Tenure, job security and development of university

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Abstract

The research success of university requires efficient recruiting. The talents of candidates are unobservable for administrators, and so they delegate hiring to the faculty, who has better knowledge of the job market. Since professors dislike putting their own employment at hazard, faculty, especially less productive, has an incentive to hire less productive candidates to insure against getting fired themselves. I argue that both tenure and long-term administrative positions mitigate this problem, and allows to hire better-able candidates.
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In many endeavors, i.e. developing a research university, efficient hiring is essential. It is not sufficient to have talented researchers, one should also think about how to sustain and improve the current organization’s potential. This brings into question the organization of the enterprise under study, and the organization of the system of contracts in it. How to improve the hiring process?

I use the establishment of a new research university as an illustrative example. Administrators, especially less experienced, have little knowledge about abilities of candidates applying for professorships. Freshly employed senior faculty, on the other hand, has plenty of knowledge about the abilities of candidates, so administrators would like to employ that knowledge. If senior professor always hires the best candidate available, administrators
have an incentive to improve the average performance of research university by sacking the senior professor. Therefore, senior professors might not choose what’s best for the university. In such a situation it is crucial to coordinate the incentives of professors concerning their academic and administrative work so that they make beneficial decisions. I want to show that both tenure and long-term administrative positions can be used to expedite the development of the university. Particularly, if there is an institutional call for rotation, mandatory removal of faculty from administrative positions after a short term, tenure is the only way of guaranteeing that senior faculty is interested in hiring better junior people.

Tenure is a rather unusual type of a contract for organizations, but it is common for a research university. Presence of tenure has multiple effects on university. McPherson and Winston (1983) tell a story of additional job security for professors that permits them, in particular, to specialize in their research. Tenure is applicable to resolve the (departmental chair) scarce slot problem, as shown by Siow (1998). In Kahn and Huberman (1988), tenure is a mechanism to resolve the two-sided moral-hazard problem in the university. Perhaps the most similar paper to mine is Carmichael (1988), where tenure incites senior faculty to reveal their knowledge about abilities of new junior faculty. I argue that tenure allows to gouge information from the senior professor, which facilitates hiring and therefore improves the welfare.

The Model

I develop a 3-period game model. There is one university in the economy. The university is a nonprofit institution whose goal is to maximize the reputation\textsuperscript{1}. The reputation is assumed to be the average level of ability of professors working at the university.

There are two actors in the university: the professor and the administrator. At the beginning, the senior professor receives an offer from the administrator to take up the position of the head of the department. At this position he will have extra duties, that may bring him additional costs and gains depending on his recruiting policy.

The main actor is the senior professor (agent 1) with research ability $\theta_s$. His gains outside the university are normalized to zero. Objective function

\textsuperscript{1}This may be the total productivity of its faculty and not necessarily the monetary income resulting from such.
of the professor is the utility that he receives from different activities. He has two periods of work life.

In period 0 the senior professor receives an offer to become the head of department. He has an opportunity to make the following decision: he can choose between taking up an administrative post (head of department) and staying at a faculty post. In other words, he chooses between a pure academic career and an administrative career. In period 1 and 2 the senior professor as the head of department has additional duties besides the usual ones. For us his main additional duty is to make decisions about the hiring of a new junior professor.

If the professor chooses an academic career, this means for us that he will only do teaching and research (academic activities) during his lifespan. Academic activities yield utility $V$ in each period. In the second period the professor can be replaced by an administrator, this means that the professor has a short-term contract. Expected payoff of the senior professor if he chooses to remain faculty equals $V + \delta VP$, where $\delta$ is the discount factor, $P$ is the probability to keep his workplace in period 2. If the senior professor is tenured then $P = 1$.

If the professor chooses the administrative career, this means that he has additional duties apart from the academic ones. These duties include, in particular, hiring of a new junior professor. Extra administrative duties result in cost $C$. If the senior professor hires a junior professor with talent $\theta^{s1}_j$, he receives utility $\alpha \theta^{s1}_j$. I assume that the senior professor has perfect information about the talents of candidates and can hire any professor with $\theta^{s1}_j \in [0, \bar{\theta}]$. The senior professor can stay administrator during the second period as well. Then he will not be dismissed and he should hire a new professor. The senior professor will receive the expected payoff $V - C + \alpha \theta^{s1}_j + \delta(V - C + \alpha \theta^{s2}_j)$. If he can be dismissed with probability $G$, then the expected payoff is $(V - C)(1 + \delta(1 - G)) + \alpha \theta^{s1}_j + \alpha \theta^{s2}_j \delta(1 - G)$.

Between the first and the second periods, the senior professor has an opportunity to quit his post of the head of department. If this happens he can be dismissed afterwards by an administrator. His expected payoffs will be $V - C + \alpha \theta^{s1}_j + \delta((V + \theta^{s1}_j)P_1(\theta_s, \theta^{s1}_j) + VP_2(\theta_s, \theta^{s1}_j))$, where $P_1(\theta_s, \theta^{s1}_j)$ is the probability that both the senior professor and the junior professor stay at the university, $P_2(\theta_s, \theta^{s1}_j)$ is the probability that only the senior professor stays at the university and the junior professor is replaced.

The administrator is benevolent, but he has imperfect knowledge about the talents of candidates, he cannot distinguish among different professors in
the market. He is supposed to make hiring decisions. The level of candidate’s talent is a random variable $\theta_{jn} \sim U[0, \bar{\theta}]$. Expected payoffs of administrator when professor the offer equal the average talent of professors working at the university,

if the senior professor accepts offer:

$$E_3 = \begin{cases} 
(\theta_s + \theta_{j1}^s)/2, & \text{if he does not hire anyone} \\
(\theta_s + E(\theta_{j2}))/2, & \text{if he dismisses the junior professor} \\
(\theta_{j1}^s + E(\theta_{j2}))/2, & \text{if he dismisses the senior professor}
\end{cases}$$

if the senior professor rejects offer:

$$E_2 = \begin{cases} 
(\theta_s + \theta_{j13})/2, & \text{if he does not hire anyone} \\
(\theta_s + E(\theta_{j3}))/2, & \text{if he dismisses the junior professor} \\
(\theta_{j13} + E(\theta_{j3}))/2, & \text{if he dismisses the senior professor}
\end{cases}$$
1. Senior Professor taking up an administrative position

2. Agent 1 (head of department) hires a professor with ability \( \theta_{j_1} \in [0, \bar{\theta}] \)

3. Agent 1 (head of department) returns to the faculty status continues to be the head of department

4a. New head of department replaces senior keeps both replaces junior

4b. New head of department replaces senior keeps both replaces junior

4. Agent 1 hires new professor

**Game diagram**

This game has a Nash equilibrium. Equilibrium depends on the following parameters: talents of professors, benefits from their academic activities, level
of job security. I use the concept of Nash sequential equilibrium and to find this equilibrium I use backward induction. At stages 4a and 4b administrator should make recruitment decisions. He can keep at the university both the senior and the junior professors, he can fire the junior professor and hire a new one, he can fire the senior professor. Administrator attains the maximal reputation if he keeps at the university two most talented professors. The optimal strategy of administrator is to keeps at the university the most talented professors.

The optimal strategy of the administrator, if the senior professor accepts the offer:

- keep both junior and senior, if $\theta_s \geq E(\theta_{jn})$ and $\theta_{j1}^s \geq E(\theta_{jn})$
- keep senior, if $\theta_s \leq E(\theta_{j3})$ and $\theta_s \geq \theta_{j1}^s$
- keep junior, if $\theta_s \leq E(\theta_{j3})$ and $\theta_s \leq \theta_{j1}^s$.

The optimal strategy of the administrator, if the senior professor rejects the offer:

- keep both junior and senior, if $\theta_s \geq E(\theta_{j2})$ and $\theta_{j21} \geq E(\theta_{j2})$
- keep senior, if $\theta_s \leq E(\theta_{j2})$ and $\theta_s \geq \theta_{j21}$
- keep junior, if $\theta_s \leq E(\theta_{j2})$ and $\theta_s \leq \theta_{j21}$. 

Figure 1. Optimal strategy of the administrator
At the stage 4 the senior professor as the head of department makes only one decision: he hires a new junior professor. In order to gain maximum payoff he should hire the most talented professor. He will hire a professor with talent equal \( \theta_{j^2} = \bar{\theta} = 1 \). In this case he receives in the last period the gain equal \( V - C + \alpha \bar{\theta} \).

At the stage 3 the senior professor should compare the expected payoff from leaving the post of the head of department and the expected payoff from staying further at this post. Payoff that he can gain at this stage from leaving the post of head of department depends on the optimal strategy of administrator, on the talent of the junior professor and on his own talent. He can gain:

- \( V - C + \alpha \theta_{j^1}, \) if \( \theta_s < \text{E}(\theta_{j^3}) \) and \( \theta_s < \theta_{j^1} \)
- \( V - C + \alpha \theta_{j^1} + V + \alpha \theta_{j^1}, \) if \( \theta_s \geq \text{E}(\theta_{j^3}) \) and \( \theta_{j^1} \geq \text{E}(\theta_{j^n}) \)
- \( V - C + \alpha \theta_{j^1} + V, \) if \( \theta_s < \text{E}(\theta_{j^3}) \) and \( \theta_s \geq \theta_{j^1} \).

At the last period he compares these payoffs with the payoffs from continuing to be the head of department taking a account the level of talent of the recruited junior professor. If \( \theta_s < \text{E}(\theta_{j^3}) \) and \( \theta_s < \theta_{j^1} \)

- and \( V - C + \alpha \bar{\theta} > 0, \) then he will prefer the strategy not quit post of the head of department to the strategy return to pure faculty post
- and \( V - C + \alpha \bar{\theta} < 0, \) then he will prefer the strategy return to pure faculty post to the strategy not quit post of the head of department.

If \( \theta_{j^1} \geq \text{E}(\theta_{j^3}) \) and \( \theta_s \geq \text{E}(\theta_{j^3}) \)

- and \( \alpha \theta_{j^1} < \alpha - C, \) then he will prefer the strategy not quit post of the head of department to the strategy return to pure faculty post
- and \( \alpha \theta_{j^1} > \alpha - C, \) then he will prefer the strategy return to pure faculty post to the strategy not quit post of the head of department.

If \( \theta_s \geq \text{E}(\theta_{j^3}) \) and \( \theta_s \geq \theta_{j^1} \)

- and \( C < \alpha \bar{\theta}, \) then he will prefer the strategy not quit post of the head of department to the strategy return to pure faculty post
- and \( C > \alpha \bar{\theta}, \) then he will prefer the strategy return to pure faculty post to the strategy not quit post of the head of department.
At stage 2 the senior professor should employ a new junior professor. He chooses a junior professor, keeping in mind what he can gain in the second period. If he decides to be a permanent administrator he will hire the most talented professor, this means that his maximum payoff from administrative career equals $2(V - C + \alpha\bar{\theta})$.

If he decides to be a temporary administrator (to be head of department only for one period) his optimal strategy depends on $\theta^s_1, \theta_s, E(\theta_{j3})$. His optimal strategy is the following:

- if $\theta_s > E(\theta_{j3})$, then he will hire the most talented junior professor $\theta^s_1 = \bar{\theta}$
- if $\theta_s < E(\theta_{j3})$ and $C > \alpha$, then he will hire a professor with talent $\theta^s_1 = \theta_s$.

At stage 1 professor should decide if he takes up the post of the head of department or not. He should keep in mind what he can gain from each strategy. If he decides to be a pure academic he expects the following gain $V + VP(\theta_s > \theta_{j13})$.

In order to find the equilibrium it is necessary to compare the gains from different strategies:

- **to be a permanent administrator**
  
  $2(V - C + \alpha\bar{\theta})$

- **if $\theta_s > E(\theta_{j3})$ to be a temporary administrator and hire a more talented professor**
  
  $V - C + \alpha\bar{\theta} + (V + \alpha\bar{\theta})$

- **if $\theta_s < E(\theta_{j3})$ to be a temporary administrator and hire a less talented professor**
  
  $V - C + \alpha\theta_s + \alpha\theta_s + V$

- **to be a pure academic**
  
  $V + VP(\theta_s > \theta_{j12}), \text{ if } \theta_s < E(\theta_{j2})$;

  $2V, \text{ if } \theta_s > E(\theta_{j2})$. 

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Expected payoff from strategy

- to be head of department during all period
- to be head of department one period.
- to refuse administrative career.
I assume that $\bar{\theta} = 1$, $\delta = 1$, $G = 0$. In the case of short-term contract I have the following equilibrium. I assume that $C > 0$, $\alpha > 0$, $V > 0$.

Optimal strategy of the senior professor depends on talents of professors, benefits from academic activities, and the level of job security. The optimal strategy of the senior professor, will be the following:

a) If $V < C$, $C > 2\alpha$, then the senior professor with any level of talent prefers to be pure academic.

b) If $V > C$, $C > 2\alpha$, $V + \alpha < 2C$, then the senior professor with the level of talent less than $\theta_s < (V - C)/(V - \alpha)$ prefers to be temporary administrator and hires a less talented professor, while the senior professor with the level of talent higher than $\theta_s > (V - C)/(V - \alpha)$ prefers to be academic all his life.

c) If $V > C$, $C > 2\alpha$, $V + \alpha > 2C$, then the senior professor with the level of talent less than $\theta_s < E(\theta_{jn})$ prefers to be temporary administrator and hires a less talented professor, while the senior professor with the level of talent higher than $\theta_s > E(\theta_{jn})$ prefers to be academic all his life.

d) If $C < 2\alpha$, $V < C$, $V > 2C - 2\alpha$, $V < 2C - \alpha$, then the senior with talent $\theta_s \in [0, (V - 2C + 2\alpha)/V]$ chooses to be permanent administrator, the senior with talent $\theta_s \in [(V - 2C + 2\alpha)/V, E(\theta_{jn})]$ chooses to be pure academic, the senior professor with talent $\theta_s \in [E(\theta_{jn}), 1]$ chooses to be temporary academic and hires the most talented professor.

e) If $C < 2\alpha$, $V < 2C - 2\alpha$, then the senior professor with talent $\theta_s \in [0, E(\theta_{jn})]$ chooses to be pure academic, the senior professor with talent $\theta_s > E(\theta_{jn})$ chooses to be temporary academic and hires the most talented professor.

f) If $C < 2\alpha$, $V > C$, $2C > V - \alpha$, then the senior with talent $\theta_s \in [0, (V - 2C + 2\alpha)/V]$ chooses to be permanent administrator, the senior with talent $\theta_s \in [(V - 2C + 2\alpha)/V, E(\theta_{jn})]$ chooses to be pure academic, the senior professor with talent $\theta_s \in [E(\theta_{jn}), 1]$ chooses to be temporary academic.

g) If $2C > V + \alpha$, $V > C$, $C < 2\alpha$, $C > 1.5\alpha$ then the senior professor with talent $\theta_s < (2\alpha - C)/\alpha$ prefers to be permanent administrator, the senior professor with talent $E(\theta_{jn}) > \theta_s > (2\alpha - C)/\alpha$ prefers to be temporary administrator and hires less talented professor, the senior professor with talent $\theta_s > E(\theta_{jn})$ prefers to be temporary administrator and hires the most talented professor.

h) If $2C < V + \alpha$, $V > C$, $C < 2\alpha$, $C > 1.5\alpha$, $(2\alpha - C)/\alpha < (V - 2C + 2\alpha)/V$ then the senior professor with talent $\theta_s < (2\alpha - C)/\alpha$ prefers to be permanent administrator, the senior with talent $(2\alpha - C)/\alpha < \theta_s < (V - 2C + 2\alpha)/V$
\( (V - 2C + 2\alpha)/V \) prefers to be temporary administrator and hires a less talented professor, the senior with talent \( (V - 2C + 2\alpha)/V < \theta_s < E(\theta_{jn}) \) prefers to be pure academic, the senior with talent \( \theta_s > E(\theta_{jn}) \) prefers to be temporary administrator and hires the most talented professor.

\( \text{i) If } V - 4C - 4\alpha > 0, V > C, C < 1.5\alpha, \text{ then the senior professor with talent } \theta_s < E(\theta_{jn}) \text{ prefers to be permanent administrator, the senior professor with talent } \theta_s > E(\theta_{jn}) \text{ prefers to be temporary administrator and hires the most talented professor.} \)

**Equilibrium**

*Optimal strategy profile* A. Professor holds up an administrative position, hires the most able professor less able than him, returns to the faculty status; administrator keeps at the university the most talented professors, if the values of parameters are the following:

- \( V > C, \quad C > 2\alpha, \quad V + \alpha < 2C, \quad \theta_s < (V - C)/(V - \alpha) \)
- \( V > C, \quad C > 2\alpha, \quad V + \alpha > 2C, \quad \theta_s < E(\theta_{jn}) \)
- \( 2C > V + \alpha, \quad V > C, \quad 1.5\alpha < C < 2\alpha, \quad E(\theta_{jn}) > \theta_s > (2\alpha - C)/\alpha \)
- \( 2C < V + \alpha, \quad V > C, \quad 1.5\alpha < C < 2\alpha, \quad V(2\alpha - C) < \alpha(V - 2C + 2\alpha) \)
  \( (2\alpha - C)\alpha < \theta_s < (V - 2C + 2\alpha)/V. \)

The professor will stay administrator for some time. He will hire a weak professor for this position. At the end he will return to the faculty status and will not be afraid of been dismissed. In this situation we see that the payoffs of academic activity are higher than payoffs of administrative activity.

*Optimal strategy profile* B. Professor holds up an administrative position, hires the most able professor, stays administrator; administrator keeps at the university the most talented professors, if the values of parameters are the following:

- \( C < 2\alpha, \quad V < C, \quad V > 2C - 2\alpha, \quad V < 2C - \alpha, \quad 0 < \theta_s < (V - 2C + 2\alpha)/V \)
- \( C < 2\alpha, \quad V > C, \quad 2C > V - \alpha, \quad 0 < \theta_s < (V - 2C + 2\alpha)/V \)
\begin{itemize}
  \item $2C > V + \alpha, \quad V > C, \quad 1.5\alpha < C < 2\alpha, \quad 0 < \theta_s < (2\alpha - C)/\alpha$
  \item $2C < V + \alpha, \quad V > C, \quad 1.5\alpha < C < 2\alpha,$
    \begin{equation*}
      V(2\alpha - C) < \alpha(V - 2C + 2\alpha),
      \quad 0 < \theta_s < (2\alpha - C)/\alpha.
    \end{equation*}
  \item $V - 4C - 4\alpha > 0, \quad V > C, \quad C < 1.5\alpha, \quad \theta_s < E(\theta_{jn}).$
  \end{itemize}

Optimal strategy profile C. Professor holds up a faculty position; administrator keeps at the university the most talented professors, if the values of parameters are the following:
\begin{itemize}
  \item $V < C, \quad C > 2\alpha, \quad \forall \theta_s$
  \item $C < 2\alpha, \quad V < C, \quad V > 2C - 2\alpha, \quad V < 2C - \alpha,$
      \begin{equation*}
        (V - 2C + 2\alpha)/V < \theta_s < E(\theta_{jn})
      \end{equation*}
  \item $C < 2\alpha, \quad V < 2C - 2\alpha, \quad 0 < \theta_s < E(\theta_{jn})$
  \item $C < 2\alpha, \quad V > C, \quad 2C > V + \alpha, \quad (V - 2C + 2\alpha)/V < \theta_s < E(\theta_{jn})$
  \item $2C < V - \alpha, \quad V > C, \quad 1.5\alpha < C < 2\alpha,$
    \begin{equation*}
      V(2\alpha - C) < \alpha(V - 2C + 2\alpha),
      \quad (V - 2C + 2\alpha)/V < \theta_s < E(\theta_{jn}).
    \end{equation*}
  \end{itemize}

It is more profitable for the professor not to become administrator. The payoff of academic activity is higher despite the risk of been dismissed. It is not profitable to be administrator even for a short period of time.

Optimal strategy profile D. Professor holds up position of the head of department for one period, hires the most able professor; administrator keeps at the university the most talented professors, if the values of parameters are the following:
\begin{equation*}
  \theta_s > E(\theta_{jn}), \quad 2\alpha < C.
\end{equation*}
Some comparative statics

While the cost $C$ grows the senior professor starts to prefer not to accept the offer of an administrator. The grow of $V$ in the case of low level of talent, inclines the professor to accept the offer of an administrator.

Tenure

Let us turn now to the analysis of the tenure. Tenure contract means that professor can not be dismissed the in second period. The senior professor chooses an academic post or an administrative post for one period. Professor chooses an academic post if $2\alpha < C$.

With the help of this model one can compare the quality of new coming professors in universities with various contract systems.

Conclusion

The analysis of equilibrium allows us to make following conclusion. For universities that set up only temporary administrative positions for their faculties, it is better to offer these positions for a long term. The rotation undermines the incentives of the faculty who are afraid of being replaced later, after their hiring services are no longer needed. This worsens the quality of junior faculty. In a system of term contracts, faculty is interested in holding to an administrative position, since this position is used for job security. In the case when universities set tenure contracts, rotation has no negative consequences. Rotation is necessary when no one wants to take up the position of the head of department, the burden of administrative work is not compensated by nonpecuniary benefits from participating in hiring better junior faculty. Tenure permits to increase the quality of staff without the need for making the senior professor suffer at administrative position.

References


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