Economics of Evaluation (with Special Reference to Promotion & Tenure Committees)

by

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Abstract

Previous research suggests that universities that fear tenuring bad candidates more than they fear rejecting good candidates would optimally have both department and outside evaluating committees. I find that a higher relative cost of accepting bad candidates is neither necessary nor sufficient for the optimality of more than one committee. Also, with some probability, *t*, the administration will tenure one with split recommendations from two committees, if one committee is more accurate than the other, one structure will have fewer errors of both types for some range of *t*, and possibly a lower expected loss from errors *for all t*.

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1. Introduction

Hiring, promoting, and tenuring good faculty are critical for a university's quality. Evidence from evolutionary biology departments is that hiring a star has a large positive impact, particularly on the quality of subsequent hires (Agrawal *et al*., 2014). Agrawal *et al*. cite Robert Lucas (1988) on the importance of getting good quality colleagues:

"Certainly in our profession, the benefits of colleagues from whom we hope to learn are tangible enough to lead us to spend a considerable fraction of our time fighting over who they shall be, and another fraction travelling to talk with those we wish we could have as colleagues…"[1]

James Heckman had this observation on hiring economists at the University of Chicago:

"…mistakes were made, but if anything over most of the period mistakes were in NOT appointing people, not in appointing people."[2]

Heckman's comment alludes to the two types of errors in hiring, tenuring, and promotions: *accepting a bad candidate*, call it an AB, and *rejecting a good candidate*, call it an RG. Heckman suggests that his department made more RGs than ABs in hiring. Particularly in tenure decisions, one might expect most departments to care more about ABs than RGs. Although departments do not wish to fail to tenure a star, failure to tenure a good candidate can be rectified by hiring and tenuring another good person in the future. Tenuring a bad candidate is more costly. A scarce faculty slot has been filled with someone who may stay for a long time.[3]

[1] Lucas (1988), p.38.
[2] Heckman (2014), p.128.
[3] It is possible that universities that are ranked lower might fear an RG more than an AB because tenuring one who becomes a star could have a big positive impact on such a department. The problem of using publication quality to evaluate faculty has received recent attention (Heckman, 2017, and Powdthavee, Riyanto, and Knetsch, 2017).

A recent study (McPherson, 2012) ranked U.S. economics departments. I consider universities with the top seventy-five economics departments.[4] For all but one university (Cal Tech, ranked number forty-one), I was able to determine if a committee outside the department made recommendations on candidates for tenure and promotion.[5] The University Chicago (number two) does not have an outside committee. At NYU (number six), a dean *may* choose either an outside committee, or the dean may request additional outside letters.[6] All of the other seventy-two universities of the top seventy-five for which I have data have an outside committee.

Sah and Stiglitz (1986, 1988) consider the optimal structure of an organization in which one must determine which projects to accept. They consider a *flat structure* (what they call a polyarchy) with one evaluator, and a *hierarchy* with two evaluators. In the former case, a single evaluator decides whether to accept a project. In the latter case, both evaluators must approve the project if it is to proceed. Projects are either good or bad. Evaluators are equally talented, have the same probability of accepting a bad project as they do of rejecting a good project, are independent, and are unbiased.

Sah and Stiglitz (1986) find that a flat structure selects a larger number of projects than does a hierarchy. Thus, a flat structure accepts more bad projects and rejects fewer good projects than a hierarchy. Lazear and Gibbs (2009) introduce the possibility of something in between a

[4] The top seventy-five economics departments are not necessarily the top seventy-five universities. However, I prefer to use a ranking that is more familiar to economists, one of our own profession. Also, at least the top departments on the list are in universities that are generally highly ranked. I stopped at seventy-five universities because, after NYU (number six), excluding Cal Tech, whose policy I could not determine, all had outside committees. Although I know of lower ranked departments without outside committees, clearly the usual policy in a wide range of universities is to have an outside committee. Non-U.S. universities are not considered herein because they may have institutional features that differ from those in the U.S.

[5] Some departments have more than two committees. I do not distinguish between universities other than if they have at least one external (to the department) committee. It was difficult to find procedures for some universities, and sometimes policies are not clearly delineated. A table containing the sources for these results is available from the author by request.

[6] I do not consider outside letters in the analysis herein. Such letters represent information that is available at all levels of academic evaluation, and are thus inputs and not a formal vote as occurs with university committees.

flat structure and a hierarchy, what they call a *second opinion structure*. However, the basic points remain unchanged: an organization trades off the two types of errors (Lazear, 1995), and, supposedly, the closer the organization is to a flat structure (*resp.*, a hierarchy), the more bad projects that are accepted (*resp.*, the more good projects that are rejected).

My intention is to analyze the optimal structure of evaluations in universities. I wish to explain why having a committee outside a department recommend candidates, in addition to a department committee, is the preferred choice of a wide range of U.S. universities. The previous literature[7] focuses on the tradeoffs between errors, and suggests that universities that fear promoting and tenuring bad candidates more than they fear rejecting good candidates would have both department and outside promotion and tenure committees. I focus on which structure has the lowest expected loss, and demonstrate that a higher cost of promoting bad candidates versus rejecting good candidates is neither necessary nor sufficient for universities to choose a hierarchy. The relative accuracy of department and outside committees, and the likelihood an administration will intervene with split committee recommendations are critical variables in determining the optimal structure for evaluation.

There are several features of academic evaluation that may differ from project or applicant evaluation in a firm. These features, discussed in more detail in Section Three, are the following. Faculty committees do not decide whether a candidate receives promotion or tenure. Rather, they *recommend* candidates. Senior administrators (provosts, chancellors, and presidents) have the final decision.[8] Also, faculty committees do not have equal ability. Finally, an outside

[7] See the articles by Sah and Stiglitz (1986, 1988) and the personnel economics textbooks by Lazear and Gibbs (2009, 2015).

[8] I ignore the fact another entity (*e.g.* a board of trustees) technically may have the final decision, given that such entities rarely fail to follow the recommendation of the top administrator involved in promotion and tenure decisions.

committee generally sees the recommendations of a department committee, so the former's recommendation may not be independent.

Introducing an administrator who makes the ultimate personnel decision leads to the possibility of reversing the previous conclusions regarding which structure leads to the most errors of either type. Also, depending on which committee more accurately judges candidate ability, one structure may involve *fewer errors of either type*. Finally, even if, as suggested above, a university fears ABs more than RGs, and one structure has fewer ABs, that is not necessarily the structure that has the *lowest expected loss* to the university from both types of errors.

Although my intention is to analyze how I believe promotion and tenure committees and administrators behave, my results also can be used for normative analysis of promotion and tenure. Lazear (1995) considered the problem of positive analysis being prescriptive:

"A good positive theory is a description of what is, and this precludes a role for those who want to teach it to others as a behavior ideal…Alternatively, we can argue that businesses do not behave according to our models but should…The answer lies in the middle ground. While economics may do very well at explaining most of what goes on in the world, some economic agents may not behave as they should."[9]

If, as Lazear suggested, profit-maximizing firms may benefit from some positive economic analysis, it is possible that some non-profit-maximizing universities may not have an optimal structure for promotion and tenure.

[9] Lazear (1995), p.7. For additional discussion of how firms can learn from academic research, see Lazear and Shaw (2011).

In this paper, possible strategic behavior by evaluators is mostly ignored. I assume that the recommending committees vote truthfully. I believe that the committees involved in promotion and tenure decisions have the same objective: to promote and tenure good candidates. There seems to be little reason for committees to behave strategically. As argued by Carmichael (1988, 2001), one role of tenure is to induce honest evaluations by faculty. This issue is discussed in more detail in Section Nine.

2. Previous research on tenure, promotion, and faculty evaluation

In this section, I discuss some previous research on tenure and promotion, and indicate how this paper addresses issues heretofore unexplored.[10] Faria and McAdam (2015) analyze the lifetime productivity of scholars. In their model, scholars transform dissertation chapters into published articles. They consider how the life cycle of research productivity is affected by the tenure decision. Besancenot, Faria, and Vranceanu (2009) consider how research as a signal may lead lower level universities to try to emulate higher level universities in research production. Consequently, the latter may engage in excessive research to sort themselves from the former, the classic signaling problem (Spence, 1974). El Ouradighi, Kogan, and Vranceanu (2013) consider how the compensation structure from administrators affects the allocation of effort between teaching and research. Faria, Mixon, and Salter (2012) argue that, although a university benefits from faculty reputation for research productivity, administrators may have an incentive to induce high paid tenured faculty to leave.

[10] *Why* tenure exists has been considered elsewhere. For example, see Carmichael (1988, 2001), Aghion and Jackson (2014), and Prendergast (2015). I discuss Carmichael's argument for tenure in Section Three and Section Nine.

My interest in the issue of evaluating faculty for promotion and tenure differs from that of previous researchers. I am not concerned with the reward structure for professors, or their lifetime productivity. Rather, as discussed in Section One, I am interested in the evaluation structure of universities, particularly whether one or more than one committee makes promotion and tenure recommendations to the university administration. The issue of evaluating faculty is related to but differs in important ways from the problem of evaluating projects considered by Sah and Stiglitz (1986, 1988). The optimal structure for evaluating faculty for promotion and tenure has not been analyzed previously.

3. Features of academic evaluation

A. Administrators decide

In a university, faculty committees recommend and administrators decide. Herein, a flat structure means there is only the department promotion and tenure committee and the administration.[11] A hierarchy means there are department and outside promotion and tenure committees and the administration.[12]

I assume the administration never goes against a department recommendation when there is only a department committee, and never goes against the department and outside committees when the committees are in agreement. However, I assume there is a positive probability the

[11] In the Sah-Stiglitz (1986) model, either one or two evaluators approve a project. With two evaluators, both must approve. Herein, technically, there is a hierarchy when just the department committee and the administration exist. However, as shown in Section Three, if the administration never goes against a department recommendation, then essentially there is a flat structure when there is only the department committee. Thus, to be consistent with the previous literature, I will refer to that case as a flat structure.

[12] Some universities have committees at the department and college levels, some have committees at the department and university levels, and some have committees at all three levels. I will focus on either one (the department) or two committees, with the second committee referred to as the "outside committee." Introducing a third committee would not change the basic results: depending on the likelihood the administration grants tenure when committees have split recommendations, there may be a tradeoff between errors with different evaluation structures, but it is possible one structure has *fewer errors of both types*.

administration will grant tenure or promotion if there is a split between the department and outside committees. Thus, I assume an administration that is neither relatively intrusive nor completely passive.

Carmichael (1988, 2001) compares universities to sports teams. In the latter, as in many businesses, owners and managers can identify talent reasonably well. In universities, administrators generally come from different academic disciplines than promotion and tenure candidates, and find it difficult to accurately identify talent. Carmichael uses this argument to justify tenure. Faculty members in a discipline are in the best position to evaluate other faculty members in the same discipline, but, absent the protection of tenure, would be reluctant to recommend hiring candidates who might be superior and replace them. With faculty having the knowledge and incentives to act correctly, administrators are reluctant to overrule faculty committees on hiring, promotion, and tenure.

I agree that the administration rarely goes against the clear sentiment of the faculty. However, if the administration *never* goes against a department decision, why are there usually (in the U.S.) outside committees? Also, suppose the outside committee is negative when the department committee is positive. In that case, assuming the administration would *never* approve tenure means the department has *less* influence on the tenure decision. Thus, it seems reasonable to believe there is some chance the administration will grant tenure with a split vote from recommending committees.[13]

B. The committees may not have the same accuracy

[13] Lazear (1995) discusses how salespersons must report to a manager to get a final decision. With more knowledge about appropriate decisions, it is likely managers in business are more willing to overrule subordinates than are academic administrators.

Sah and Stiglitz (1986) assume evaluators are unbiased, equally talented, and independent. Extensions of their analysis are found in Lazear and Gibbs (2009, 2015), who assume the second evaluator is more likely to make a correct decision, given knowledge of what the first evaluator did, and in Sah and Stiglitz (1988), who assume evaluators have the same values, but differ in the extent of information they possess.

In promotion and tenure decisions, an outside committee should be less able than a department committee to judge an applicant. If the outside committee is independent, it will ignore what the department committee did. However, if the outside committee updates its information based on the recommendation of the department committee, then the argument by Lazear and Gibbs is persuasive. It still may be possible that the department committee is more likely than the outside committee to make the correct recommendation. Thus, I will consider both possibilities---the outside committee is more accurate, and the department committee is more accurate. Also, the outside committee's accuracy may depend on whether the department committee correctly evaluated a candidate. That possibility is addressed in Section Six.

4. A general model of the likelihood of errors

A. Outline

For brevity, I refer to a tenure decision, but the decision could involve hiring, promotion, or reappointment. I ignore the problem of achieving consensus within a committee. Also, I ignore the separate decisions by administrators---chairs, deans, provosts, and presidents. Rather I consider either one or two committees that make recommendations to a single administration.

Only the administration can make a decision.[14] Candidates are either *good* or *bad*. The department committee has a probability of p of making a correct recommendation (favorably recommending a good candidate, or rejecting a bad candidate[15]), and the corresponding probability for the outside committee is ρ. An error occurs in either accepting a bad candidate, an AB, or rejecting a good candidate, an RG. I assume no one is perfect in evaluating candidates so $max(p, \rho) < 1$. Since there is no sense having a committee evaluate if it is less accurate than a coin flip in judging quality (Lazear and Gibbs, 2009), I also assume $½ \leq min(p, \rho)$.

If there is only a department committee, it is assumed the administration always follows the department recommendation. If there are both department and outside committees, the administration follows the two committees if the committees agree. With two committees, if only one of the two committees recommends tenure, the administration recommends tenure t of the time, with $0 \leq t \leq 1$. The administration plays no role in the analysis *except* if there is a hierarchy and the two committees disagree.[16] The administration's decision is assumed to be exogenous, possibly the result of institutional history. This assumption is considered in more detail in Section Seven.

[14] I ignore budgetary issues herein. Faria, Loureiro, Mixon, and Sachsida (2013) suggest that a department with a small budget is less likely to award tenure to someone is who highly paid. I expect that is not a serious problem. Someone who is highly paid prior to tenure is likely to be in a department with a relatively large budget. A department with a small budget would likely have lost a productive junior faculty member before tenure because such an individual would be a good candidate to be raided by another department. In general, budgetary problems may result in fewer individuals hired in a department, or fewer hired to tenure track positions. I am interested in the structure of evaluation for tenure and promotion *given* a department that has such decisions to make.

[15] Akerlof and Michaillat (2017) have a different probability of making the two kinds of mistakes. They only have one level of evaluation.

[16] Lazear and Gibbs (2009) consider a situation with two evaluators who each review N projects per period. With a flat structure, $2N$ projects are evaluated, but, with a hierarchy (each project reviewed by both evaluators), only N projects are evaluated. Although a hierarchy results in a higher *rate* of good applicants rejected, the *total number* rejected is lower with a hierarchy because only one half as many projects are evaluated with the hierarchy as are considered with the flat structure. In the problem herein, the number of candidates evaluated is the same regardless of which structure is used.

Different departments may have different views of who is good or bad. Higher level universities and departments demand more research. A tenure candidate who is considered bad at a higher level department could be considered good at a lower level department. This is immaterial for my analysis. Faria, Loureiro, Mixon, and Sachsida (2013) find that publications are important for promotion and tenure across all types of universities. Thus, a similar evaluation process for promotion and tenure occurs at different kinds of departments.[17]

Proposition One. *If there is a high enough probability the administration will tenure one who has received a split vote from the two committees, the usual likelihood of errors is reversed: more bad candidates receive tenure with a hierarchy, and more good candidates are rejected for tenure with a flat structure.*

Proof. The rest of this section develops the proof of Proposition One. Note, Proposition One does *not* depend on the relative values of ρ and p.

B. Accept a bad candidate

Recall the assumption the administration grants tenure to a candidate in three cases: when 1) there is only a department committee, and the committee recommends tenure; 2) there are department and outside committees, and both recommend tenure; and 3) there are two committees, only one of which recommends tenure. In the first two cases, tenure is awarded 100% of the time. In the third case, tenure is awarded t of the time.

[17] Faria *et al*. (2013) note that the ideal data set would "…follow individual faculty over time, and include faculty who were denied tenure and promotion at a particular institution. Unfortunately, the collection of such a sample would be prohibitively difficult, if not impossible." Additionally, for my purposes, there would have to be a way of determining if an individual turned down for tenure was favorably viewed by any recommending committee, and if one who received tenured was subsequently viewed as a mistake by his or her department. This hypothetical data set is even less likely to be obtained than the one described by Faria *et al*. (2013).

Let prob(AB|1) be the probability of accepting a bad candidate (a false positive) with only the department committee, and prob(AB|2) be the probability of accepting a bad candidate with two committees. Both probabilities are conditional on the candidate being bad. With only one committee, an AB occurs if the department makes a mistake. With two committees, an AB occurs if both committees make a favorable recommendation, or if the committees split and the administration grants tenure. We then have:

$$\text{prob(AB|1)} = 1-p, \tag{1}$$

$$\text{prob(AB|2)} = (1-p)(1-\rho + t\rho) + p(1-\rho)t. \tag{2}$$

If the administration will not accept an individual with split committee votes ($t = 0$), a flat structure leads to more ABs. Then prob $(AB|2)|_{t=0} = (1-p)(1-\rho) <$ prob(AB|1) = $(1-p)$. If $t = 1$, prob $(AB|2)|_{t=1} = 1-p\rho >$ prob(AB|1) = $1-p$. Thus, for a large enough value of t, a hierarchy has more ABs than would a flat structure.

Why could more bad candidates receive tenure with a hierarchy? With a flat structure, if the department rejects a candidate, the individual does not receive tenure. With a hierarchy, even if the department rejects a candidate, if the outside committee recommends the individual, and t is high enough, the second chance aspect of the hierarchy can result in prob(AB|2) > prob(AB|1).

The critical value for t, t_B, is found by setting prob(AB|1) = prob(AB|2).[18]

$$t_B = \frac{\rho(1-p)}{p+\rho-2p\rho}\,. \tag{3}$$

[18] The denominator of t_B in *eq*.(3), call it D, is clearly positive. $D = p + \rho - 2p\rho = (p-\rho)^2 + p(1-p) + \rho(1-\rho) > 0$.

For $t < t_B$, a hierarchy accepts fewer bad candidates than would a flat structure. The opposite is true for $t > t_B$.

C. Reject a good candidate

With only the department committee, an RG occurs if the department makes a mistake. With two committees, an RG occurs if both committees make a mistake, or if only one makes a mistake and the administration rejects the tenure request. Then prob(RG|1) and prob(RG|2) are, respectively, the probabilities of rejecting a good candidate when there is one committee or there are two committees. Both probabilities are conditional on the candidate being good.

$$\text{prob(RG|1)} = 1-p, \tag{4}$$

$$\text{prob(RG|2)} = (1-p)(1-\rho) + [p(1-\rho) + \rho(1-p)][1-t]. \tag{5}$$

If $t = 0$, $\text{prob(RG|2)}|_{t=0} = 1-\rho p > \text{prob(RG|1)} = 1-p$. If $t = 1$, $\text{prob(RG|2)}|_{t=1} = (1-p)(1-\rho)$, which clearly is less than prob(RG|1). Thus, for large enough values of t, a hierarchy can reject fewer good candidates than would a flat structure.

Why could there be fewer RGs with a hierarchy than with a flat structure? If the department rejects with a flat structure, that is the end of it. When there is a hierarchy, a department rejection, acceptance by the outside committee, and a large enough value for t mean a second chance with the hierarchy can lead to the hierarchy rejecting fewer good candidates than a flat structure.

Now set prob(RG|1) = prob(RG|2) to find t_G: [19]

$$t_G = \frac{p(1-\rho)}{p(1-\rho)+ \rho(1-p)} . \quad (6)$$

For $t < t_G$, a hierarchy rejects more good candidates than would a flat structure. The opposite is true for $t > t_G$.

5. When one structure may have fewer errors of both types.

Proposition Two. *Suppose the outside committee is a more accurate judge of candidates than is the department committee. Then it is possible to have fewer types of both errors with a hierarchy than with a flat structure.*

Corollary. If the department committee is a more accurate judge of candidates than the outside committee, then it is possible to have fewer types of both errors with a flat structure than with a hierarchy.

Proof. The proof will be for the case when $\rho > p$. With $t_B = \frac{\rho(1-p)}{p+\rho-2p\rho}$ and $t_G = \frac{p(1-\rho)}{p(1-\rho)+ \rho(1-p)}$, if $p = \rho$, then $t_B = t_G = ½$. First, consider the effects of p and ρ on t_B:

$$\frac{\partial t_B}{\partial p} = \{+\}\rho[p(1-p) - 1 - 4p\rho] < 0, \quad (7)$$

$$\frac{\partial t_B}{\partial \rho} = \{+\}p > 0. \quad (8)$$

[19] Lazear and Gibbs (2009) refer to a hierarchy with $t > 0$ as a second opinion structure. What they call a hierarchy has two levels of evaluators with $t = 0$. One of their claims is that a second opinion structure has the lowest rate of rejecting good candidates. However, this cannot be true in general since, with t small enough, their second opinion structure is essentially the same as their hierarchy. I find a flat structure has the lowest likelihood of rejecting a good candidate if $t < t_G$. Compared to the analysis herein, the second opinion structure is like having one committee and an administration, where the latter *may* accept the committee's recommendation.

Starting with $p = \rho$, either a decrease in p or an increase in ρ will raise t_B, so $t_B > ½$. Now consider the effects of p and ρ on t_G:

$$\frac{\partial t_G}{\partial p} = \{+\}[p(1-\rho)^2 + p(1-\rho)^2 + \rho(1-p)(1-\rho) + p(1-\rho)(2\rho - 1)] > 0, \quad (9)$$

with $\rho \geq ½$. Also:

$$\frac{\partial t_G}{\partial \rho} = \{+\}p(p-1) < 0. \quad (10)$$

Starting with $p = \rho$, when ρ increases or p decreases, t_g decreases, so $t_g < ½$. Thus, with $\rho > p$, a larger gap between ρ and p implies a smaller t_G and a larger t_B. Then it is less likely more good candidates are rejected with a hierarchy than with a flat structure, and more likely more bad candidates are accepted with a flat structure than with a hierarchy. □

Why is $t_G < t_B$ if $\rho > p$? That is, as $\rho - p$ rises, why does t_G fall, and why does t_B rise? Consider t_B. If p decreases and ρ increases, the department is more likely to recommend a bad candidate, and the opposite is true for the outside committee. Thus, the disadvantage of a flat structure relative to a hierarchy in accepting bad candidates is increased, so $dt_B > 0$.

Now consider t_G. If p decreases and ρ increases, the department is less likely to recommend a good candidate, and the opposite is true for the outside committee. Thus, the advantage of a flat structure in rejecting fewer good candidates is decreased, so $dt_G < 0$.

Table One demonstrates that there is a significant range of t for which $t_G < t < t_B$ when

$\rho > p$. For example, if $\rho = .9$ and $p = .8$, for $.308 < t < .692$, a hierarchy has fewer errors of both types than a flat structure. One might not believe top research universities would have $t > .692$, so that a flat structure would reject more good candidates than a hierarchy. However, a much lower level of t is consistent with a hierarchy accepting fewer bad candidates than a flat structure---and having fewer errors of both types. The possibility a hierarchy may have fewer of both types of errors may explain why almost all of the universities for which I have data have more than one promotion and tenure committee.

The possibility remains that $p > \rho$. In that case, simply reverse the previous results in this section. Then there would exist a range of t in which a flat structure has fewer errors of both types. The results are the mirror image of when $\rho > p$. If p and ρ were switched in Table One, the values for t_B and t_G would also switch.[20]

6. The outside committee's accuracy depends on the department committee's accuracy

As discussed earlier, the outside committee may be more accurate in evaluating candidates for tenure because it knows the recommendation of the department committee. One possibility not yet considered is that the outside committee's accuracy depends on whether the department committee was correct in its recommendation. Thus, suppose the probability the outside committee correctly evaluates a candidate is λ if the department committee was correct, and α if the department committee was incorrect, with $\lambda > \alpha$.

If $\alpha > p$, or if $p > \lambda$, nothing fundamental changes from the analysis above. If

[20] In a previous version of this paper, I considered the cases when the administration treats either committee as supreme in that tenure is never granted with a split vote if 1) the college committee had the favorable recommendation, or, alternatively, if 2) the department committee had the favorable recommendation. In the first case, I found $t_B = t_G = 1$: a flat structure always accepts more bad candidates and rejects fewer good candidates than would occur with a hierarchy. In the second case, if $p > \rho$, then $t_B < t_G = 1$, so it is possible a flat structure accepts fewer bad candidates than would a hierarchy (when $t > t_B$). However, if $p < \rho$, then $t_B = t_G = 1$.

$\alpha > p$, the department committee is always less accurate than the outside committee. The outside committee is always less accurate than the department committee if $p > \lambda$. The interesting case is if $\lambda > p > \alpha$: the department committee is less accurate than the outside committee only when the department committee correctly assessed an applicant. I now derive t_B and t_G, assuming $\lambda > p > \alpha$. From *eqs*.(1) and (4), prob(AB|1) = prob(RG|1) = 1- *p*. Now:

$$\text{prob(AB|2)} = (1 - p)(1 - \alpha - t\alpha) + pt(1 - \lambda), \tag{11}$$

$$\text{prob(RG|2)} = (1 - p)(1 - \alpha) + (p[1 - \lambda] + \alpha[1 - p])(1 - t). \tag{12}$$

Now set prob(AB|1) = prob(AB|2) and prob(RG|1) = prob(RG|2) to derive t_B and t_G respectively:

$$t_B = \frac{\alpha(1-p)}{\alpha(1-p)+p(1-\lambda)}, \tag{13}$$

$$t_G = \frac{p(1-\lambda)}{p(1-\lambda)+\alpha(1-p)}. \tag{14}$$

As before both t_B and t_G exceed zero and are less than one, so, relative to a hierarchy, it is possible to accept fewer bad candidates (if $t > t_B$), and to reject more good candidates (if $t > t_G$) with a flat structure. Comparing *eqs*. (13) and (14), a hierarchy can have fewer errors of both types ($t_G < t_B$) if:

$$p < \frac{\alpha}{1+\alpha-\lambda}. \tag{15}$$

For example, if $\lambda = .9$, and $\alpha = .7$, then $t_G < t_B$ if $p < .875$. If $\lambda = .8$, and $\alpha = .6$, then $t_G < t_B$ if $p < .75$. Previously, I assumed the probability the outside committee made a correct decision was ρ, which was independent of the accuracy of the department committee. In that case, $t_G < t_B$ if $p < \rho$. In this section, λ is the highest probability of a correct decision by the outside committee. Now $t_G < t_B$ if λ is slightly greater than p. Thus, it appears that allowing the outside committee's accuracy to depend on the department committee's accuracy does not significantly affect my results.

7. Is the administration's intervention endogenous?

Another possibility is that the administration's probability of tenuring an applicant who received split votes from two committees is endogenous. Prendergast and Topel (1996) argue that supervisors value their ability to affect the welfare of subordinates. In academia, this suggests that administrators would not commit to not tenuring one with a split vote from recommending committees. Since the administration does not have the ability to evaluate candidates as well as committees that consist of faculty actively engaged in research and teaching, the administration almost always goes with committee recommendations when the committees agree.[21]

[21] I assume the administration *never* goes against committee recommendations for tenure unless there are two committees that disagree. In hiring decisions, senior administrators rarely overrule department recommendations. One noteworthy case occurred in 1946. The Department of Economics at the University of Chicago wanted to hire George Stigler. The university president, Ernest C. Colwell, believed Stigler was too empirical, and vetoed the appointment (Wallis, 1993). Also, in 1938, Harry Gideonese, an opponent of President Robert Hutchins, was unanimously recommended for tenure by the economics faculty at Chicago, but was rejected by the university administration (Ebenstein, 2015).

When evaluators are split, the administration must weigh the internal political problems with either granting or not granting tenure. Institutional history and characteristics of administrators likely determine *t*,[22] which implies one might (as I have) treat *t* as exogenous.

Consider formally the possible endogeneity of *t.* First, suppose a university has two committees. Normalize the number of candidates to one, with *g* the fraction of candidates who are good. Let C_{AB} equal the cost of accepting a bad candidate, and C_{RG} equal the cost of rejecting a good candidate. We have prob(AB|2) and prob(RG|2) from *eqs*.(2) and (5).

The expected loss from these errors with two committees, L_2, is:

$$L_2 = \text{prob(AB|2)}[1 - g]C_{AB} + \text{prob(RG|2)}gC_{RG}. \quad (16)$$

Using *eqs*.(2) and (5), differentiate L_2 with respect to *t*:

$$\frac{\partial L_2}{\partial t} = [p + \rho - 2p\rho][(1- g)C_{AB} - gC_{RG}]. \quad (17)$$

Now prob(AB|2) is linear in *t* with $\frac{\partial prob(AB|2)}{\partial t} > 0$, and prob(RG|2) is linear in *t* with $\frac{\partial prob(RG|2)}{\partial t} < 0$. From footnote fourteen, $[p + \rho - 2p\rho] > 0$. Thus, if $(1- g)C_{AB} > gC_{RG}$, the optimal *t* is zero. Otherwise, the optimal *t* is one. If the expected cost of tenuring a bad candidate---the cost times the probability a candidate is bad---exceeds the expected cost of rejecting a good candidate, an administration that can choose the likelihood it will tenure one with a split vote

[22] Prendergast (2015) suggests universities differ in how much administrators intervene in the evaluation of candidates for tenure. Herein, such a difference implies that *t* varies among universities. Prendergast is interested in how different control rights affect the kinds of activities undertaken by candidates for tenure, an issue that is ignored herein.

would *never* tenure one with a split vote. Conversely, if the expected cost of tenuring a bad candidate is less than the expected cost of rejecting a good candidate, the administration would *always* tenure one with a split vote.

Casual observation suggests that t is neither zero nor one. One possibility is that there are costs to an administration that tenures one with a split vote. Then the optimal t may be between zero and one. Such costs could be a loss of support from faculty who do not believe one should be tenured without the support of all faculty recommending committees. Alternatively, as suggested above, it may simply be difficult for administrators to commit to a likelihood of a favorable decision for an applicant who received split committee recommendations.

8. The optimal structure.

I have shown that the likelihood of different errors---rejecting good candidates and accepting bad candidates---with either a flat structure or a hierarchy depends on the accuracy of the department and outside committees (p and ρ, respectively), and the likelihood the administration will intervene with split committee votes (t). The literature on optimal structure (footnote seven) considers the tradeoffs between accepting bad and rejecting good candidates, but does not consider the expected loss from each structure, given the cost of different errors. The factors that affect the expected loss are the costs and likelihood of either error, the probability an applicant is good, and the likelihood the administration will accept an applicant who received split committee recommendations.

Proposition Three. *Suppose the cost of accepting a bad candidate equals the cost of rejecting a good candidate, and there is an equal number of good and bad candidates. Then a hierarchy will have a lower expected loss from errors than a flat structure if the outside committee is more*

accurate than the department committee independent of the probability of intervention by the administration.

Corollary. If the department committee is a more accurate judge of candidates than the outside committee, then a flat structure will have a lower expected loss from errors than a hierarchy independent of the probability of intervention by the administration.

Proof. Using *eqs*.(2), (5), and (16), we have prob(AB|2), prob(RG|2), and the expected loss with a hierarchy from the two kinds of errors, L_2. Similarly, from *eqs*.(1) and (4), we have Prob(AB|1) = prob(RG|1) = 1–*p*. Now the expected loss with a flat structure, L_1, is:

$$L_1 = (1\text{-}g)\text{prob(AB|1)}C_{AB} + g\ \text{prob(RG|1)}C_{RG}. \quad (18)$$

Using *eqs*.(2), (5), (16), and (18), a hierarchy has a lower expected loss than a flat structure if:

$$[1\text{-}g][\text{prob(AB|1)} - \text{prob(AB|2]}C_{AB} > g[\text{prob(RG|2)} - \text{prob(RG|1]}C_{RG}. \quad (19)$$

It is straightforward to show that [prob(AB|1) – prob(AB|2] > [prob(RG|2) – prob(RG|1] if $\rho > p$. Thus, if $g = ½$ and $C_{AB} = C_{RG}$, a hierarchy has a lower expected loss than a flat structure if $\rho > p$.[23] □

Consider why, if $g = ½$ and $C_{AB} = C_{RG}$, *t* is irrelevant for which structure has a net advantage in terms of errors. If $min(t_G, t_B) < t < max(t_G, t_B)$, then one structure has fewer errors of

[23] For brevity, I will mainly consider the case when $\rho > p$ in this section. Flipping the inequality simply flips which structure is superior.

both types, and so has the lowest expected loss for any likelihood a candidate is good, g, and regardless of which cost is greater, C_{AB} or C_{RG}. If $t < min(t_G, t_B)$ or $t > max(t_G, t_B)$, one structure has more ABs and fewer RGs than the other. Which structure has the lowest expected loss depends on 1) the cost of each type of error, 2) the percentage of candidates who are good, and 3) the relative accuracy of the two committees. Numbers one and two determine the expected cost of either type of error. Number three involves the net advantage of one structure versus the other in terms of errors.

With $\rho > p$, when $t < min(t_G, t_B) = t_G$, a flat structure has more ABs and fewer RGs than a hierarchy, so [prob(AB|1) – prob(AB|2)] > 0, and [prob(RG|2) – prob(RG|1)] > 0. With [prob(AB|1) – prob(AB|2)] > [prob(RG|2) – prob(RG|1)], when $\rho > p$, the increased likelihood of ABs with a flat structure versus a hierarchy exceeds the increased likelihood of RGs with a hierarchy, so the hierarchy has a lower expected loss than a flat structure if $g = ½$ and $C_{AB} = C_{RG}$.

Again with $\rho > p$, when $t > max(t_G, t_B) = t_B$, a flat structure has fewer ABs and more RGs than a hierarchy, so [prob(AB|1) – prob(AB|2)] < 0, and [prob(RG|2) – prob(RG|1)] < 0. Now [prob(AB|1) – prob(AB|2)] > [prob(RG|2) – prob(RG|1)] can be rearranged for convenience of exposition, and we have [prob(AB|2) – prob(AB|1)] < [prob(RG|1) – prob(RG|2)]. The latter two bracketed terms are positive. The increase in ABs going from a flat structure to a hierarchy is less than the increase in RGs going from a hierarchy to a flat structure. Again, a hierarchy is superior to a flat structure if $g = ½$ and $C_{AB} = C_{RG}$.

Thus, if $g = ½$ and $C_{AB} = C_{RG}$, t does not matter in terms of how the probability of errors affects the relative losses from the two structures. What *t can* affect is the impact of g, C_{AB}, and C_{RG} on the expected loss with a hierarchy, as will now be demonstrated.

Consider how t interacts with the likelihood a candidate is good and the costs of either type of error. Define $\Delta_{AB} \equiv$ [prob(AB|1) – prob(AB|2)], and $\Delta_{RG} \equiv$ [prob(RG|2) – prob(RG|1)]. We have:

$$\Delta_{AB} = \rho(1- p) + t(2p\rho - \rho - p), \tag{20}$$

$$\Delta_{RG} = p(1- \rho) + t(2p\rho - \rho - p), \tag{21}$$

with $2p\rho - \rho - p < 0$. Now $L_2 < L_1$ if:

$$[1-g]\Delta_{AB}C_{AB} > g\Delta_{RG}C_{RG}. \tag{19'}$$

If the administration is reluctant to tenure one with a split committee vote, so $t < min(t_G, t_B)$, then $\Delta_{AB} > 0$, $\Delta_{RG} > 0$, and $\Delta_{AB} > \Delta_{RG}$ when $\rho > p$. Thus $L_2 < L_1$ if:

$$\frac{1-g}{g} > \frac{\Delta_{RG}C_{RG}}{\Delta_{AB}C_{AB}}. \tag{22}$$

The RHS of *ineq.*(22) is less than one if, as one would expect, $C_{AB} > C_{RG}$ since $\Delta_{AB} > \Delta_{RG}$. Thus, if $t < min(t_G, t_B)$, so there are more RGs with a hierarchy than with a flat structure, there must be a relatively large number of good candidates---and thus a much greater risk of an RG than an AB---for the flat structure to dominate a hierarchy.

If, despite what one might generally believe, the administration is *not* relatively reluctant to promote or tenure one with a split committee vote, so $t > max(t_G, t_B)$, then $\Delta_{AB} < 0$ and

$\Delta_{RG} < 0$. In this case, the flat structure has fewer ABs than does a hierarchy. Now dividing both sides of i*neq*.(19') by $g\Delta_{AB}C_{AB}$ reverses the inequality, so $L_2 < L_1$ if:

$$\frac{1-g}{g} < \frac{\Delta_{RG}C_{RG}}{\Delta_{AB}C_{AB}}. \qquad (23)$$

Not that, with $t > max(t_G, t_B)$, $\Delta_{AB} > \Delta_{RG}$, and both Δ_{AB} and Δ_{RG} are negative.[24] Now, unless g is sufficiently small---so ABs are more of a problem than RGs---a hierarchy is more likely to have a lower expected loss than a flat structure.

Suppose, as discussed in Section One, a) accepting bad candidates is more costly than rejecting good candidates ($C_{AB} > C_{RG}$); b) because it acts knowing the department committee's recommendation, the outside committee is more accurate ($\rho > p$, so $\Delta_{AB} > \Delta_{RG}$); and c) the administration is relatively reluctant to grant tenure when committees have split recommendations ($t < min(t_G, t_B)$, so $\Delta_{AB} > \Delta_{RG} > 0$). Then *ineq*.(22) applies, and the right side of the inequality is less than one. Thus, if fewer than half of candidates for tenure are good, a hierarchy has a lower expected loss than a flat structure. To see the importance of which committee is more accurate, consider the following examples.

Example One. With $t < min(t_G, t_B)$, a hierarchy's disadvantage is that it rejects more good candidates than a flat structure. Even if $C_{AB} = C_{RG}$, g must be relatively large in order to reverse *ineq*.(22). Suppose $C_{AB} = C_{RG}$, $\rho = .9$, and $p = .8$. Then $\Delta_{AB} = .18 - .26t$, and $\Delta_{RG} = .08 - .26t$. Since $\frac{\Delta_{RG}}{\Delta_{AB}}$ is inversely related to t, to increase the likelihood the inequality does not hold (so a

[24] Thus, $|\Delta_{RG}| > |\Delta_{AB}|$ so, if $C_{AB} > C_{RG}$, the RHS of *ineq*.(23) may exceed, equal, or be less than one.

flat structure could have the lowest expected loss), suppose $t = .1$. Let g^* be the value of g for which the two structures have the same expected loss. For $g > g^*$, a flat structure has the lowest expected loss. In this case, $g^* = .74$. If we reverse ρ and p, so $\rho = .8$, and $p = .9$. Now $\Delta_{AB} = .08 - .26t$, and $\Delta_{RG} = .18 - .26t$. With $t = .1$, and the department committee more accurate than the outside committee, $g^* = .26$.

Example Two. Suppose accepting a bad candidate is much more expensive than rejecting a good candidate, say, $C_{AB} = 2C_{RG}$. Now it is less likely than in Example One that a flat structure has a lower expected loss than a hierarchy when $t < min(t_G, t_B)$. In this case, $g^* = .85$ when $\rho = .9$ and $p = .8$, and $g^* = .41$ when $\rho = .8$ and $p = .9$.

These examples illustrate how sensitive the results are to the relative accuracy of the two committees. Also, the examples demonstrate that, even if accepting bad candidate is much more costly than rejecting a good candidate, if the department committee is more accurate than the outside committee, it is plausible that a flat structure would have the lowest expected loss. Example Two suggests a flat structure could have the lowest expected loss if about forty percent or more of tenure candidates are good, provided $\rho = .8$, $p = .9$ and $C_{AB} = 2C_{RG}$. The fact that almost none of the top seventy-five economics departments is in a university with a flat structure suggests that the outside committee is universally believed to be more accurate than the department committee, an issue discussed further in Section Nine.

Assuming that $t < min(t_G, t_B)$, a hierarchy accepts fewer bad candidates and rejects more good candidates than a flat structure. Then a hierarchy is more likely to have the lowest expected loss from evaluation errors 1) the greater the cost of accepting bad candidates relative to

rejecting good candidates, 2) the smaller the percentage of candidates for tenure who are good, and 3) the more accurate the outside committee is relative to the department committee. Numbers one and two are reversed if $t > max(t_G, t_B)$ because then a hierarchy accepts more bad candidates and rejects fewer good candidates than a flat structure.

9. Strategic behavior

As in the articles by Sah and Stiglitz (1986, 1988), and the personnel economics textbooks by Lazear and Gibbs (2009, 2015), I have assumed that the evaluators---department and outside promotion and tenure committees---truthfully report their findings, and that neither committee nor the administration behaves strategically. I ignore strategic behavior because I believe that the committees and individuals involved in promotion and tenure decisions have the same objective: to promote and tenure good candidates. In this case, there seems to be little reason to behave strategically.

One reader of an earlier version of this paper suggests the following case involving a tenure decision. Suppose the outside committee is perfectly accurate ($\rho = 1$), the department committee is less accurate ($p < 1$), and the administration always grants tenure with a split decision ($t = 1$), and never grants tenure if both committees vote no. Then, the department committee should *always vote no*. If the candidate is good, the outside committee will always recognize this and vote yes, and the administration will always grant tenure in this case. If the candidate is bad, the outside committee will always recognize this and vote no, and the administration will never grant tenure when this occurs.

Certainly the department committee could strategically vote no in all tenure cases, given the assumptions in the preceding paragraph. However, those assumptions are questionable. First,

as argued throughout this paper, it seems unlikely that an administration would grant tenure with a split recommendation, so *t* is not likely to be close to one. More importantly, the argument in Lazear and Gibbs (2009, 2015) that the second evaluator (the outside committee) may be more accurate is based on the second evaluator seeing the truthful recommendation of the first evaluator. If the department committee always votes no, the outside committee learns nothing from the department's recommendation. Since the department should be more knowledgeable than an outside committee when the latter has no information from the department, one would expect that ρ would not be close to one if the department always votes no.[25]

Therefore, the case discussed in the previous two paragraphs does not seem to be plausible, nor can I find other examples of plausible strategic behavior[26] when all of the evaluators and decision makers have the same objective. Thus, I believe little is lost by ignoring potential strategic behavior. [27]

Further, as argued by Carmichael (1988, 2001) the rationale for tenure is that it induces honest hiring by faculty by protecting them from being replaced if those they hire turn out be better than the department's current faculty. Honest hiring implies, *a fortiori*, honest tenure decisions. If those hiring are later not recommended for tenure by jealous colleagues, then honest hiring has little meaning. The belief that faculty are more competent than administrators in

[25]Another question raised by a reader of this paper is, with only one committee, if $\rho > p$, why is not the outside committee the one committee? The best answer to that point is the one just made in the text: without seeing the department's honest evaluation, the outside committee would *not* likely be more accurate than the department committee.

[26] If departments compete for faculty positions, faculty on an outside committee might be negative on a tenure decision in the belief that their departments would ultimately receive a position if someone is turned down for tenure. While possible, I do not see this as a serious problem. Since many departments would generally have faculty on an outside committee, there is not likely a high probability of any one department gaining a position if another department has someone turned down for tenure.

[27] The administration does not behave strategically for the same reason the faculty committees do not do so: the administration's goal is to tenure good candidates and not tenure bad candidates. Also, as argued in Section Seven, the administration is likely to play a different role than do faculty committees, and is primarily worried about difficulties involved in either decision with a split recommendation from evaluating committees.

judging who should be hired, promoted, and tenured, and that faculty are honest in their recommendations suggests why administrators show so much deference to faculty recommendations in these decisions.

10. Summary

Previous research suggests that universities that fear tenuring bad candidates more than they fear rejecting good candidates would optimally have both department and outside evaluating committees---a hierarchy. Virtually all of the universities with top seventy-five economics departments have a hierarchy. However, I find that a higher relative cost of accepting bad candidates is neither necessary nor sufficient for the optimality of more than one committee. There are two additional factors that likely explain the prevalence of outside promotion committees.

First, top administrators at research universities are not likely to grant tenure when recommending committees are split. If this were not true, then having two committees could mean accepting more candidates than would occur with one committee. Second, an outside committee knows the recommendation of the department committee so the former may be more accurate than the latter, despite the department committee being more knowledgeable than the outside committee. Assuming that universities fear tenuring bad candidates more than they fear rejecting good candidates, if the department committee were more accurate than the outside committee, it would significantly increase the likelihood that having only a department committee---a flat structure---would be optimal.

Finally, some colleges within a university likely differ in their heterogeneity. For example, arts and sciences colleges may contain hard sciences departments along with

humanities. In that case, a department may be a more accurate judge of its promotion and tenure candidates than is a college committee, even with the outside committee seeing the recommendation of the department committee. If universities fear accepting bad candidates more than rejecting good candidates, then, in the more heterogeneous colleges, it is more likely a flat structure would be optimal. Therefore, a university policy mandating either an external committee or no external committee may not be wise. Rather, a policy like that at NYU---where the dean of a college chooses either an external committee or additional outside letters---may be optimal.

Table One. When a hierarchy has fewer errors of both types than a flat structure (with $\rho > p$ so $t_G < t_B$).			
ρ	p	t_G	t_B
.9	.8	.308	.692
.9	.7	.206	.794
.9	.6	.143	.857
.8	.7	.368	.632
.8	.6	.273	.727
.7	.6	.391	.609

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