties, such as many in Europe, could improve the well-being of their members if they liberalized their internal decision making processes.

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1 Introduction

Academic faculties, country clubs, social networks, as well as internet clubs, share one common characteristic: they are status organizations. The interaction among the members of these organizations increases the utility for the individual member. The value of interaction depends on the status of the individual member. The higher the status of an individual member is (for instance, in an academic faculty the ability to publish high-quality research) the more valuable this member is for others. Status is a vertically differentiable good, characterized by some degree of rivalry. The larger the number of members that interact with one person, the less valuable this interaction becomes individually.

As a matter of precision, we focus on one important application of the status organizations framework, hiring decisions in academic faculties. Hiring decisions are crucial in faculties (more than in many other industries) because successful research is highly dependent on human capital. Although as researchers we experience and participate in hiring decisions frequently, a theoretical framework that takes into account the specifics of individual collaboration between highly skilled workers is missing.

We concentrate on two sets of questions. First, what are the implications of competition among faculties for the allocation of new members and the distribution of the resulting surplus? For instance, will top PhDs join the best or just second tier universities and for what wage? Second, what is the impact of alternative governance structures on the competitive outcome and who benefits from a certain decision-making rule in a certain faculty? For example, should all members of one faculty get veto rights or is it better to grant decision rights to the highest ranking faculty member? Why? Is the answer to this question important for the other faculty or the candidate?

We will show that the job candidates (researchers) with highest status levels join the club with the highest average status. Candidates with lower status levels either join the club with a low average status or are not accepted by any club at all. New faculty members with low status levels are unable to appropriate any surplus from joining a faculty. In contrast, new members with high status are protected by the competition that arises amongst the clubs and are thereby able to share the surplus with existing faculty members.

The answer to our second research question is that the aggregate surplus of a faculty is maximized if a decision-making rule is employed that makes the *average* faculty member pivotal. This is due to positive and negative externalities that make decisions by members with more extreme preferences, such as the lowest ranking or the highest ranking member, detrimental to the utility of most of their fellows. Consequently, governance structures that allow every member to veto a hiring decision or that assign decision rights to the most reputable member of a faculty are clearly dominated.

As in practice information asymmetries and transaction costs may make it a non-trivial

task to find a governance structure that makes the average member pivotal, we argue that *majority voting* is a second-best alternative for many faculties. The reason is that, as long as the status frequency distribution in a faculty is not too skewed, the median member's preferences, who is made pivotal under majority voting, are not too far from the average member's. This finding translates to our main policy implication. Faculties that are governed by consensus (such as many in Europe) could improve the well-being of their members if they liberalized their internal decision making processes, that is if they moved more into the direction of majority voting.

We model competition among faculties for candidates in a two-faculty framework. The two faculties with a given number of existing members with given status levels differ in their average status levels. A high average status faculty (e.g. Harvard University) competes with a faculty with lower average status level (e.g. State University X). Existing members trade off the utility they receive via the average status level of the other members of their faculty, which has implications for the success of joint research projects, against the reduction in teaching load that can be bought if no new member enters the faculty. We show that faculty members with low status benefit more from joint research than members with high status. This advantage is diluted more than proportional by entry of new members with low status. Hence, we find somewhat surprisingly that low status members are more restrictive in allowing candidates to enter the faculty if they are pivotal.

The paper is organized as follows. In the next section we provide an overview of the related literature. In section 3, we outline the baseline model and look into the competition between two faculties in the presence of majority voting. In section 4, we characterize the equilibrium in this setup. In section 5, we analyze the allocation of surplus and introduce the generalized pivotal member model. In section 6, we discuss robustness of our main assumptions, whereas in section 7 we conclude and derive several testable hypotheses.

2   Related Literature

In order to place our approach relative to the existing literature we stress upfront the key properties and the main distinguishing features of our model relative to the existing literature. They are as follows. (i): Status is a one-dimensional, vertically differentiable type variable. Hence the *relative* preference ordering of access to a candidate among existing members, and vice versa, is equal. All players are exogenously endowed with status, i.e. we do not allow them to invest in status. (ii): *Making use* of the status of a fellow faculty member, however, incurs a cost (for the remaining faculty members) because it dilutes the value of interaction with this fellow, which makes using status a rival good. (iii): The actual payoff created by using all faculty members' status, however, differs among individuals because, from the perspective of a lowly ranked member, the average status value of his fellows

is higher than from the perspective of a highly ranked member. (iv): The status utility of faculty members is *not perfectly transferable* as we consider a friction between the payment of money and the consumption of perks.

We can identify several different branches of literature related to our work. First, the seminal works on the economic theory of clubs were published in the 1960s. Most notably, Buchanan (1965) and Olson (1965) initiated a wave of research on the economic theory of clubs and club goods, which was to be further developed in the decades following (see Sandler and Tschirhart (1980) and Cornes and Sandler (1996, ch. 11)). As in Ellickson et al. (1999), we deal with the individual characteristics of new and incumbent faculty members and the interrelation of a faculty's aggregate characteristics and its competition for new candidates. In contrast to those authors, we do not explicitly calculate the optimal size of faculties but equilibrium levels of wages paid to for new candidates. Helsley and Strange (1991) too, compare discriminating pricing schemes but our paper, furthermore, endogenizes faculties' governance structure.

A second strand of the literature covers the dynamic aspects of clubs' decision making rules and admission of new members. Sobel (2001) focuses on multidimensional characteristics and heterogeneous preferences of members showing the circumstances under which status level thresholds that have to be met by candidates increase or decrease over time. Barbera et al. (2001) and Cai and Feng (2004) offer related approaches analyzing the effects of various interest groups within a club on entrance of new members in equilibrium. Apart from the fact that we do not model dynamic aspects explicitly, our model contrasts with respect to characteristics (i) and partly (iii).

Third, our paper builds on the idea of clubs as status organizations being introduced by Hansmann (1986, 1996) who refers to "clubs" as a "prototypical example of status organizations". Hansmann (1986), however, regards the formation of a club system while we assume that clubs already exist.

The papers most closely related to ours are Epple and Romano (1998, 2002) who analyze the competition among private and public schools for pupils in a world where peer effects make school quality dependent on the ability composition of a school's student body. Epple and Romano (1998) show that the competition of tax-financed public schools and profit-maximizing private schools leads the latter to skim off the wealthiest and most able students. We differ significantly by looking at competition among faculties that have similar objective functions and where faculty decisions are determined by existing members rather than a profit-maximizing investor.

Our paper is also closely related to the empirical investigations of governance structures in universities. By looking into the functions and limitations of democatric governance structures in US universities, Masten (2006) shows that democratic decision-making processes are hindered by neither the size of the organization nor the heterogeneity of its voting members.

Rather, he finds that large universities with heterogenous departments have more democratic structures in place than small, homogeneous colleges. Against this background he looks into the function of such democratic processes. We complement his analysis to a certain extent. Rather than focussing on democratic decision processes per se, we look into the implications of different (democratic) governance structures. Thereby, we focus on the input market: the decision of universities and faculties to hire new faculty members.

3 The Model

We model two academic faculties, $j \in \{A, B\}$, which compete for a new researcher. Individuals are, with the exception of their status position, identical. The status position describes their relative value for fellow scholars in social exchange processes and can be attributed to a wide set of characteristics such as methodological and writing skills as well as network relations.

Status positions of existing members are drawn from a distribution over the interval $[\underline{s}, \bar{s}]$. Faculty A (B) has N_A (N_B) existing members, where N_j is a finite number. Faculty j's ($j = A, B$) member with highest status is called $\bar{n}_j$, its member with lowest status is $\underline{n}_j$, and its member with median status is m_j (see details below). Furthermore, we define member P_j of faculty j as the pivotal member of faculty j who is decisive given a certain governance structure or decision making rule which applies equally in both faculties. In the main body of the paper we apply a majority voting rule and thereby equate the pivotal member with the member with median status. We denote the aggregate status of all existing members of Faculty A (B) by $\sum_A s^i$ ($\sum_B s^i$), where s^i is the status of member i. We assume that setup costs are sufficiently high such that it is prohibitive for a subset of members (or new candidates) to form a third faculty.

Each faculty has access to a given total budget for hiring of new researchers and lecturers, $\bar{B}$, which it is assigned exogenously by its university's executive board. To focus on the impact of status differences on the competitive outcome, we assume that the hiring budget in both faculties is equal. There are two alternative uses of the financial endowment of faculty j. First, it can hire pure teaching staff (who have no voting rights in the faculty) on a perfectly competitive labor market. In exchange, they take some teaching burden off the existing faculty members, which is worth $\alpha \bar{B}/N_j$ to each member, where $\alpha < 1$. This assumption depicts the notion that, due to rules imposed by the governing body of the university (the state or a private endowment or institution), it is not feasible for existing members to hire and pay themselves for additional teaching and consume financial resources without discounting. The second alternative use of faculty j's financial endowment is to hire a new researcher (candidate C) and offer him a wage W_j. The remaining budget of $\bar{B} - W_j$

is used for hiring pure teaching staff.[1]

By means of collaboration and social exchange, faculty members can increase their research output and, hence, their well-being. This effect hinges on the average status of the other faculty members, where status is a rival good: each member has a fixed amount of resources (time) to interact with his fellows. If the number of fellows increases, interaction with a given fellow decreases on average. This interpretation of the status variable, as rival good, is different from status being equal to reputation, a non-rival good. However, our formal representation of (average) status being the argument in the member's utility function is also in line with status as a partially non-rival good: if the status of a faculty member creates utility both via reputation (non-rival) and via interaction and exchange (rival), we only need to assume that both aspects are superior in one faculty as compared to another. Even if status utility only stemmed from reputation, our framework would be appropriate under the notion that the reputation of a faculty is the more pronounced the higher is the average status of its members. Henceforth, however, we focus on the rival aspect of status.

Support follows a random exchange among faculty members. Therefore, in expectation, each member gains an equal share of a fellow's support. Cooperation is more productive and valuable for each member, the higher the social status of the counterpart. Hence, we depict the utility function of a particular existing member k of faculty j as:[2]

$$U_j^k = \hat{s}_j^k + \alpha(\frac{\bar{B} - W_j}{N_j}), \tag{1}$$

whereby $\hat{s}_j^k$ denotes the average status of all the other members in faculty j from the point of view of faculty member k. Our linearity assumption does not put any particular weight on either of the two arguments of the utility function: the utility gained from joint research (average status of fellow members) and from teaching load reduction (budget left over for hiring new teaching staff) are perfect substitutes. The marginal rate of substitution between status and money is constant for all players and, hence, independent of a member's own status. The introduction of α relaxes the assumption of status and money being perfect substitutes. Note that any friction in the model that could be reached by assuming concave utility of status or convex operating costs (with respect to the number of faculty members) can be reinterpreted with reference to $\alpha < 1$ but with significantly less calculus.

Before we introduce the new candidate, let us briefly spell out some notation. For member

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[1]An alternative interpretation is that a functioning faculty, which allows for productive cooperation among the faculty members, requires financial resources in order to cover operating costs, pay for travel costs for conferences etc. Here, $\bar{B}$ is the faculty's total budget for these purposes, and W_j is the wage of a new member.

[2]Subscripts denote faculties, and superscripts denote individuals.

k with status s^k in faculty A the average status of all *other* faculty members is:

$$\hat{s}_A^k = \frac{\sum_A s^i - s^k}{N_A - 1},\tag{2}$$

whereas in faculty B we have:

$$\hat{s}_B^k = \frac{\sum_B s^i - s^k}{N_B - 1}.\tag{3}$$

We assume that faculty A is the more exclusive faculty. That is, the average status in faculty A as well as the status utility enjoyed by the (identical) pivotal member is higher than in faculty B:

$$\hat{s}_A \equiv \frac{\sum_A s^i}{N_A} > \frac{\sum_B s^i}{N_B} \equiv \hat{s}_B \quad and \quad \hat{s}_A^P > \hat{s}_B^P.\tag{4}$$

We assume all existing faculty members to be immobile because of switching costs. In contrast, the candidates, newly graduated Ph.D.s, for instance, are mobile and can choose to apply at any of the two faculties.[3] A candidate who is accepted as new member of a faculty affects both arguments of the utility function of the existing faculty members. First, the new candidate, with status value s^C, changes the average status value enjoyed by member k in faculty A to:

$$\hat{s}_A^k = \frac{\sum_A s^i - s^k + s^C}{N_A},\tag{5}$$

if he joins A. The corresponding expression for faculty B is:

$$\hat{s}_B^k = \frac{\sum_B s^i - s^k + s^C}{N_B}.\tag{6}$$

If candidate C is admitted to a faculty, he also gains via interaction with the other members. Furthermore, he receives a wage W_j in faculty j. However, by joining a particular faculty, a new member foregoes opportunity costs, denoted by R, which he could gain from working in another, non-academic profession.[4] As the average status of j's members from the perspective of a new member equals the average status of the existing members, $\hat{s}_j$, the utility function of candidate C entering faculty j is:

$$U_j^C = \hat{s}_j + W_j - R.\tag{7}$$

Note that W_j is not discounted by α in the candidate's utility function because there are no rules that prohibit him from spending the wage as he wishes. This is different for existing faculty members and reflects institutional rules in most universities.

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[3]We will discuss this assumption further in section 6.

[4]The candidate's opportunity costs could be positively related to his status value, or not. We show in section 6 that the quality of our results is unaffected by this relation and, thus, model R as a constant.

We model the competition among the two faculties for new entrants as a two-stage game. In the first stage, both faculties A and B simultaneously decide whether they are willing to allow the candidate to enter at all, that is they choose a minimum status level, $s_{j,min}$, that the entrant must satisfy. They also make take-it-or-leave-it offers to the new candidate, W_j. In the second stage, the new entrant chooses to join the faculty that provides him with the highest nonnegative utility and accepts his entry. In both stages of the game, complete information prevails. We solve this game by backward induction for a subgame-perfect solution.

4 Majority voting in faculties

We start by focusing on the case in which majority voting in faculties prevails. Later on, we will address other rules of decision making in faculties as well. The strict monotonicity of the utility gains of the existing members from entry of the new member allows us to apply the median voter theorem. This implies that the median faculty member is the one who actually determines the decisions of the faculty. This characteristic can be shown as follows. The utility differential, that is the post-entry utility minus the pre-entry utility of the k-th individual in faculty j, is:

$$
\begin{aligned}
\Delta_j^k &= \frac{\sum_j s^i - s^k + s^C}{N_j} - \alpha \frac{W_j}{N_j} - \frac{\sum_j s^i - s^k}{N_j - 1} \\
&= \frac{s^k - \sum_j s^i}{N_j(N_j - 1)} + \frac{s^C - \alpha W_j}{N_j} = \frac{1}{N_j}(s^C - \hat{s}_j^k - \alpha W_j),
\end{aligned} \tag{8}
$$

which is strictly increasing in s^C and the rank of k within the faculty. Therefore we obtain:

Lemma 1 (Admission incentives) *Existing faculty members with lower status rank gain less (or lose more) from a candidate's entry than members with higher status rank. Thus, the minimal status level of a new member required by an individual existing member k is lower, the higher the status rank of this existing member.*

Understanding this lemma is a key to the remainder of the results of this paper. The lowest ranking existing member of faculty j, $\underline{n}_j$, without entry enjoys a gross status utility of $\frac{\sum_j s^i - s(\underline{n}_j)}{N_j - 1}$, which is strictly *larger* than the highest ranking member's, $\bar{n}_j$'s utility, $\frac{\sum_j s^i - s(\bar{n}_j)}{N_j - 1}$. Between the two extremes, gains from joint research are monotonous. Upon entry of any new member, the advantage of low ranking existing members over high ranking members is diluted. Hence, $\underline{n}_j$ suffers more than proportionally from entry, which is expressed by (8). The intuition behind this is that high status members gain relatively less from social interaction than their fellow members with low status. An entrant who participates in social interaction with the high status faculty fellows is therefore crowding out existing faculty

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members with low status levels. This crowding-out effect is less of concern for high status level members because they benefit relatively less from joint research anyway. Given that all existing faculty members benefit proportionally from the teaching load reduction (or any other facilities bought with the budget remaining after hiring a new member), faculty members with higher status levels are relatively more liberal than the ones with lower levels when deciding about entry of new members. As increasing N_j mitigates this effect, our analysis is best suited for faculties with a small number of members.

4.1   The candidate's decisions

In the final stage of the game the entrant has to make two decisions: should he join a faculty at all and, if so, which one? The candidate will be willing to join a faculty j if the utility this option offers is positive:

$$\hat{s}_j + W_j - R \geq 0. \tag{9}$$

We will refer to this inequality as the *participation constraint* of the entrant in faculty j, (PC_j). It implies that the candidate is willing to enter j if, and only if, the expected gains from interaction with the other faculty members and the wage offered are not lower than his opportunity cost associated with entry.

Given that the entrant will join any faculty at all, he will choose the one that offers him the highest net utility, meaning that he will prefer faculty j over faculty q if:

$$\hat{s}_j + W_j > \hat{s}_q + W_q. \tag{10}$$

If this inequality holds for the equality sign, we will call it the *indifference condition* (IC) of the entrant. For matters of completeness we assume that, in this case, the candidate will join faculty A. By using this assumption and rearranging (10), we know that faculty A will attract the candidate if the wage it offers and the status lead it has over faculty B are not smaller than the wage offered by B:

$$W_A = W_B - (\hat{s}_A - \hat{s}_B). \tag{11}$$

Given the anticipated behavior of the entrant, we will now address the optimal behavior of the faculties.

4.2   The choices of the faculties

In the first stage of the game, faculties A and B compete by simultaneously choosing a minimum status level of the candidate $(s_{j,min})$ and the wage rate (W_j), taking into consideration the candidate's reaction.

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The decision problem of the pivotal median member of faculty j is to maximize the utility differential $\Delta_j^{m_j}$ he will individually receive from entry of the candidate subject to the candidate's willingness to join faculty j (and not the other faculty, q):

$$\text{Max}_{s_{j,min};W_j} \quad \text{argmax}\left\{\Delta_j^{m_j}, 0\right\} \tag{12}$$

$$s.t.$$

$$\hat{s}_j + W_j - R \geq 0$$

$$\hat{s}_j + W_j > \hat{s}_q + W_q$$

where

$$\Delta_j^{m_j} = \frac{s^{m_j} - \sum_j s^i}{N_j(N_j - 1)} + \frac{s^C - \alpha W_j}{N_j}. \tag{13}$$

Note that the second side constraint may hold with equality for faculty A.

As a first step towards characterizing the subgame-perfect equilibrium we analyze the minimal status requirements of the respective faculties as a function of the wages offered. Therefore, we use the indifference condition, which faculty A must ensure that it holds, and solve $\Delta_j^{m_j} = 0$ for s^C. This yields:[5]

$$s_{A,min}(W_B) = \frac{\sum_A s^i - s^{m_A}}{N_A - 1} - \alpha \cdot \left(\frac{\sum_A s^i}{N_A} - \frac{\sum_B s^i}{N_B}\right) + \alpha W_B \tag{14}$$

$$s_{B,min}(W_B) = \frac{\sum_B s^i - s^{m_B}}{N_B - 1} + \alpha W_B. \tag{15}$$

For tractability, we rewrite (14) and (15) as:[6]

$$s_{A,min}(W_B) = \hat{s}_A^{m_A} - \alpha(\hat{s}_A - \hat{s}_B) + \alpha W_B \tag{16}$$

$$s_{B,min}(W_B) = \hat{s}_B^{m_B} + \alpha W_B. \tag{17}$$

Since $\Delta_j^{m_j}$ is strictly increasing in s^C, this implies that faculty j will not make any *acceptable* offer to candidates with $s^C < s_{j,min}$. Comparing the minimum status position determined by the two faculties we find:

$$s_{A,min} - s_{B,min} = \hat{s}_A^{m_A} - \hat{s}_B^{m_B} + \alpha(\hat{s}_B - \hat{s}_A). \tag{18}$$

Note that (18) is independent of the wages offered by the faculties. This characteristic allows for a separate analysis of the faculties' choices of minimum status requirement and

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[5]Henceforth, when writing $s_{j,min}$ we implicitly refer to $s_{j,min}(s^P)$, where P is the pivotal existing faculty member in the specific decision making process.

[6]Recall that $\hat{s}_j^{m_j}$ refers to the status utility enjoyed by the median member of faculty j, whereas $\hat{s}_j$ refers to the average status of faculty j, which coincides with the status utility enjoyed by an entrant to j.

wage offered. The first difference on the RHS of (18) reflects the (positive) difference in the "willingness-to-accept" a certain candidate due to the impact on the ex-ante utility enjoyed by the median member in faculty A compared to his counterpart in faculty B. In contrast, the second term in (18) reflects the "necessity-to-pay" for a new member by faculty A relative to the one in faculty B. This difference is negative because every new entrant gains relatively more when entering faculty A rather than faculty B given the higher average status level in faculty A. This implies that the new member is willing to accept a lower salary in faculty A compared to the one in faculty B. The sign of the RHS of (18) depends, thus, on the relative impact of the two effects.

Lemma 2 (Entry thresholds) *Let* $\tilde{\alpha} \equiv min\{1, \frac{\hat{s}_A^{m_A} - \hat{s}_B^{m_B}}{\hat{s}_A - \hat{s}_B}\}$. *Then,*
(i) With $\alpha < \tilde{\alpha}$, *the more exclusive faculty A is only willing to accept entrants with a relatively higher status level compared to faculty B. The required minimum status position of faculty B is strictly lower than the one of faculty A (i.e.* $s_{A,min} > s_{B,min} \forall W_B$).
(ii) With $\alpha \geq \tilde{\alpha}$, *the required minimum status of faculty B is higher than the one of faculty A, implying that faculty B is more restrictive (i.e.* $s_{A,min} \leq s_{B,min} \forall W_B$).

The second part of Lemma 2 emerges if and only if the status distributions of the two faculties are asymmetrically skewed. If the difference between median and average status level in both faculties is the same (or smaller in A than in B), then $\tilde{\alpha} = 1$, which implies (because α is assumed to be strictly smaller than one) that only case (i) is feasible. With all other status distributions, the second case becomes feasible but will only emerge if α is sufficiently large. This only occurs if the reduction of teaching load is so valuable for existing faculty members that they would rather pay the wage of additional teaching staff completely out of their private pockets than to teach themselves. Given that the main focus of our analysis is on faculties in which the social interaction among members that leads to improved research outcomes plays an important role, this is not the point of interest in the current paper. Therefore, we concentrate our analysis on case (i) of Lemma 2 only.[7]

Before we characterize the subgame-perfect equilibrium, let us define the following wage levels. The minimum salary a candidate might accept from faculty B is given by:

$$W_B^E \quad \equiv \quad R - \hat{s}_B.$$

The minimal competitive salary of faculty B, still allowing faculty B to attract the new

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[7]Before proceeding, however, we note that the implications of the second case on the analysis in this section are quite straightforward (the results in all other sections remain unchanged): If faculty A is less restrictive than faculty B ($s_{A,min} \leq s_{B,min}$), a candidate will enter faculty A independent of his own status s^C because A is, for any given wage level W_B, more attractive for the candidate and more willing to accept new members than faculty B. Hence, if $\alpha \geq \tilde{\alpha}$, no candidate will join faculty B.

candidate, is given by:

$$W_B^+ \equiv (\hat{s}_A - \hat{s}_B) + \frac{s^C}{\alpha} - \frac{\hat{s}_A^{m_A}}{\alpha} + \epsilon,$$

where ϵ is the smallest feasible monetary unit. Furthermore, we define the minimum salary offered by faculty A that lets the candidate's IC hold if faculty B offers the candidate its entire hiring budget, $\bar{B}$, as wage:

$$\tilde{W}_A \equiv \bar{B} - (\hat{s}_A - \hat{s}_B).$$

We prove in the appendix:

Proposition 1 (Equilibrium with majority voting) *Assume $\alpha < \frac{\hat{s}_j^{m_j} - \underline{s}}{\hat{s}_j} \forall j$. The subgame-perfect equilibrium can be characterized as follows:*
(i) Region IV: A candidate with very low status, $s^C < s_{B,min}(W_B^E)$, does not get an acceptable offer from either faculty.
(ii) Region III: A candidate with low status level, $s^C \in [s_{B,min}(W_B^E), s_{A,min}(W_B^E))$, only gets an acceptable offer from faculty B, which he accepts. $W_B = W_B^E$.
(iii) Region II: A candidate with medium status level, $s^C \in [s_{A,min}(W_B^E), s_{A,min}(W_B = \bar{B}))$, receives acceptable offers from both faculties. He joins faculty B for a wage $W_B = W_B^+$.
(iv) Region I: A candidate with high status level, $s^C \geq s_{A,min}(W_B = \bar{B})$, receives acceptable offers from both faculties. He joins faculty A for a wage of $W_A = \tilde{W}_A$.
(v) The faculty losing the competition for the candidate in a region offers a wage as competitive as possible (such that $\Delta_j^{m_j} = 0$ for that faculty's median member.)

If $\alpha \geq \frac{\hat{s}_B^{m_B} - \underline{s}}{\hat{s}_B}$, region IV does not exist and all candidates are accepted by some faculty. If $\alpha \geq \frac{\hat{s}_A^{m_A} - \underline{s}}{\hat{s}_A}$, region III also does not exist. As these two cases do not affect our main positive insights, namely that some candidates enter faculty A for this wage whereas others enter faculty B for that wage, we will analyze the full spectrum of regions as characterized in Proposition 1.

Figures 1 (delineating the allocation of entrants to faculties) and 2 (plotting the wage paid by the "winning" faculty) illustrate Proposition 1.

In region IV, there is no wage level that satisfies a candidate's participation constraint and produces a nonnegative utility differential for the median member m_B (let alone m_A). Thus, candidates in this region stay with their outside option. For candidates in region III, faculty B is protected from competition of faculty A as the median voter of faculty A would only want to compete for the candidate if the wage expenses are quite low. This would, however, violate (PC_A). In region I, on the other hand, faculty A is protected from intense competition. Because of its budget constraint, $\bar{B}$, faculty B is not able to offer a high status candidate a package of an attractive research environment and a wage that exceeds faculty
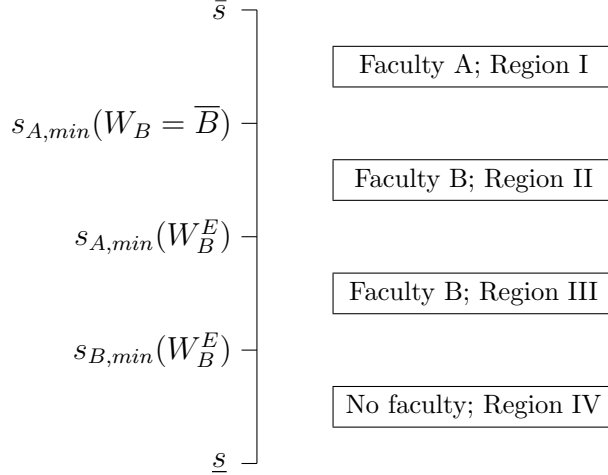
Figure 1: Stratified segmentation of candidates in faculties A and B

A's. In region II, competition for the candidate is most intense: no faculty is protected from competitive bids of the other faculty. Due to the impact of W_B on $s_{A,min}$, however, faculty B can offer a wage, W_B^+, that is sufficiently attractive for the candidate such that an equally attractive wage of faculty A would turn the utility differential of A's median member slightly negative. Consequently, the candidate will enter club B.

The intuition of Proposition *1.(v)* is that the "losing" faculty j neither has an incentive to bid a higher wage than the most competitive wage (as it would violate $s_{j,min}$ and make $\Delta_j^{m_j} < 0$) nor to ask for a lower wage (this would make membership in faculty j even less attractive for the candidate and would not change m_j's surplus of zero). Given this strategy of the losing faculty, the "winning" faculty's best response, according to the arguments above, is to offer W_B^E, W_B^+ and $\tilde{W}_A$ in the respective regions III to I.

As a direct consequence of Proposition 1 we have the following:

Corollary 1 (Wage levels) *In equilibrium the highest ranking candidates (in region I) receive lower wages than some candidates with relatively lower status (the best in region II).*

In other words, top ranking researchers prefer to join a top ranking faculty for comparatively low remuneration, whereas some researchers with lower status join lower ranking faculties for a comparatively high salary. Figure 2 visualizes this idea.[8]

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[8]Note that in figure 2 we plotted equilibrium wages of the winning faculty for $\hat{s}_A < 2\hat{s}_B + \bar{B} - R$. If this inequality did not hold, we would have $W_B^E \geq \tilde{W}_A$. In region II, W_B^+ would adjust accordingly, starting from the low level of W_B^E at $s_{A,min}(W_B^E)$ and increasing linearly to a value of $\bar{B}$ at $s_{A,min}(W_B = \bar{B})$.
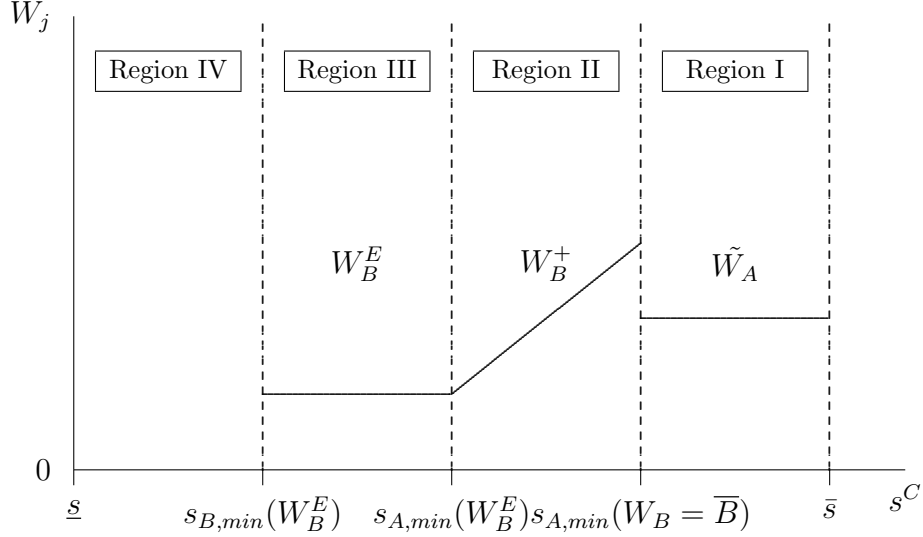
Figure 2: Wage paid by the "winning" faculty

The figure shows W_j on the vertical axis and s^C on the horizontal axis, divided into Region IV, Region III, Region II, Region I (left to right). Curves labeled W_B^E, W_B^+, and $\tilde{W}_A$. Horizontal axis points: $\underline{s}$, $s_{B,min}(W_B^E)$, $s_{A,min}(W_B^E)$, $s_{A,min}(W_B = \overline{B})$, $\bar{s}$.

5 The allocation of surplus and the pivotal member

5.1 The allocation of surplus under majority voting

To enable us comparing the impact of the decision-making rules applied in the faculties on the competitive outcome, we will follow a two step procedure. First, we analyze the division of the surplus that is created by entry of a candidate *between* the three key players in the majority voting case: the median members of faculties A and B and the candidate. Second, given a faculty gains the candidate as new member, we analyze the distribution of surplus *within* this faculty.

Equation (1) states that, without entry of a candidate, the median member of faculty j obtains a utility level of $\hat{s}_j^{m_j} + \alpha \bar{B}/N_j$. The candidate gets his outside option, R. (7) and (8) capture the utility *differentials* of the three key players conditional on the event that the candidate enters a faculty, which is compared to their outside options without entry. Henceforth, we will use the terms *utility differential* and *surplus* exchangeably.

By definition, the utility differential of the "losing" median member, who does not get a new fellow member, is $\Delta_j^{m_j} = 0$. The utility differential of the "winning" median member, whose faculty employs the candidate as a new member in equilibrium, is given by (8) but depends on the equilibrium wage. We prove the following Lemma in the appendix.

Lemma 3 (Surplus division between the key players under majority voting) *(i): In Region IV, the surplus of all three key players is zero. (ii): In Region III, only the median member of faculty B enjoys positive surplus, which is increasing in the status of the candidate. (iii): In Region II, only the candidate gains positive surplus, which is increasing in his own status. (iv): In Region I, both the candidate and the median member of faculty A*

receive positive surplus, given R is sufficiently low, but only the median member's surplus increases in the candidate's status.

Lemma 3 reflects again the varying degree of competition among the two faculties in the respective regions allowing faculty B (A) to achieve a positive surplus in region III (I). The fact that the two faculties are protected from competition in these two regions implies that they can grasp the entire increasing total welfare which arises if candidates with increasing status enter. In region II, in which competition is intense it is the candidate who can collect the entire surplus. In addition it shows that, depending on the status of the candidate, each key player can yield a positive surplus from entry.

Now we are turning to the question, how is the surplus that is generated via entry of a candidate distributed *within* a faculty? To answer this question we first need to define the aggregate surplus of the "winning" faculty, which employs the candidate as a new member. It is, following (8):

$$\Delta_j \equiv \sum_k \Delta_j^k = s^C - \hat{s}_j - \alpha W_j. \tag{19}$$

In the following Lemma, which is proven in the Appendix, we only state the surplus of the winning faculty in each region. By definition, the surplus of the losing faculty is zero. The surplus of the candidate is given by Lemma 3. In region IV, there is no winning faculty.

Lemma 4 (Aggregate surplus of the winning faculty under majority voting) *At the lower bound of a region, the surplus of the winning faculty (j) is:*

$$\hat{s}_j^{m_j} - \hat{s}_j.$$

The aggregate surplus of the winning faculty increases in region III (for faculty B) and in region I (for A) with s^C whereas it stays constant in s^C in region II.

Lemmas 3 and 4 put us in a situation where we can compare the surplus of the median voter of the winning faculty with the aggregate surplus of his faculty.

At the lower bound of each region, the median member of the winning faculty j receives zero surplus, while the aggregate surplus of his faculty is $\Delta_j = \hat{s}_j^{m_j} - \hat{s}_j$. If this expression is *positive*, it implies that a candidate with a status level marginally below the lower bound of the region is not admitted to the faculty at all or, at least, not admitted for the wage paid in the equilibrium of the region; see Proposition 1. However, from the aggregate member perspective, it would have been beneficial to admit the candidate for the equilibrium wage, that is it would have been beneficial to lower $s_{j,min}$. It follows that, in this case, the median member of the winning faculty implemented an access policy that is *too restrictive*.

In turn, if $\Delta_j = \hat{s}_j^{m_j} - \hat{s}_j$ is *negative*, it implies that a candidate with a status level equal to the lower bound of the region is admitted to the faculty for the equilibrium wage of that

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region. However, from the aggregate member perspective, it would have been beneficial not to admit the candidate for the equilibrium wage, that is it would have been beneficial to increase $s_{j,min}$. Hence, in this case, the median member of the winning faculty implemented an access policy that is *too liberal.*

Let us interpret *lowering* the minimum status requirement of a faculty as an investment in new members. Based on the above discussion we can state the following Lemma without a formal proof.

Lemma 5 (Positive and negative externalities in admitting candidates) *If $\hat{s}_j^{m_j} > (<)\hat{s}_j$, there is a positive (negative) externality from the median member of the winning faculty to the aggregate of his fellows, which results in underinvestment (overinvestment) in new faculty members.*

Lemma 5 points on two important determinants for the aggregate surplus of the winning faculty: the frequency distribution of status levels in the faculty, that is whether $\hat{s}_j^{m_j}$ is larger or smaller than $\hat{s}_j$, and the identity of the pivotal faculty member.

In the remainder of this article we will analyze the second determinant in more detail. We will show how the status rank of the pivotal member, who is determined by a certain decision-making rule within the faculty, influences the competitive equilibrium outcome and hence the aggregate surplus of the existing faculty members.

5.2   The generalized pivotal member model

We now generalize our main set-up by extending our approach by allowing for a pivotal voter who is different from the one with median status. The exact nature of the pivotal voter depends on the governance structure or decision-making rule chosen by the faculties. We defer the general analysis of our game, depending on $\hat{s}_j^P$, the status enjoyed by the pivotal member of faculty j, to Appendix A.4 as it resembles the analysis of the majority voting case to a large extent. Here we only report the most important differences to the baseline model and a key result leading to new insights.

Related to the baseline model we consider the case where:

$$\alpha < min\{1, \frac{\hat{s}_A^P - \hat{s}_B^P}{\hat{s}_A - \hat{s}_B}\}. \tag{20}$$

It is important to understand that, in a world where decision-making rules in the two faculties may differ, there are several cases where this inequality does *not* hold. For instance, if $\hat{s}_A^P$ is small and $\hat{s}_B^P$ is large, that is if the pivotal member in faculty A has a relatively high status s_A^P and the pivotal member in B has a relatively low status s_B^P, (20) may not hold. This may occur if, for instance, faculty A assigns decision-making power to its member with highest status, whereas faculty B gives every member veto rights and, hence, makes its lowest

ranking member pivotal. In this case, regions III and IV characterized in Proposition 1 may not exist.

To cover the full spectrum of our previous analysis, however, we assume for the remainder of the analysis that all regions exist in equilibrium, that is that (20) holds. This assumption covers many status distributions and decision-making rules in the two faculties. We show in Appendix A.4 that the following version of Lemma 5 is correct.

Lemma 6 (Externalities in the pivotal member model) *From the joint perspective of all members of a faculty, (i): if $\hat{s}_j^P > \hat{s}_j$, due to a positive externality the pivotal member is too restrictive and, hence, underinvests in new faculty members. (ii): If $\hat{s}_j^P < \hat{s}_j$, due to a negative externality the pivotal member is too liberal and overinvests in new faculty members.*

According to (8), Δ_j^k increases strictly monotonically in s^k, the status rank of member k. Hence, Δ_j^P is strictly monotonic in s_j^P, the status rank of the pivotal member in faculty j. Taking this together with Lemma 6 allows us to establish the following Proposition without formal proof.

Proposition 2 (Optimal status rank of the pivotal member) *(i): The aggregate surplus of the winning faculty in a region, $\Delta_j(s_j^P)$, increases in the status rank of the pivotal member, s_j^P, if $s_j^P < \hat{s}_j$. $\Delta_j(s_j^P)$ decreases in s_j^P if $s_j^P > \hat{s}_j$. (ii): $\Delta_j(s_j^P)$ has a well-defined and unique maximum at $s_j^P = \hat{s}_j$.*

Given that, according to Lemma 4, a faculty can only expect a positive surplus as a whole if it wins the competition for the candidate, Proposition 2 contains the main normative result of this paper. It implies that the total surplus of a faculty, conditional on attracting the candidate as a new member, has a well-defined maximum in the domain of status levels of its existing members. This maximum is located at the *average* status level of a faculty, $\hat{s}_j$. Because of the strict monotonicity of $\Delta_j^P(s_j^P)$ in s_j^P, it is unique.

If the decision-making rule in a faculty makes a member with a more extreme status level pivotal, most of his fellow members suffer from a positive or negative externality. Specifically, if the status level of the pivotal member is *lower* than the faculty's average status, he will be *too restrictive* and prevent that candidates with certain status levels enter the faculty, although this would be beneficial for the faculty as a whole. In turn, if the status level of the pivotal member is *higher* than the faculty's average status, he will be *too liberal* and permit entry of some candidates whose status level is so low that the faculty as a whole loses more than it gains. If a member with average status level is made pivotal, the two types of externalities just level out.

5.3 Policy implications of the pivotal member model

The previous analysis, in particular Proposition 2, leads to several clear-cut normative implications. First, from the perspective of the existing members of an academic faculty, a decision-making rule or governance structure should be implemented that assigns de facto authority over hiring decisions to the faculty member with average status. In a frictionless world, this objective could be implemented via a regime of *unanimity voting with side-payments*, for instance. This means that every faculty member obtains the right to veto entry of a candidate but that side-payments among the faculty members are possible (and members have the liquidity to pay them). For a given status level of the candidate, s^C, all existing members who would receive a positive surplus from entry (high status members) would have an incentive to make side-payments to their fellows with negative utility differential (low status members). Then, by the definition of Δ_j, gains and losses within a faculty would level out and every member would have the same net surplus after side-payments were made. By this procedure, the minimum status requirement of the entire faculty would equal the one set by the member with average status.

In practice, however, the world is only rarely frictionless and the Coase Theorem does not always hold. Those frictions could arise from bargaining costs during specifying side-payments, university regulations curbing side-payments, or transaction costs in general. In such a second-best world, given that the frequency distribution of status levels within a faculty is not too skewed, it may be beneficial to establish a *majority voting* rule. As demonstrated in the baseline model, under this governance structure the median member is pivotal. For many status distributions, the difference between the utility enjoyed by the median member, $\hat{s}_j^{m_j}$, and the utility enjoyed by the (hypothetical) average member, $\hat{s}_j$, is not large. Furthermore, majority voting is frequently used in practice and relatively easy to implement. More specifically, we show in the appendix that the following Proposition is true.

Proposition 3 (Dominance of Majority Voting) *Majority voting produces a (weakly) higher surplus for the existing faculty members as a whole than any governance structure that makes members with extreme status values pivotal.*

This Proposition implies that, irrespective of the status frequency distributions in faculties, majority voting is (weakly) preferable to *unanimity voting without side-payments*, where the lowest ranking member is in control, or to *meritocracy*, where the highest ranking member can make decisions. Due to this characteristic and its simplicity, we perceive majority voting to be an attractive governance structure for faculty members in all settings where the transaction costs of more complicated regimes are high.

If those costs are low, however, in some cases of skewed status frequency distributions, it is feasible to adjust the gap $\hat{s}_j^P - \hat{s}_j$ via applying a more complicated decision-making rule

that requires a certain percentage x of members to accept a candidate as faculty member (*qualified majority voting*). It would be important to bear in mind that the existing member with highest status is the one who will agree first to admitting a candidate, given a certain wage offered, followed by the one with second highest status, and so on.

On the candidate side our analysis has two implications. First, given candidates have a choice (which we have not modeled), they prefer to apply for research jobs where competition between faculties is most intense. The reason is that there competition pushes up the wage level and candidates benefit proportionally from a marginal increase in own status (cf. region II). Second, ceteris paribus candidates prefer faculties where an existing member with high status is pivotal. Those members benefit relatively more from the status of a new member and, thus, are willing to pay a higher wage than existing members with lower status.

6   Discussion and robustness

We will focus in this section on what we consider the main assumptions of our setup and its conclusions.

The main mechanism in our analysis hinges on the fact that faculty members with higher status gain relatively more from a new member than existing members with a lower status. Technically, this stems from the fact that faculty members benefit from the average status of their fellow members (excluding their own) independent of the specific form of the utility function. The fact that existing members with lower status gain less than existing members with higher status depicts the fact that, in case of entry, they have to share the possibility to interact with higher status members with more fellows (*dilution effect*). In contrast, high status members gain relatively less from social interaction. They benefit more from faculty facilities etc., that is from the monetary contribution of the new member. Given that we consider faculties as status organizations, in which social interaction matters and in which social status is vertically differentiated, this is a quite natural and general mechanism. Moreover, the dilution effect is most prevalent with a rather small number of faculty members and is mitigated as the faculty size increases. Therefore, we consider our main mechanism to be robust as long as we do not study faculties that are very large and as long as we accept the notion of status being a vertically differentiated value.

Second, we consider in the main body of our analysis a one-shot game. If we extend it to a repeated game setting, the results will depend on the shape of the ex ante and the ex post (after entry took place once) frequency distributions of members in both faculties. What is important for our analysis is the insight that our results are robust in each stage of the game as long as it complies with our parameter setting in Lemma 2.(i).

Third, we have modeled competition for a new candidate in a two-faculty framework. Are our results robust to an extension to many faculties? Consider the case in which the status of

a new candidate is drawn from a distribution over $[\underline{x}, \bar{x}]$, where $\underline{x} << \underline{s}$ and $\bar{x} >> \bar{s}$. Assume that, out of many vertically stratified faculties, we focus on faculties Z, A, and B, where faculty Z has a higher average status than faculty A, which has a higher average status than B. Assumption (4) holds respectively. When determining the entry regions as in Proposition 1, the threshold level between faculties A and B remains $s_{A,min}(W_B = \bar{B})$. However, in this setting faculty A also faces competition from the higher status faculty Z. Taking the intuition of Lemma 2, faculty A has incentives to offer a higher wage than faculty Z to any new candidate, until its budget constraint becomes binding, at $\bar{B}$. We conclude that we can expect entry in faculty A for all new candidates with $s^C \in [s_{A,min}(W_B = \bar{B}), s_{Z,min}(W_A = \bar{B})]$, where $s_{A,min}(W_B = \bar{B}) = \hat{s}_A^{m_A} - \alpha(\hat{s}_A - \hat{s}_B) + \alpha\bar{B}$ and $s_{Z,min}(W_B = \bar{B}) = \hat{s}_Z^{m_Z} - \alpha(\hat{s}_Z - \hat{s}_A) + \alpha\bar{B}$. This interval is non-empty for:

$$\alpha < \frac{\hat{s}_Z^{m_Z} - \hat{s}_A^{m_A}}{\hat{s}_Z + \hat{s}_B - 2\hat{s}_A}. \tag{21}$$

Then each faculty has a positive probability of gaining the candidate as new member in equilibrium. Wages are determined according to the result of region II, the most competitive region in our basic setting.

Fourth, let us discuss the symmetry of the utility functions of all players (existing members of both faculties as well as the candidate), which our results crucially depend on. Our model implies that the marginal rate of substitution between status (or utility from joint research) and monetary transfers (or teaching load reduction) is identical for all agents. A relaxation of this assumption has potentially strong, but in most cases quite obvious implications. The most interesting application is when the new candidate values status less than money. In this case, the competitive advantage of faculty A decreases. The difference in wages becomes more important. This effect becomes most obvious if the candidate is only interested in wage. A new entrant with high status is relatively more attractive for faculty B than for faculty A (since the effect on average status is more pronounced for faculty B). Hence, faculty B is able and willing to attract high status candidates. A potentially relevant application of this may be if highly reputable professors prefer second-tier universities, thereby making more money than by joining a top-university. Since there are no obvious justifications of systematic differences in preferences, we stick to our symmetry assumption in the main body of the analysis.

A related issue is our assumption on the existence of a budget constraint, $\bar{B}$. The driving force of our analysis is the trade-off between utility from status and from money. As long as there is any budget constraint for the two faculties (allowing for non-existence of budget constraints obviously is little convincing), the quality of our results remains intact. If we start from our initial assumption and relax budget constraints, faculty B can compete more fiercely with faculty A in monetary terms, that is it can offer a higher wage. This change leads to the shrinking of region I but it leaves all other results intact.

7 Conclusion

In this paper we have investigated the impact that certain decision-making rules or governance structures in academic faculties, where the members may decide about hiring new members, have on the competitive outcome of the labor market for new researchers. The main novel assumption of our model is that faculties are status organizations, where a member's utility depends on the average research capability of his *fellow* members. Thus, utility from faculty membership is different among all members, unless they have the same status. This insight leads to interesting implications for the role of different governance structures that make this member or that member pivotal in a certain decision-making process.

Our main positive result shows that high status candidates join the higher ranking faculty but for a medium wage, whereas lower ranking candidates join the lower ranking faculty. Interestingly, the best candidates joining the lower ranking faculty receive higher wages than the candidates joining the better faculty. These results are testable empirically.

Our main normative result is that the aggregate surplus of a faculty is maximized if a decision-making rule is employed that makes the average faculty member pivotal. This is due to positive and negative externalities that make decisions by members with more extreme preferences, such as the lowest ranking or the highest ranking member, detrimental to most of their fellows.

As in practice information asymmetries and transaction costs may make it a non-trivial task to find a governance structure that makes the average member pivotal, we perceive the *majority voting rule* as a second-best alternative for most faculties. The reason is that, as long as the status frequency distribution in a faculty is not too skewed, the median member's preferences, who is made pivotal under majority voting, are not too far from the average member's.

This insight implies both our main policy implication and a testable empirical hypothesis: As faculties benefit, on a cooperative basis, from avoiding extreme decision making rules, we expect to observe trends towards majority voting. As, for instance, many academic faculties in Europe are governed in a consensus-based way, we expect them to liberalize their decision-making processes over time.

Our model applies to a wide range of potential applications beyond our particular example of academic institutions. The defining characteristics are: first, the organizations are member-owned, that is the existing members possess the decision rights and they can enjoy the budget not used for hiring. Second, the organizations get a fixed budget assigned by some authority but in exchange the authority can determine rules that prohibit that members take out the budget as a dividend. This explains the discount factor $\alpha < 1$. Third, members' utility depends on the status positions of their fellow members. These assumptions are typically met by clubs with a vertically structured status variable such as country clubs, internet

clubs, conference organizations etc. In contrast, our model cannot be applied without adaptations to clubs with a multi-dimensional status variable, where members' preferences are not single-peaked.[9]

There are a number of potential avenues for extensions. First, endogenizing the decisions of university executive boards, who determine the hiring budget in our model but may also be in charge for determining a governance structure at the faculty level, would be rewarding. Second, we have assumed in this first model of its kind that status is a unidimensional vertically differentiable variable. Relaxing this assumption by allowing both faculties and candidates to also position in a horizontal dimension may trigger interesting strategic interactions. Third, analyzing the implications of competition among investor-owned clubs (such as some professional sports clubs) would be a straightforward and particularly interesting extension. As a first step in this direction it would be crucial to define the objective function of such an organization.

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[9]Current NATO members, for instance, when considering entry of new states into their faculty, could either have a preference for military power or for a certain geographical location of candidate states (e.g. being situated in Eastern Europe to serve as potential buffer against Russia). Old members' preferences could be horizontally differentiated in both dimensions, hence a unique ranking of potential candidates (and existing members alike) along the status line would be impossible. A similar reasoning applies to other political clubs such as the European Union.

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A   Appendix

A.1   Proof of Proposition 1

(i): Because of Lemma 2.(i), the cut-off status level below which candidates do not get an acceptable offer from any faculty is determined by faculty B. W_B^E denotes the salary for which (PC_B) of the entrant just holds with equality. As $s_{B,min}$ is increasing in W_B, $s_{B,min}(W_B^E)$ is the lowest status level where faculty B makes an offer that meets (PC_B).

(ii): By definition of $s_{A,min}$, in the range $s^C \in [s_{B,min}(W_B^E), s_{A,min}(W_B^E))$ faculty A is not able to make a membership offer to the candidate that satisfies both parties (independently of faculty B's behavior). Therefore, faculty B is able to exploit the candidate completely, which means to set $W_B = W_B^E$.

(iii): For $s^C \geq s_{A,min}(W_B^E)$, demanding $W_B = W_B^E$ has the consequence that faculty A has an incentive to match the offer of faculty B. The candidate would then join faculty A. In the range $s^C \in [s_{A,min}(W_B^E), s_{A,min}(W_B = \bar{B}))$, however, faculty B can make sure that $s_{A,min}(W_B) > s^C > s_{B,min}(W_B)$. Thus, faculty A has no incentive to offer the candidate entry with a salary that would both meet (PC_A) and make him prefer membership in faculty A over faculty B. Because of the second part of this inequality, faculty B still has this incentive, though. As an increase in wages increases $s_{A,min}$ and $s_{B,min}$ by the same factor, α (see (16) and (17)), B can sustain this behavior in the entire region II. By using (16) we can find W_B^+ as defined above, whereby ϵ denotes a very small number and $(\partial W_B^+)/(\partial s^C) > 0$. Hence, an entrant with s^C very close to $s_{A,min}(B_B = \bar{B})$ receives almost the maximum wage that faculty B can pay from its budget.

(iv): Because of the budget constraint of faculty B, W_B cannot be increased indefinitely. Hence, faculty B has no tool to prevent faculty A from making candidates with $s^C \geq s_{A,min}(B_B = \bar{B})$ an offer that benefits both of them. Faculty A can let the indifference condition (and the participation constraint) of the candidate hold. Comparing (9) and (11) reveals that, from the point of view of faculty A, (11) is (weakly) more restrictive if $W_B \geq R - \hat{s}_B$, that is if (PC_B) holds. This condition holds $\forall s^C \geq s_{B,min}(W_B^E)$, that is in regions III, II, and I. This result implies that, if faculty A offers a wage in region I for which the indifference condition holds, the participation constraint holds, too. Thus, faculty A offers a wage level that is equal to the difference of the average status levels between the two faculties from the point of view of the entrant. This consideration yields $W_A = \tilde{W}_A$.

(v): The faculty losing the competition for the candidate (both faculties in region IV, faculty A in regions III and II, faculty B in region I) gets a surplus of zero, no matter which (rational) strategy it employs. If it plays the most competitive strategy and offers a $(s_{j,min}, W_j)$-combination such that $\Delta_j^{m_j} = 0$, it still has no incentives to deviate. However, it ensures that the actions characterized in parts *(i)-(iv)* of the Proposition are incentive-compatible.

Q.E.D.

A.2 Proof of Lemma 3

In region IV, no entry takes place. Hence, there we have $\Delta_A^{m_A} = \Delta_B^{m_B} = \Delta_C = 0$.

In region III, the candidate chooses to join faculty B but will not get any surplus from entry as W_B^E just pays him his reservation value: $\Delta_C = \Delta_A^{m_A} = 0$. In contrast, $\Delta_B^{m_B}(W_B^E) = \frac{1}{N_B}(s^C - \hat{s}_B^{m_B} - \alpha(R - \hat{s}_B))$. By definition of $s_{B,min}(W_B^E)$, this expression is zero at its lower bound. It is increasing in s^C.

In region II, the candidate also joins faculty B. Hence, $\Delta_A^{m_A} = 0$. Substituting W_B^+ in (8) yields $\Delta_B^{m_B}(W_B^+) = \frac{1}{N_B}(s^C - \hat{s}_B^{m_B} - \alpha(\hat{s}_A - \hat{s}_B + \frac{s^C}{\alpha} - \frac{\hat{s}_A^{m_A}}{\alpha} + \epsilon))$. Note that s^C cancels from this expression. By definition, $\Delta_B^{m_B}(W_B^+) = 0$ at its lower bound, which does not change over the course of region II because it is constant in s^C. In contrast, the candidate benefits from higher own status value: $\Delta_C = \frac{s^C - \hat{s}_A^{m_A}}{\alpha} + \hat{s}_A + \epsilon - R$. This differential is zero at its lower bound, $s_{A,min}(W_B^E)$, and grows linearly with increasing s^C.

In region I, the candidate joins faculty A. Thus, $\Delta_B^{m_B} = 0$. Substituting $\tilde{W}_A$ in (8) yields $\Delta_A^{m_A} = \frac{1}{N_A}(s^C - \hat{s}_A^{m_A} - \alpha(\bar{B} - (\hat{s}_A - \hat{s}_B)))$. This expression is zero at its lower bound, $s_{A,min}(W_B = \bar{B})$, and increases in s^C. The candidate receives a utility differential of $\Delta_C = \bar{B} + \hat{s}_B - R$, which is positive for sufficiently low R and constant in s^C. *Q.E.D.*

A.3 Proof of Lemma 4

In region III, $\Delta_B = s^C - (1 - \alpha)\hat{s}_B - \alpha R$, which is increasing in s^C. By definition of $s_{B,min}(W_B^E)$, the status level of an admitted candidate in region III is at least $s^C = \hat{s}_B^{m_B} + \alpha(R - \hat{s}_B)$. Substituting this into Δ_B yields $\Delta_B\left(s^C = s_{B,min}(W_B^E)\right) = \hat{s}_B^{m_B} - \hat{s}_B$ in case of the lowest ranked admitted candidate. Depending on the ex ante frequency distribution of status in faculty B, this can be positive or negative.

In region II, substituting W_B^+ in (19) yields $\Delta_B = \hat{s}_A^{m_A} - \alpha\hat{s}_A - (1 - \alpha)\hat{s}_B - \alpha\epsilon$. In case of the lowest ranked candidate admitted in region II, this yields $\Delta_B(s^C = s_{B,min}(W_B^+)) = \hat{s}_B^{m_B} - \hat{s}_B$. Just as in region III, this can be positive or negative. In contrast to region III, Δ_B is not increasing in s^C.

In region I, substituting $\tilde{W}_A$ in (19) yields $\Delta_A = s^C - (1 - \alpha)\hat{s}_A - \alpha\hat{s}_B - \alpha\bar{B}$, which is increasing in s^C. In case of the lowest ranked candidate admitted in region I, this yields $\Delta_A(s^C = s_{A,min}(W_B = \bar{B})) = \hat{s}_A^{m_A} - \hat{s}_A$. Depending on the ex ante frequency distribution of status in faculty A, this can be positive or negative. *Q.E.D.*

A.4 The pivotal member model in a nutshell

The pivotal member P maximizes Δ_j^P instead of $\Delta_j^{m_j}$; see (12). The side-constraints are the same as in the majority voting case. Thus, the minimum status requirements set by pivotal members in faculties A and B are:

$$s_{A,min}^P(W_B) = \hat{s}_A^P - \alpha(\hat{s}_A - \hat{s}_B) + \alpha W_B \tag{22}$$

$$s_{B,min}^P(W_B) = \hat{s}_B^P + \alpha W_B. \tag{23}$$

These minimum status levels increase in $\hat{s}_j^P$. Drawing on Lemma 1, they decrease in s_j^P, the own status level of a pivotal member. Hence, the higher is the status rank of the pivotal member of faculty j, the lower is the minimum status requirement for new entrants in j.

Now, consider the case where $\alpha < min\{1, \frac{\hat{s}_A^P - \hat{s}_B^P}{\hat{s}_A - \hat{s}_B}\}$, related to Lemma 2.(i) and the main part of our baseline model. It follows that $s_{A,min}^P(W_B) > s_{B,min}^P(W_B)$. This is the key expression that allows us to use the subgame-perfect equilibrium characterized in Proposition 1 with only mild adaptations. As long as $\alpha < \frac{\hat{s}_j^P - s}{\hat{s}_j} \forall j$, this Proposition holds, where W_B^E and $\tilde{W}_A$ are equal to the baseline model, whereas $W_B^{+P} = (\hat{s}_A - \hat{s}_B) + \frac{s^C}{\alpha} - \frac{\hat{s}_A^P}{\alpha} + \epsilon$. The latter expression implies that the equilibrium wage of candidates in region II increases in the status rank of the winning faculty's pivotal member.

In contrast, an important difference between the baseline model and the generalized model with pivotal members arises if $\alpha \geq \frac{\hat{s}_A^P - \hat{s}_B^P}{\hat{s}_A - \hat{s}_B}$. Then it follows that $s_{A,min}^P(W_B) \leq s_{B,min}^P(W_B)$. Thus, it is possible that some regions do not exist in equilibrium.

Consequently, the division of total surplus as in the baseline model depends on the existence of the region in which a party makes positive surplus. According to Lemma 3, this means that faculty B has to make sure that region III exists, while faculty A depends on region I for making positive surplus. Apart from the limit cases, the candidate gains surplus in both regions II and I.

For conclusiveness, we assume for the remainder of the analysis that all regions exist in equilibrium. In this case, the division of surplus between the three key players depicted in Lemma 3 is not changed in qualitative terms. We just have to switch the wording in Lemma 3 from "median member" to "pivotal member". Lemma 4 has to be adjusted because the boundaries of the regions depend on the status values of the pivotal members. Hence, at the lower bounds of regions III-I we have:

$$\Delta_B\left(s^C = s_{B,min}^P(W_B^E)\right) = \hat{s}_B^P - \hat{s}_B,$$
$$\Delta_B\left(s^C = s_{B,min}^P(W_B^{+P})\right) = \hat{s}_B^P - \hat{s}_B,$$
$$\Delta_A\left(s^C = s_{A,min}^P(W_B = \bar{B})\right) = \hat{s}_A^P - \hat{s}_A.$$

By the same reasoning as used in Lemma 5 we can state Lemma 6.

A.5 Proof of Proposition 3

Define for faculty j:

$$\sum_{-i} s^i \equiv \sum_j s^i - s^{\bar{n}_j} - s^{m_j}, \tag{24}$$

i.e. the aggregate status of all faculty members apart from the top member and the median member.

Hence, we have:

$$\hat{s}_j = \frac{\sum_{-i} s^i + s^{m_j} + s^{\bar{n}_j}}{N_j} \tag{25}$$

$$\hat{s}^{\bar{n}_j} = \frac{\sum_{-i} s^i + s^{m_j}}{N_j - 1} \tag{26}$$

$$\hat{s}^{m_j} = \frac{\sum_{-i} s^i + s^{\bar{n}_j}}{N_j - 1} \tag{27}$$

$$\Rightarrow \hat{s}^{\bar{n}_j} < \hat{s}^{m_j} \tag{28}$$

In order to prove the Proposition for the case that the pivotal voter is the faculty member with the *highest* status, building on Proposition 2, we have to show that:[10]

$$|\hat{s}^{\bar{n}_j} - \hat{s}_j| \geq |\hat{s}^{m_j} - \hat{s}_j| \tag{29}$$

We prove by contradiction. We claim the contrary of (29):

$$|\hat{s}^{\bar{n}_j} - \hat{s}_j| < |\hat{s}^{m_j} - \hat{s}_j| \tag{30}$$

(30) can only hold if either:

$$(i) \quad \hat{s}_j < \hat{s}^{\bar{n}_j} < \hat{s}^{m_j} \tag{31}$$

$$(ii) \quad \hat{s}^{\bar{n}_j} < \hat{s}_j < \hat{s}^{m_j} \tag{32}$$

holds.

From (31) it follows that:

$$\hat{s}_j < \hat{s}^{\bar{n}_j} \tag{33}$$

$$\Leftrightarrow \frac{\sum_{-i} s^i + s^{m_j} + s^{\bar{n}_j}}{N_j} < \frac{\sum_{-i} s^i + s^{m_j}}{N_j - 1} \tag{34}$$

$$\Leftrightarrow (N_j - 1)s^{\bar{n}_j} < \sum_{-i} s^i + s^{m_j} \tag{35}$$

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[10]For the case in which the pivotal voter is the one with the lowest status, the prove can be conducted in a similar fashion.

Substituting (24) and adding $s^{\bar{n}_j}$ to both sides yields:

$$N_j s^{\bar{n}_j} < \sum_j s^i = N_j \hat{s}_j, \tag{36}$$

which is false as long as at least one member has a status values less than the top member. Hence, the first part of our initial claim in (30) is contradicted.

As a next step we address case (ii): from (32) it follows that:

$$\hat{s}_j - \hat{s}^{\bar{n}_j} < \hat{s}^{m_j} - \hat{s}_j \tag{37}$$

$$\Leftrightarrow 2\frac{\sum_{-i} s^i + s^{m_j} + s^{\bar{n}_j}}{N_j} < \frac{\sum_{-i} s^i + s^{\bar{n}_j}}{N_j - 1} + \frac{\sum_{-i} s^i + s^{m_j}}{N_j - 1} \tag{38}$$

$$\Leftrightarrow 2(N_j - 1)(\sum_{-i} s^i + s^{m_j} + s^{\bar{n}_j}) < N_j(2\sum_{-i} s^i + s^{m_j} + s^{\bar{n}_j}) \tag{39}$$

$$\Leftrightarrow N_j(s^{m_j} + s^{\bar{n}_j}) < 2(\sum_{-i} s^i + s^{m_j} + s^{\bar{n}_j}) \equiv 2N_j \hat{s}_j \tag{40}$$

Note that (40) implies that the following is analogous to (37):

$$s^{m_j} + s^{\bar{n}_j} < 2\hat{s}_j \tag{41}$$

As, by definition, $\hat{s}_j = \frac{\sum_{n_j}^{m_j} s^i}{N_j} + \frac{\sum_{m_j+1}^{\bar{n}_j} s^i}{N_j}$ and due to the definition of the median, it is most likely that (41) holds if (i): $s^{m_j} = s^{n_j}$ and (ii): $\hat{s}_j(s^{m_j} = s^{n_j})$ is maximal. By definition of the average, the maximum of $\hat{s}_j(s^{m_j} = s^{n_j})$ is reached if all status values above the median have the top status value, $s^{\bar{n}_j}$, and all status values below and including the median have the minimal status value, s^{n_j}. Hence:

$$\max\{\hat{s}_j(s^{m_j} = s^{n_j})\} = \frac{N-1}{2N_j}s^{\bar{n}_j} + \frac{N_j+1}{2N_j}s^{n_j} \quad \text{if } N_j \text{ is odd-numbered.} \tag{42}$$

If N_j is even-numbered, this maximum is lower.

Substituting (42) in (41) yields:

$$s^{n_j} + s^{\bar{n}_j} < \frac{N_j-1}{N_j}s^{\bar{n}_j} + \frac{N_j+1}{N_j}s^{n_j} \tag{43}$$

$$\Leftrightarrow s^{\bar{n}_j} - s^{n_j} < 0, \tag{44}$$

which is in contradiction to our status value definitions. It follows that (32) never holds. Hence, the second part of (30) is contradicted as well, thereby proving Proposition 3. *Q.E.D.*