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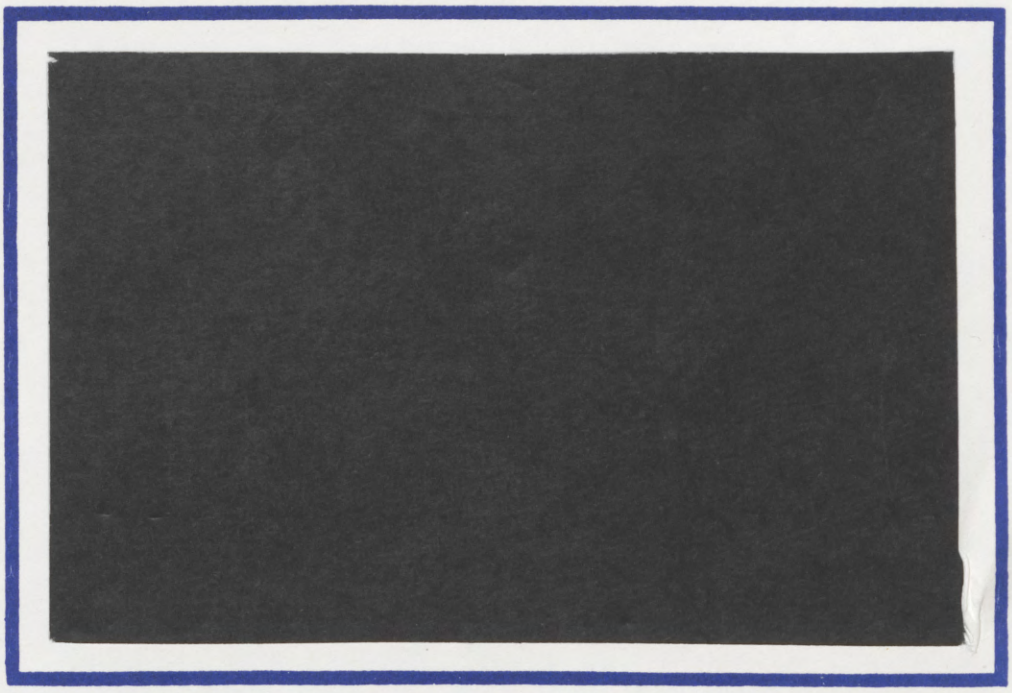

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# TENURE: CAN IT BE EXPLAINED BY AN 'EFFICIENCY WAGE' ARGUMENT

by

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# TENURE: CAN IT BE EXPLAINED BY AN 'EFFICIENCY WAGE' ARGUMENT

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## ABSTRACT

A two-period efficiency wage model is constructed to show that granting tenure may be a rational choice by a firm. The driving force is the idea that tenure has value to the employee who receives it. Consequently the turnover cost of tenured employees is lower than that of untenured. The difference is the benefit the firm draws from granting tenure. The cost involves the firm's commitment to employ the tenured employees at the second period. The fraction of tenured employees in the firm's labor force is the variable whose optimal choice maximizes the present value of profits.

## 1. Introduction

Why is there tenure?[1] This question attracts the thinking of economists who believe that: If offering tenure is a voluntary choice and the firms involved are rational maximizers, it ought to be optimal to do so. Put differently, it should be true that not granting tenure will decrease the expected utility of firms who normally do so.

A few alternative theories that generate implications which are consistent with the tenure phenomena appear in the economic literature. They are briefly summarized below.

Harris and Weiss (1984) follow a job matching approach which involves learning, overtime, of the quality of the employee to perform the job. In their model tenure is attained once the necessary quality is ascertained. At that point in time the match employer-employee becomes final and is not severed until retirement. They present two versions. In the first, a risk neutral employer faces risk neutral employees. In the second, a risk-neutral employer faces risk-averse employees. In the first version, as they note, the existence of tenure (in the sense that at one point in time the match becomes final) does not require a contractual tenure agreement. In the second version an insurance of the risk-averse employees by the risk-neutral employer plays a role. In this case, tenure is an outcome which, expost, the firm may wish to undo. It therefore resembles more the reality.

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[1] This question is the title of a paper by Ito and Kahn (1986). It is also included in the title of a paper by Carmichael (1988). The question mark emphasizes the theoretical puzzle that the existence of tenure causes.

Ito and Kahn (1986) formulate the optimal contract offered by a firm to an employee in the presence of double asymmetry of information. The employer cannot observe the level of the employee's effort and the employee cannot observe at least some of his efforts' returns to the employer. They present two versions, one with, and one without, expost negotiation. The optimality of prior commitment to a future wage without renegotiation is caused by the assumption that the employee has a decreasing absolute risk aversion which leads him to increase his effort if the promised (future) wage increases. The optimality of granting tenure in the form of a commitment to a future lower bound on wage along with expost renegotiation of the actual wage (above the guaranteed boundary) is obtained under the assumptions that the employee has, expost, an outside alternative with returns which are apriori random.

Carmichael (1988) observes that in academia: "new members of the team are selected by the incumbent members of the department..." rather than by the management, because "management does not have the ability to judge the talents of potential new hires...", whereas "...the incumbents at the firm do have this ability...". Carmichael claims that incumbents will not provide management with true information about potential recruits if that information will affect negatively their chances of keeping their jobs. He shows that to extract 'incentive compatible' information from incumbents requires the firm to grant the incumbents tenure.

This paper provides another alternative theory which implies that offering tenure may be an optimal choice by a firm. The theory draws on the efficiency wage paradigm which gained momentum in the early '80s. First of all because the paradigm's assumptions are realistic by themselves and thus sensible and more importantly because it can explain the existence of persistent unemployment, a phenomena which contemporary economists grope with. Katz (1986), Akerlof and Yellen (1986) and Stiglitz (1988) published surveys of the vast literature within the efficiency wage paradigm.

Incorporating ideas from the efficiency wage paradigm in an intertemporal framework generates a model which implies that offering tenure may be an optimal choice by a firm. It has some other attractive features in that it fits some relevant stylized facts. The model and its implications is presented in section 2; the model's implications are compared with some stylized facts in section 3, and section 4 contains concluding remarks.

## 2. A Two-Period Efficiency Wage Model with Tenure

### 2.1. A two-period assumption

Offering tenured positions to employees is an intertemporal commitment by a firm. It contractually guarantees a future employment to some if its employees. The simplest intertemporal model that enables an analysis of the choice of the number of tenured positions together with the choice of the levels of other variables which are under the firm's control requires two periods. Within a two-period model the firm guarantees (in the first period) the employment of some of its employees in the second period.

## 2.2. The 'turnover cost' assumption in a nutshell

The turnover cost assumption is a member of the 'efficiency wage' paradigm of behavioral assumptions. For the sake of completeness I will review the essence of the turnover cost assumption in a nutshell.[2] 'Turnover cost' is caused by voluntary labor mobility. Employed workers are searching for better alternatives. A worker who finds a better job quits. The firm has to replace him in order to keep its desired level of employment. The replacement of the flow of quits necessitates resources (hiring, training, etc.) which are costly. This cost is the 'Turnover Cost'.

The firm perceives its 'Turnover Cost' to decrease as it increases its wage relative to the wage distribution in the economy because increasing the wage decreases the chances of its workers finding a better job.[3] The firm is small relative to the labor market and thus perceives the wage distribution to be exogenous (i.e., its own choice of wage and employment level has a negligible effect on the wage distribution).

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[2]For a complete detailed survey of the idea and its applications see Stiglitz (1988), Katz (1986), and Akerlof and Yellen (1986).

[3]The desirability of a job is, in general, multidimensional. It depends on the wage, working environment, level of risk, etc. For simplicity, the wage, in this paper, is the sole attribute of the desirability of a job. All other attributes are ignored. Their inclusion will not alter the qualitative results.

### 2.3. 'Turnover Cost' and Tenure

Tenure has value to the employee over and above the instantaneous compensation (wage). Therefore, given the wage, the quit rate of tenured employees is lower than that of untenured. Consequently, the turnover cost of tenured employees is lower than that of untenured employees at any wage level chosen by the firm. The difference between the turnover cost of untenured and tenured employees is the benefit the firm draws from granting tenure. The cost involves the firm's commitment to employ the tenured employees in the second period at a wage above some lower bound which does not depend on the realization of the state of nature at the second period. Surely there exist bad states of nature at which the firm will lose because of its commitment to tenured employees.

### 2.4. Other assumptions

Workers (tenured or untenured) are assumed to be homogenous. The wage the firm pays its tenured and untenured employees is the same (tenure is therefore only a commitment to a future employment).[4] The guaranteed lower bound on the future wage of tenured employees is assumed to be exogenous for simplicity.

The firm is assumed to know the price of its output in the first period before it has to chose the levels of tenured and untenured employment and the wage it pays in the first period.

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[4]This assumption is made by Salop (1979) who justifies it by morale, moral hazard and capital market imperfections.

In the first period the firm has a perception of the distribution of its output price in the second period, but does not know the actual price that will be realized at that time. This perceived distribution is assumed (for simplicity) to be independent of the first period's price. Likewise, the firm has a perceived distribution on the possible realizations of wage distributions in the second period.

## 2.5. A formal presentation

A formal presentation of the firms' problem under the above characterization necessitates the following notation.

Let $p_i$, $w_i$ and $\ell_i$, denote the exogeneously given output price, the firm's choice of wage and employment level respectively in the i'th period, and let $t$ be the fraction of tenured employees in the first period. Let $G^i(\tilde{w})$ be the distribution of wages as perceived by the firm for the i'th period.

Let

(1) $$f = f(\ell_i)$$

be the production function which transforms labor into output and let

(2) $$h^t = h^t(w^1, G^1(\tilde{w}))$$

and

(3) $$h^u = h^u(w^1, G^1(\tilde{w}))$$

be the perceived 'turnover cost' per unit of labor (i.e., the average turnover cost) in the first period for tenured and untenured employees respectively, and let

$$(4) \qquad h = h(w^2, G^2(\tilde{w}))$$

be the turnover cost function in the second period. It is the same for all employees because the firm ends its life by the end of the second period.

$h^t$, $h^u$ and $h$ do not depend on the level of employment $\ell_i$ because the firm's share in the labor market is assumed to be negligible implying that the firm cannot affect the market's dstribution by its own choice of wage.

The production function $f$ is assumed to be an increasing concave function in $\ell$ and $h^t$ and $h^u$ are assumed to be decreasing convex functions in $w_i$. Correspondingly the following sign for the first and second derivatives are specified:

$$(5) \qquad f_\ell > 0, f_{\ell\ell} \leq 0; \; h^t_{w_1} < 0, \; h^t_{w_1 w_1} > 0; \; h^u_{w_1} < 0, \; h^u_{w_1 w_1} > 0;$$

$$h_{w_2} < 0, \; h_{w_2 w_2} > 0.$$

Also, since tenure is valued by employees we have:

(6) $$h^t(w_1, G^1(\tilde{w})) < h^u(w_1, G^1(\tilde{w})) \quad \text{for any } w_1.$$

In the second period the firm is committed to employ its tenured labor force, $t\ell_1$, at a wage which exceeds the exogenously given lower bound on the wage $\underline{w}$. Its problem in the second period after the price $p_2$ is realized is thus:

(7) $$\max_{w_2, \ell_2} \; p_2 f(\ell_2) - [w_2\ell_2 + \ell_2 h(w_2, G^2(\tilde{w}))]$$

subject to

(8) $$\ell_2 \geq t\ell_1 \quad \text{and}$$

(9) $$w \geq \underline{w}.$$

The constraint (8) is surely binding for low realizations of the output price $p_2$. Denote the solution to (7), (8) and (9) by: $\tilde{V}(t\ell_1, p_2, G^2(\tilde{w}))$.

Let the expected value of $\tilde{V}(\cdot)$, as perceived by the firm in the first period, before it chooses $\ell_1$, $w_1$ and $t$, be:

(10) $$V(t\ell_1) = \underset{p_2, G^2(\tilde{w})}{E} \; \tilde{V}(t\ell_1, p_2, G^2(\tilde{w}))$$

where $E$ is the expectation operator.

Clearly $V(t\ell_1)$ is a diminishing function. It is assumed to be concave and its derivative at zero is assumed to be zero. Formally:

$$(11) \qquad V'(t\ell) < 0; \quad V''(t\ell) < 0; \quad V'(t\ell_1 = 0) = 0.$$

The firm takes the effect of the choice of tenure on the expected profit of the second period, $V(t\ell_1)$, into consideration when it makes that commitment in the first period. Its first period's problem is thus:

$$(12) \qquad \underset{w_1,\ell_1,t}{\text{Max}} \; p_1 f(\ell_1) + \{-\left[\ell_1(w+th^t(w_1,G^1(\tilde{w})) + (1-t)h^u(w_1,G^1(\tilde{w})))\right]$$

$$+ V(t\ell_1)\}$$

subject to

$$(13) \qquad t \leq 1.$$

The term in the squared brackets is the labor cost in the first period. It includes the wage bill as wll as the turnover cost, which is the weighted average of the turnover cost of tenured and untenured workers. $V(t\ell_1)$ captures the (negative) effect of tenure on the firm's second-period's expected profits.

The maximization in (12) can be done in two stages. In the first stage the firm minimizes the cost of production for any given $\ell_1$ by choosing an optimal wage and an optimal fraction, t (of $\ell_1$) to be tenured. That is, the firm minimizes the negative of the term in the curly brackets in equation (12) for a given $\ell_1$.

In the second stage the firm chooses $\ell_1$ that maximizes (12) for the realized $p_1$.

Differentiating $\ell_1[w + th^t(w_1, G^1(\tilde{w})) + (1-t)h^u(w_1, G^1(\tilde{w}))] - V(t\ell_1)$ with respect to w and t, subject to the constraint (13), yields respectively the following first-order conditions:

(14) $$1 + th^t_w + (1-t)^u_{hw} = 0$$

and

(15) Either:

(a) $h^t(w_1, G^1(\tilde{w})) - h^u(w_1, G^1(\tilde{w})) - V'(\ell_1) < 0$ and $t = 1$

or:

(b) $h^t(w_1, G^1(\tilde{w})) - h^u(w_1, G^1(\tilde{w})) - V'(t\ell_1) = 0$ and $t < 1$.

Let $\ell_1(p)$ be the level of the labor force that maximizes equation (12), subject to equation (13), if the price is p. $\ell_1(p)$ is an increasing function by eq.(5). Note from equations (5) and (11) that there exists a value of $\ell_1(p)$, say $\ell^*$, such that for any $\ell_1(p) \leq \ell^*$ equation (15a) is satisfied, in which case all workers are tenured. For

any $\ell_1(p) > \ell^*$ equation (15b) is satisfied and only a fraction of the labor force is tenured.

The intuition is straightforward. If the firm employs in the first period a small number of employees, tenuring all of them will not generate a signficant risk of having too much labor in the second period. This is so because the realizations of the price, p, in the two periods are independent. Consequently, the associated second-period cost of tenuring is small leading the firm to take advantage of the lower turnover cost of tenured workers (in the first period).

Note from eq.(14) that when all workers are tenured (i.e., t=1), the wage chosen by the firm is that which minimizes the cost of tenured labor per unit, $w_1 + h^t(w_1, G^1(\tilde{w}))$, which includes the wage and the 'turnover cost' per unit. This wage is marked $w^*$ in figure 1.

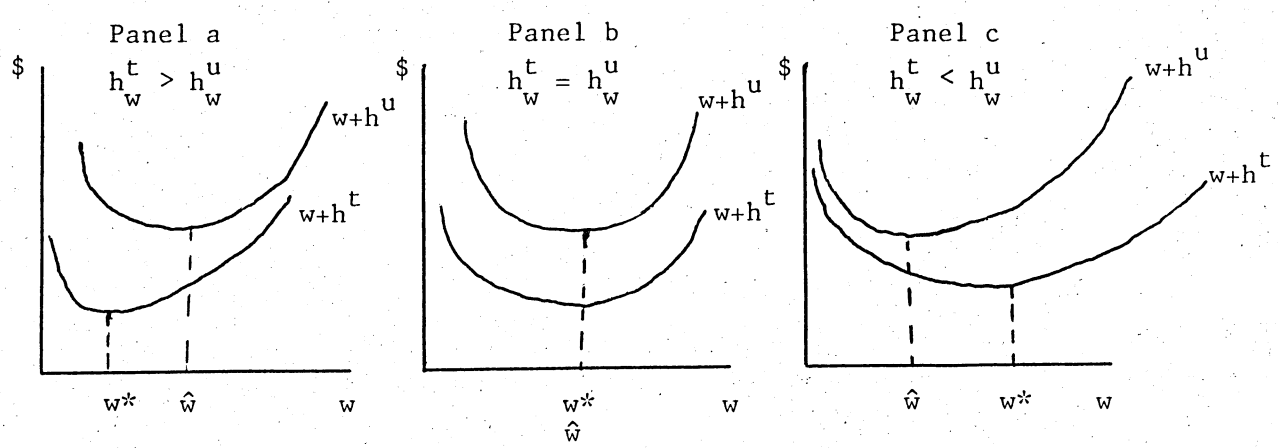


Figure 1

Thus $w^*$ is the optimal choice of wage for any output price $p < p^*$ where $p^*$ is the solution of

$$(16) \qquad \ell_1(p^*) = \ell^*$$

This invariance of the chosen wage to changes in the demand for the firm's output is indeed the hallmark of 'efficiency wage' models. It leads to the possibility of existence of unemployment in equilibrium (see, for example Salop (1979) and Summers (1987)). However, in a two-period model with an endogenous choice of the level of tenure the invariance of the chosen wage holds in general only for low price realizations (i.e. $p_1 \leq p^*$) in which case all workers are tenured, or in the special case where the turnover cost functions of tenured and untenured workers are parallel.

If the realization of the price, p, is high (i.e. $p_1 > p^*$), only a fraction of the employees are tenured. On this range of prices equation (15b) replaces equation (15a) and should hold simultaneously with equation (14). Yielding the following sign pattern:[1]

$$(17) \qquad \text{Sign } \frac{dw}{dp} = \text{sign}(h_w^t - h_w^u) \lessgtr 0 \quad \text{if} \quad h_w^t \gtrless h_w^u \ \forall \ w$$

$$(18) \qquad \text{Sign } \frac{dt}{dp} = -\ \text{sign}(th_{ww}^t + (1-t)h_{ww}^u) < 0 \ \forall \ w.$$

The sign in equation (18) is implied by the signs $h_{ww}^t > 0$ and $h_{ww}^u > 0$ (see equation 5).

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[1]See Appendix.

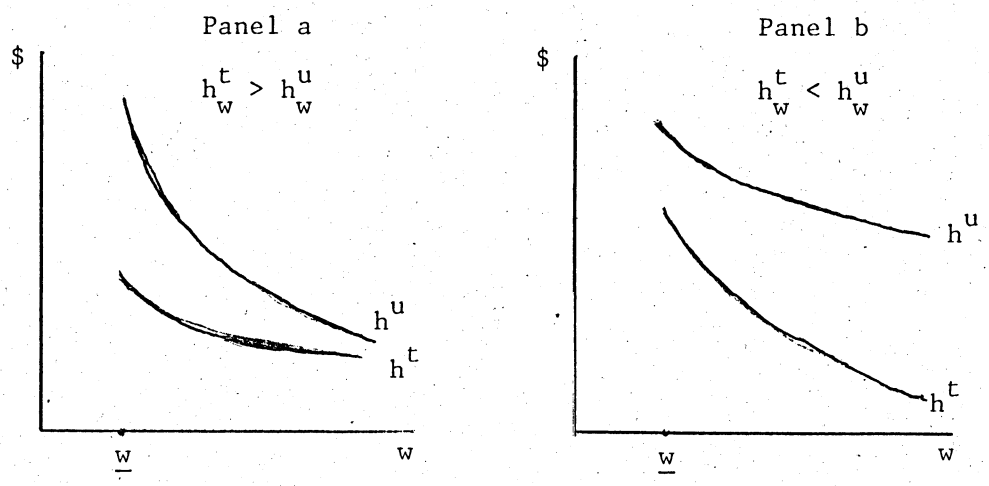


**Figure 2**

Turning to equation (17) note that $h_w^t > h_w^u$ implies that as $w$ increases $h^u$ and $h^t$ converge as demonstrated in figure 2, panel a. $h_w^t = h_w^u$ implies that $h^u$ is parallel to $h^t$. $h_w^t < h_w^u$ implies that $h^u$ and $h^t$ diverge as $w$ increases as is demonstrated in figure 2, panel b.

The corresponding graphs for the unit cost of labor, $w+h(w)$, appear in figure 1. $w^*$ is the wage that minimizes the unit cost of tenured labor and $\tilde{w}$ is the wage that minimizes the unit cost of untenured labor.

Note from equation (17) that as $p_1$ increases (on the range $p_1 > p^*$), the wage, $w$, chosen by the firm, varies from $w^*$ in the direction of $\hat{w}$, which is also the boundary of $w$. The chosen wage $w$

approaches $\hat{w}$ as the fraction of tenured labor, t, approaches zero as is implied by the first-order condition eq.(14). When $h_w^t > h_w^u$ the wage chosen by the firm increases continuously from $w^*$ to $\tilde{w}$ (see figure 1, panel a). When $h_w^t = h_w^u$, $w^*$ and $\hat{w}$ coincide in which case the optimal wage is invariant to changes in the output price (see figure 1, panel b).

If $h_w^t < h_w^u$ the optimal wage decreases from $w^*$ to $\hat{w}$ as the output price increases (on the range $p_1 > p^*$). This is summarized in the following proposition:

**Proposition 1**

There exists a price level $p^*$ such that:

(a) On the range of prices $p \leq p^*$:

(a1) All employees are tenured (i.e., $t = 1$)

(a2) The wage, $w^*$, chosen by the firm does not vary with the price and is chosen so as to minimize the unit cost of tenured labor.

(b) As the price, p, increases on the range $p > p^*$:

(b1) The fraction of tenured employees decreases

(b2) The wage varies from the wage, $w^*$, that minimizes the unit cost of tenured labor to the wage, $\hat{w}$, that minimizes the unit cost of untenured labor.

(b3) $\hat{w}$ is above (below) $w^*$ if the wage derivative of $h^t$ is larger (smaller) than the wage derivative of $h^u$ for any wage, $w$.

(c) The employment level, $\ell$, increases with the price, $p$, anywhere.

A graphical demonstration of the contents of this proposition appears in figure 3 for the case $h^t_w > h^u_w$.

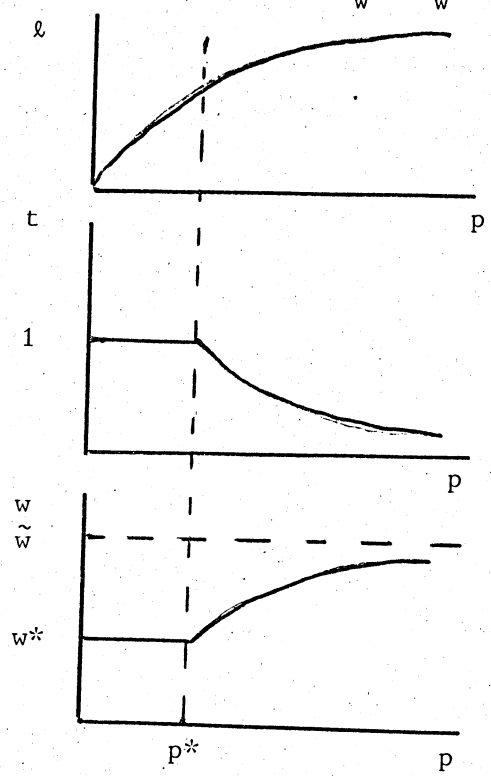


Figure 3

The intuition behind the proposition is straightforward. The unit cost of labor in this model is a weighted average of the unit costs of tenured and untenured workers, the weights being the corresponding fractions. As weight is shifted from tenured to untenured employment,

the wage that minimizes the average unit cost of labor shifts from the wage that minimizes the unit cost of tenured labor to the wage that minimizes the unit cost of untenured labor. Further, as p increases the desired level of employment increases. For a given fraction of tenured employees this raises the expected second period's marginal cost of the commitment to employ them. By reducing the share of the tenured workers the firm balances again the associated marginal benefit and cost.

## 3. The Model's Implications and Stylized Facts

The following is a list of some stylized facts which characterize the tenure phenomenon in the labor market

(a) Tenure is a one-sided guarantee. Workers can quit if they find a better job.

(b) Tenure is an effective commitment. In some possible future realizations of the state of nature the firm will be happy to undo expost its exante commitment.

(c) The firm responds to an increased demand by expanding more its untenured than tenured labor force, thereby the fraction of tenured employees decreases.

Some other related facts are:

(d) The firm responds to an increased demand by

(d1) increasing its labor force (in order to expand production) and

(d2) increasing (or leaving unchanged) the wage it pays its employees.

(e) There exists persistent unemployment in the labor market.

The model presented in section 2 is consistent with the facts a, b, c, $d_1$ and e without imposing additional structure on it.

Facts c and $d_1$ are the empirical counterparts of the proposition of section 2. Fact a is a direct empirical manifestation of the assumption that $h^t(w, G(\tilde{w}))$, although smaller than $h^u(w, G(\tilde{w}))$, is not zero for any w. Fact b follows from the positive probability of low price realization in the second period. Fact e follows since the firms are not wage takers. Rather, each firm chooses its own wage so as to minimize its perceived average labor cost (which includes the turnover cost as well as the wage bill). The firms' perceptions may be such that the employment levels chosen by them do not exhaust the supply of labor and thus not all workers will find jobs. This may cause firms to realize that their perceptions were erroneous and consequently revise them, but this is a slower process.

The fact $d_2$ is implied by the model if $h^t_w \geq h^u_w$. This requires the 'turnover cost' functions of tenured and untenured employees not to diverge (in the relevant range of wages) as the chosen wage increases. In terms of the graphical demonstration, $h^u(\cdot)$ and $h^t(\cdot)$ should relate to each other as in panel a in figure 2 (or be parallel) rather than as in panel b. Correspondingly the unit cost of tenured and untenured labor should relate to each other as in panel a or b in figure 1 and not as in panel c.

It can be argued that if the general framework of the model is correct, then it must be true that $h_w^t$ exceeds $h_w^u$ as this condition is necessary to generate consistency of the model with the stylzed facts. However, more can be said. The assumption $h_w^t \geq h_w^u$ is apriori logical by the 'turnover cost' argument itself, at least on the range of wages at the upper tail of the wage distribution. To justify this claim let the wage be the sole attribute of the quality of a job for employees. Let $\bar{w}$ be the upper bound on the perceived wage distribution and assume that those who quit are not (immediately) tenured in their new jobs. If the firm chooses $\bar{w}$ as its wage it perceives the nontenured as well as the tenured employees to have no better alternatives. Put differently the probability of finding a better job is zero for both. Correspondingly the turnover cost is the same for both. A leftward shift of the wage (from $\bar{w}$) increases the probability that the firm's employees may find higher paid jobs. Each job with a higher wage will be accepted by a nontenured employee if offered to him, but only a fraction (the highest wage offers) will be accepted by tenured employees, since the difference (between the offered wage and the current wage) should exceed the value of tenure. Thus, at least in the proximity of $\bar{w}$ the derivative of $h^t$ with respect to $w$ exceeds that of $h^u$ (the absolute value of $h_w^t$ is smaller than the absolute value of $h_w^u$).

## Concluding Remarks

The optimality of tenure is driven in this model by the firm's perception of its labor 'turnover cost' function. If the firm perceives the 'turnover cost' to be smaller for tenured than for untenured workers, the firm benefits in the present from granting tenure. The associated cost is the possible future losses in bad realizations of the state of nature, because the firm will then be stuck with too many tenured workers that should be compensated according to the guaranteed wage.

The behavioral characteristics of the model are consistent with some empirical facts of the tenure phenomena. In particular, tenure is a one-sided guarantee by a firm to an employee for a future employment. It is an effective commitment in that in some possible future realization the firm would be happy to undo expost its exante commitment. Also, the fraction of tenured employees decreases as the firm increases its labor force in response to an increase in the demand for its product.

This paper focuses attention on the phenomena of tenure. However, tenure is but an extreme form of seniority. The seniority rule arranges the employees by their order of likelihood of involuntary separation from their firm. The most senior are the least likely to be fired or laid off. The tenure contract guarantees future employment. However, this guarantee is limited. Surely tenured employees will lose their jobs in case of a firm's going bankrupt. Also, even if the firm is not

bankrupt the firm can fire a tenured employee if he does not satisfy the behavioral code in the terms of the tenure contract, a code which is typically vague enough to enable diverse interpretation.

Note now that the qualitative result of the optimality of tenure as obtained here will not be altered if instead of a full guarantee of future employment only a partial guarantee is offered. The strength of the guarantee only shifts the position of the turnover cost function. The stronger is the guarantee the lower will be the turnover cost.

The optimality of tenure is obtained in this model in spite of the assumption that workers are homogeneous. This leaves open the question who will obtain tenure. An obvious possibility is that tenure will be granted according to the order of recruiting. The first ones will be those who obtain tenure. This is indeed the rule under the seniority system which is typical in industry.

Replacing the assumption of labor homogeneity by the assumption of labor heterogeneity will not alter the conclusion that granting tenure is optimal. However, it might give the firm a better ranking criterion. The workers can be ordered by their quality and the best will receive tenure. This is indeed the criterion which is used in universities.

The behavioral difference between universities and industry in the tenure criterion may reflect the higher variance of the relevant quality in universities compared with the variance of the relevant quality in industry.

## APPENDIX

$t = 1$ on the range $\ell_1 \leq \ell^*$. In this case equation (14) reduces to

(A1) $$1 + h_w^t(w_i) = 0.$$

The solution $w^*$ does not depend on $\ell_1$. On the range $\ell_1 > \ell^*$ the solution is inernal. Equations (14) and (15b) should be satisfied simultaneously. Let $w(\ell)$ and $t(\ell)$ be the values of $w$ and $t$ which solve equations (14) and (15b) simultaneously. The associated derivatives, $\frac{dw}{d\ell}$ and $\frac{dt}{d\ell}$ are:

(A2) $$\frac{dt}{d\ell} = -\frac{tv''}{\Delta}(h_w^u - h_w^t)$$

and

(A3) $$\frac{dt}{d\ell} = -\frac{tv''}{\Delta}(th_{ww}^t + (1 - t)h_{ww}^u)$$

where:

(A4) $$\Delta = (th^t_{ww} + (1-t)h^u_{ww})\ell V'' - (h^t_{ww} - h^u_w)^2 > 0.$$

The sign follows from the second-order condition at a minimum).

Since $V'' < 0$ (see eq.11) it follows that

(A5) $$\text{Sign}\,\frac{dw}{d\ell} = \text{Sign}(h^u_w - h^t_w)$$

and

(A6) $$\text{Sign}\,\frac{dw}{dt} = \text{Sign}(th^t_{ww} + (1-t)h^u_{ww}).$$

Finally since $\ell$ increases with $p$ it follows that

(A7) $$\text{Sign}\,\frac{dw}{dp} = \text{Sign}\,\frac{dw}{d\ell}$$

and

(A8) $$\text{Sign}\,\frac{dt}{dp} = \text{Sign}\,\frac{dt}{d\ell}.$$

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