Status and Incentives

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The paper introduces status as reflecting an agent's claim to recognition in her work. It is a scarce resource: increasing an agent's status requires that another agent's status is decreased. Higher status agents are more willing to exert effort in exchange for money; better-paid agents would exert a higher effort in exchange for an improved status. Results are coherent with actual management practices: (i) egalitarianism is desirable in a static context; (ii) in a long-term work relationship, juniors' compensations are delayed; past performances are recompensed by pay increases along with an improved status within the organization's hierarchy.

Keywords: repeated moral hazard, internal labor markets, social status.
JEL classification: D82, L23, M12, J33.

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We should like to thank the editor and an anonymous referee for their fruitful comments and suggestions. We are also indebted to seminar participants at Fourgeot seminar (Paris), Institut d'Analisi Economica (Barcelona), Université d'Aix-Marseille 2, Université Catholique de Louvain, Université de Caen, Université des Sciences Sociales de Toulouse, University of Virginia, Stockholm School of Economics, Erasmus University and the participants in the workshop *Social Interaction and Economic Behavior* in Paris December 1999 for stimulating criticism and comments on an early version of the paper, participants at the conference *Organizational Behaviour, structure and Change; The Economics of Personnel and Organizations* in Toulouse May 2003, and especially Lucy White, for their comments and fruitful discussions. We are thankful to Thomas Mariotti and Marie-Christine Henninger for their help and suggestions. All remaining errors are ours.

1 Introduction

Although economists have put out a substantial amount of research on work incentives, their approach remains at odds with much of the management and organization literature on the subject. The logic of using money to induce effort, which is the main focus of economic analysis, is definitely a key feature of actual incentive packages. Yet, a mere description of monetary incentive schemes falls short of providing a full account of management practices. Even in cases where direct monetary incentives are used extensively they are associated with other types of benefits ranging from travel or merchandize to symbolic rewards. It is for instance a common practice to grant top sales people medals, rings, sculptures, plaques and so on, handed out during lavish ceremonies (see Nelson 1994). It is often argued that merchandize, although a poor substitute for money according to standard economic theory, is an effective means of providing incentives because of its trophy value: it reminds the winner and others of her/his high past performance. Wood (1998) quotes Will Haffer vice-president of sales with Bowne-publishing, reminiscing about winning a large screen TV: "Actually the main reason I wanted it was that it was the top prize. I could afford to buy a big screen but it was not the same as winning it."

Whereas the above examples suggest that there are some benefits in stressing differences among employees, the opposite point is often made that it is appropriate to adopt an egalitarian approach by expunging symbolic differences (see Pfeffer, 1994). There has been a substantial body of research, in the wake of Adams (1965), on the impact of "unequal" or "unfair" treatment on work motivation. According to Adams' "equity" theory, people react to inequity by making up for it. For instance, they lower their input if they feel that what they obtain in return is insufficient relative to others around them.[1] While status differences are enjoyed by those with a high status, they are disliked by those with a low status who, as a result, lose motivation. Hence, recognition should not be viewed as a cheap substitute for money. It has a cost because it is valued in relative terms: what matters is earning more recognition than others. In the present paper we propose a simple framework in which the desirability of using status to stress

[1] For economic arguments against large pay differences see Milgrom (1988) and Lazear (1989).

differences among organization members can be assessed.

Typically, sociologists use social status to capture the need for social recognition. As defined by Weber (1922), social status is "an effective claim to social esteem in terms of negative or positive privileges". He insists that a status ranking is not directly related to wealth or income though it may be affected by them. Thus, Veblen's theory (1899), in which status stems mostly from relative income or wealth, is somewhat restrictive.[2] An opposite argument could actually be made for the reverse causality: a higher status is the basis for earning a higher income. There is some experimental evidence, both from psychologists (Jemmott and Gonzalez, 1989) and economists (Ball and Eckel, 1996, Ball and Eckel, 1998, and Ball, Eckel, Grossman and Zame, 2001) that an exogenous and random distribution of status among individuals has a significant impact on their relative performance.[3] Belliveau *et ali.* (1996) study how CEO compensations are affected by the CEO's status relative to that of the compensation committee chair. They find that high status CEOs matched with low status compensation chairs are significantly better paid than low status CEOs matched with high status compensation chairs.

We consider a multi-agents moral hazard problem and allow for an agent's preferences to depend directly on her status as well as income and effort. There is not much debate among economists over the fact that individuals care about status. There is however some discussion over the proper modeling strategy. Letting social status be an argument of the utility function is what Postlewaite (1998) calls the "direct" approach. It may be traced back to Frank (1984)[4] and has found its most compelling support in an evolutionary argument developed in Fershtman and Weiss (1998). The proponents of an alternative "instrumental" approach, where status indirectly

[2]Empirically, there is obviously a strong correlation between social status and material well-being. There is for instance a clear positive correlation between the ranking of occupations in term of social status by respondents in surveys and the average income in these occupations. However, the status ranking of occupations may be much better explained if education is added along with income as an explanatory variable (see Perrot, 1999). See the survey by Weiss and Fershtman (1998) for references on the implications of Veblen's theory in economic models.

[3]Ball *et al.* (2001) created status by arbitrarily awarding a "gold star" (a pin) to half of the subjects. All the subjects then played a standard buyer/seller game (oral double auction). Status was found to be a significantly positive (and unconscious –the gold star was never mentioned in the strategy the players reported to follow) determinant of a subject's earnings. The result held whether it was clear or not to the participants that the gold star was awarded on an arbitrary basis.

[4]In the pioneering work of Frank (1984), status is derived from the ranking of relative income. This assumption, which is natural when dealing with macro-economic problems such as growth, consumption and saving, is not appropriate when focusing on internal labor markets. Firms differentiate employees' status through other means than relative income (e.g., the hierarchical structure). In fact wages are rarely public information in firms.

affects an individual's consumption level, criticize the direct approach for lacking robustness: results are sensitive to the specification of preferences (see Postlewaite, 1998). In Section 2 we argue in favor of preferences characterized by a complementarity between status and income: high status agents are willing to exert more effort in exchange for additional income while better paid agents are willing to exert more effort in exchange for an improved status. As sociologists would put it, agents exhibit a taste for status congruence.

Organizations may grant recognition to their members through various formal sources of status: wage distribution, distribution of scarce non monetary resources (such as offices, furniture, computers, locker rooms, dining facilities...), conspicuous awards or, most commonly, positions in the organization's hierarchy. Although some of these attributes clearly provide material benefits (more independence, more influence, better work conditions) many others are symbolic and their value to employees stems mostly from the social or psychological benefits they entail (self esteem or social recognition). Here we ignore material benefits and consider a pure status ranking that could ensue, for instance, from the ranking of positions in a formal hierarchy. The choice of a status allocation in a hierarchy is constrained by the production process (i.e., the technology). Yet there are many instances of firms in the same industry resorting to different hierarchies despite similar production technologies. For instance in the auto industry Toyota has seven layers of management between its CEO and employees on the factory floor, whereas Ford has seventeen and GM has as many as twenty-two (see Milgrom and Roberts, 1992). Using a panel of 300 US firms over the years 1986-1999, Rajan and Wulf (2003) find a significant trend of reduction in the number of layers in management over the period, while controlling for various variables pertaining to the firm's structure, in particular its size. This evidence suggests that firms are somewhat able to adjust hierarchies and this ability may be used to provide work incentives. In order to emphasize the relationship between status and work incentives we abstract from the technical role played by the hierarchy and leave much latitude to the principal to act as a social engineer.

Leaving technology aside, the principal still faces two categories of constraints. First, status

bestowed upon agents should be deemed legitimate in order to significantly impact their behavior. Our results show that, for incentive purposes, the principal only chooses to award different status levels to agents who have had different past performances: thus legitimacy may reasonably be rooted in such differences in performance. Our focus is rather on the second constraint that arises because status is enjoyed through interpersonal comparisons. Regardless of the method used to grant social recognition, its value is perceived in *relative* terms. For instance, if status is derived from a person's position in a formal hierarchy, in order to increase one agent's status, it is necessary to improve her position in the hierarchy relative to others who, inevitably, suffer some loss. In other words, status in organizations is a scarce resource.

Our results show that career profiles greatly differ depending on whether or not the employer may commit to long term incentive schemes. In a short term interaction with no commitment, the employer chooses to introduce limited status differentiation, which usually translates into a relatively flat hierarchy. Monetary compensations are performance based so that wages should reflect productivity differences. Indeed, in a one-shot work relations, status may not be handed out as a reward for good past performances. Then the relevant question is whether an employer would *ex ante* choose to differentiate status among *a-priori* identical workers. The answer is no. Although agents with a high status are more responsive to monetary incentives, the resulting benefits are outweighed by the impact of a lower work motivation for those with lower status. This short term result emphasizes the cost of status differentiation stigmatized in the human resource management literature.

In order to bring in the benefits of differentiation, we adopt a long term perspective and consider an organization comprised of overlapping generations of agents. We find that it is optimal to give young agents a status as low as possible along with no monetary incentives. Their motivation to work stems solely from the prospect of being promoted. For incentive purposes promotions are more substantial for those who have been successful in the past; they end up with prestigious positions paid above their marginal productivity. Because individual preferences exhibit complementarities between status and money, symbolic and material rewards reinforce

each other. By concentrating both types of compensations in the same time period and in the same state of nature, the organization exploits their complementarity so as to reduce the total wage bill. Although this differential treatment of older employees reduces instantaneous profit, the loss is more than compensated by the benefit resulting from the added incentives for junior employees. In other words an employer that is able to commit organizes an internal labor market where pay is attached to jobs, rewards are delayed in time and a larger income is associated with more recognition (e.g. a higher rank in the hierarchy). Whereas wage differences are small early in the career they become very substantial in excess of productivity differences as tenure increases. We show that these results are robust to the introduction of income risk aversion, a case where a standard repeated moral hazard model would prescribe to smooth consumption over time (see for instance Rogerson, 1985, Chiappori et al., 1994).

More complicated issues would arise if we were to take into account an equilibrium status allocation with multiple organizations. For instance Fershtman, Hvide and Weiss (2005) consider a model with competitive firms, each comprising one principal and two agents, where workers have the same productivity but different status concerns. They analyze the impact of cultural diversity in the work place on the labor market equilibrium.[5] Performing a similar equilibrium analysis for large corporations is challenging because large firms use their market power to shield their employees from market pressures.[6] As a first step the present paper focuses on internal labor markets.

We present the static setting in Section 2 where we describe the organization, the agents' preferences and the allocation of status among agents; we also establish that optimal short term incentives involve no differentiation in status among agents. The overlapping generations framework is introduced in Section 3 where we show that promotions are optimal if long-term commitment is feasible. Section 4 illustrates the empirical relevance of our theoretical findings

[5]They show that when status, which is based on wage comparisons, is derived locally (i.e., within the firm) firms choose to mix workers to enhance 'cultural trade'. This policy increases total output and wage dispersion. In contrast, when some workers care about global status (i.e., they compare wages with a reference group outside the firm) while others care about local status, segregation may arise.

[6]This is true to some extent only. For instance Lazear and Oyer (2004) exploiting Swedish data show that in the long term, wages are determined externally, presumably reflecting centralized bargaining.

through a comparison of work relations in the US and in Japan and Section 5 compares our approach to some related literature on work incentives. We finally provide concluding remarks in Section 6.

2 The cost of status manipulation

We consider the provision of work incentives to agents whose effort level is unobservable. If, as is usually assumed, an agent's preferences are fully characterized by a taste for money and a distaste for effort, incentives may be provided through monetary rewards and penalties. As we argued in the introduction, actual incentive procedures typically involve many non-monetary attributes that are valued mostly as signs of a greater workplace recognition. We use the concept of status to summarize the overall access to the psychological or social benefits that an employee may secure through her position in the organization. In this section we describe the static framework and show that it is costly to differentiate status among organization members when the work relationship is short term.

2.1 The organization

The organization (bureau, subdivision, firm,...) supervised by a risk-neutral principal. There are $n \geq 2$ workers indexed by $i = 1, ..., n$. They are *ex-ante* identical individuals, hired to do the same type of work, so that there is no *a priori* legitimate motive for treating them differently. The principal aims at maximizing expected profit, with profit π defined by

$$\pi(Q, w_1, ...w_n) = Q - \sum_{i=1}^{n} w_i. \tag{1}$$

where $Q = \sum_{i=1}^{n} q_i$ is total output (its price is normalized to 1) and w_i is agent i's wage.

Each worker contributes to the collective outcome by exerting an effort $e_i \geq 0$. The harder agent i works (the higher e_i is), the larger is the probability of a high output. Formally, individual i's output q_i may be either high $q_i = \overline{q}$, with probability $\mu(e_i)$ or low $q_i = \underline{q}$, with probability $1 - \mu(e_i)$ ($\overline{q} > \underline{q} > 0$). Individual output, and thus absolute performance, is verifiable. This is a case where direct individual monetary incentives are particularly appropriate. The probability

of a high performance for agent i increases with e_i at a decreasing rate. The function $\mu(.)$ is also assumed to be three times continuously differentiable with a strictly negative third derivative.[7]

Assumption 1 $\mu'(e) > 0, \quad \mu''(e) < 0, \quad \mu'''(e) < 0 \quad$ *for* $\quad e \geq 0, \quad \lim_{e \to +\infty} \mu'(e) = 0.$

We next discuss in some detail the two novel ingredients of our framework: the employee's preferences and the allocation of status in the organization.

2.1.1 Employees' preferences

A key feature of our approach is the specification of the agents' preferences that assumes some complementarities between status and income. We postulate the following utility function:

$$u(w, s, e) = sw - \psi(e), \qquad s \geq 0, \ w \geq 0, \ e \geq 0. \tag{2}$$

where s is status, w is wage income and e is effort. The disutility of work, ψ, is taken to be a strictly increasing, strictly convex and twice continuously differentiable function and has a strictly positive third derivative.[8]

Assumption 2 $\psi'(e) > 0 \quad \psi''(e) > 0 \quad \psi'''(e) > 0 \qquad$ *for* $\quad e \geq 0.$

This specification reflects in a simple manner the agents' taste for money and status and their distaste for effort. Setting status equal to 1 yields as a special case the standard quasi-linear utility, so that our results may be readily compared with predictions of a standard moral hazard framework. Linearity with respect to wage indicates that agents are risk neutral regarding income. In subsequent sections, we discuss how our results may be affected if this assumption is relaxed.[9] The requirement that status and wages should be positive is a normalization. Utility could easily be rewritten to allow for non zero lower bounds. The important point is that there are such lower bounds.

[7] This condition, along with some similar condition on preferences in Assumption 2, ensures the convexity of an agent's optimal effort with respect to work incentives.

[8] See footnote 7.

[9] The interpretation of linearity with respect to status is provided in section 3.

Since income and status are both positively valued, indifference curves relating these two variables for a given effort level are strictly decreasing. This reflects the substitution between status and income. However preferences over status and income are strictly convex so that there is not a perfect substitution between these two variables: a prestigious title does not compensate for the absence of wages, nor does a good wage make up for the contempt of others. Utility also has important implications for the income-effort and status-effort tradeoffs. Formally, the marginal rate of substitution between effort and income is decreasing in status while the marginal rate of substitution between effort and status is decreasing in income. These cross effects may be best interpreted by relating them to the psychological analysis of work motivation and the conventional wisdom prevailing among management practitioners.

We first consider the impact of a change in status on the income/effort tradeoff. Our specification of preferences implies that, for a given level of monetary incentives, an agent should be all the more willing to exert effort that she has a higher status. The literature on job satisfaction suggests that a higher status enhances work commitment. On the one hand, status is closely related to the need for recognition which has been found to be a key factor in job satisfaction (e.g. Dunette, Campbell and Hakel, 1967). On the other hand, many studies have shown that a low job satisfaction results in high turnover and absenteeism rates.[10] Tahlin (1999) found in a study on job mobility in Sweden that everything else being equal people with low status (i.e., a low prestige score according to Treiman, 1977) are more likely to make a voluntary job shift than people with high status. It should be expected that a low satisfaction also results in shirking which, contrary to absence and resignation, is not easily observable.[11]

We now examine how the trade-off between effort and status is affected by a person's income. According to our specification of preferences, richer agents care more about their status in the sense that they are willing to exert more effort in order to improve it. The hierarchy of needs proposed by Maslow (1954) provides a nice interpretation of this phenomenon. Maslow argues

[10] See for instance Day and Hamblin (1964), Baum and Youngblood (1975).

[11] Many studies have shown that there is a positive correlation between job satisfaction and quality of services (see Varma *et al.*, 1999). A positive effect of status on productivity has been found by Greenberg (1988) in a study on office reallocation.

that there is a five levels hierarchy of human needs ranking from bottom to top: physiological needs, safety needs, social needs, esteem needs and self-actualization needs. Higher level needs correspond to less material (more psychological) preoccupations. A person develops a taste for higher level needs only after fulfilling those at lower levels. In the present context, income is the means of fulfilling material satisfaction while status is the means of fulfilling psychological satisfaction. Then, individuals with low income are mostly preoccupied with material needs and care little about status while those with higher income having satisfied their material needs are mostly concerned about increasing their status. Various observations, either in the work place or in broader social contexts, illustrate the relevance of Maslow's construction. Certers and Bugertal (1966) find evidence that factors at the top of Maslow's hierarchy play a more important role for employees earning higher wages. This is consistent with the logic applied by practitioners when they use non monetary compensations. A human resource management guide indicates that using merchandize to reward employees is inappropriate for those earning low wages while such prizes are highly valued by those who are paid sufficiently well (see Nelson, 1994). Similarly, rich people seeking social recognition through the funding of charity or fine arts reflects such a shift in tastes caused by a higher income.[12]

The next section describes how the organization may allocate status among agents.

2.1.2 Status in the organization

Social status is a scarce resource because it is valued in relative terms. In order to model its scarcity let us define $s = (s_1, ..., s_n)$ as a status allocation in a feasibility set $S \subset \mathbb{R}^n_+$, the ith component measuring the status of agent i. Scarcity of status is reflected by the property that it is not possible to improve an agent's status without worsening some other agent's status. The feasibility set S is therefore analogous to a Pareto frontier. Secondly, individuals being *ex ante* identical, the feasibility set should satisfy an anonymity condition: if a status allocation

[12]For instance children with high income parents typically select high status positions (see Treiman and Ganzeboom, 1990 and Lillard and Reville, 1997). On a more anecdotal note, Cornellius Vanderbilt Whitney earning a Ph.D. for the sheer pleasure of being referred to as Doctor Whitney illustrates this appetite for status among rich people (see Fussell, 1983).

is feasible, then any permutation of this allocation is also feasible. Finally, we assume that the status feasibility set is convex. Scarcity and anonymity together with convexity, imply that feasible status allocations must satisfy the following linear constraint:[13]

$$\text{(F)} \qquad \sum_{i=1}^{n} s_i - n = 0,\ s \in \mathbb{R}^n_+.$$

Overall status summing up to n is a normalization. Any other strictly positive constant would lead to the same results. However, n has the convenient property that, when no status disparity is introduced, all agents have a status of 1 so that our results may easily be contrasted with those of the classical moral hazard literature with quasi-linear agent preferences.[14]

Finally we assume that, contrary to wages, status is awarded *before* the agent exerts effort. The status of an agent is based on her situation within the organization, typically her position in the hierarchy, within a given period. This is consistent with our interpretation of preferences where recognition induces work satisfaction which in turn induces a higher responsiveness to monetary incentives. Any attempt by the principal to reallocate status once work has been completed, for instance by awarding a medal to employees who have performed well, will only impact the agents' status in future periods, all the more so that they remain in the same organization.

Before characterizing the optimal short term incentive scheme, we briefly describe a benchmark first-best solution.

2.2 First best allocation

We now discuss what would be the optimal incentive scheme in the first-best situation where each agent may fully commit to a contractible effort level as well as to an unconditional participation in the organization. This first-best analysis is meant to provide intuition about the solution that the principal would ideally favor, rather than to make a statement about the welfare implications of our setup. Since the only binding constraint is the *ex-ante* participation constraint of the agents,

[13] The linear functional form is a consequence of the convexity assumption. It is somewhat restrictive and is meant to ease the exposition of the results (especially in the optimization problem). Some discussion of the robustness of our results to more general functional forms is provided in Section 3.

[14] Here status may be adjusted continuously (preferences are defined for a continuous variable). In contrast Dubey and Geanakoplos (2004) study the relative merits of absolute versus relative rewards in providing incentives when preferences are only defined over status rankings.

it is optimal for the principal to offer each agent to participate in a lottery where a unique winner receives all of the status and is the only employee being paid whereas all agents commit to exert the same first-best level of effort. The main argument in the proof is that, instead of having two agents with positive status, the joint status could be given to only one, where each of them would receive this total status with some probability. The added status for each agent when she is paid exactly compensates her for a lower probability of being paid. This allows for paying each agent less often, thus lowering the expected wage bill.[15] Because of the complementarities between status and income, it is optimal to concentrate status and monetary compensations on one individual so as to lower the wage bill. One might think that the optimality of a lottery depends on income risk neutrality or on the linearity of the status feasibility constraint. It turns out that the result is quite robust.[16]

Actual work relations allow for much less commitment on the part of the agent than what was postulated here. Henceforth we investigate the implications of our model in more realistic settings. We first reconsider the static problem.

2.3 Optimal short term incentives

Real world work relations typically involve a moral hazard problem since effort levels are not perfectly verifiable. Furthermore, the ability of an agent to commit is limited by work legislation which usually forbids clauses that would prevent her from quitting at any time. The moral hazard problem and the agent's lack of commitment translate into incentive compatibility constraints and interim participation constraints respectively. The information structure of a static relationship is as follows:

stage 1: the principal offers contracts stipulating each agent's status and wages;

stage 2: agents choose whether or not to participate;

[15] The lottery divides the total wage bill by n relative to what it would be when agents have identical status with probability 1. The individual probability to win the lottery is $\frac{1}{n}$. The prize is $s^{win} = n$ and $w^{win} = \underline{U} + \psi(e^*)$ where e^* is the first best effort level (i.e., it solves $\psi'(e) = \mu'(e)\Delta q$). With such a lottery individual expected utility is $\underline{U}$, each agent commits to effort level e^* and the total wage bill is $\underline{U} + \psi(e^*)$, to be compared to $n\big(\underline{U} + \psi(e^*)\big)$ when agents have identical status and all receive a wage with probability 1.

[16] A lottery is still optimal if, utility is linear in one argument and either the agent is risk averse regarding income, or utility is strictly concave in status. See section 3 for related arguments.

stage 3: interim information (the draw of a lottery, if any) is revealed and agents choose whether to quit or not;

stage 4: agents chose their effort levels;

stage 5: outputs are observed and payments are made.

The new constraints are a consequence of stages 3 and 4. The interim stage 3 may seem unnatural in this context and is solely introduced for the sake of comparability with the first-best solution by allowing for lotteries before the task is carried out. The lottery in the first-best contract violates both the interim participation constraint of stage 3 and the incentive compatibility constraint of stage 4.[17]

At stage 5, status is already determined from stage 3. As in the classical principal/agent setup there is no point to running lotteries on monetary rewards alone. Payments may however depend on output. Let $\underline{w}_i$ be agent i's fixed salary and Δw_i be agent i's bonus in case of a high performance (i.e., $\underline{w}_i+\Delta w_i$ and $\underline{w}_i$ are agent i's wages associated to outputs $\overline{q}$ and $\underline{q}$ respectively). Worker i chooses her effort so as to maximize:

$$EU_i = \Big(\mu(e_i)\Delta w_i + \underline{w}_i\Big)s_i - \psi(e_i). \tag{3}$$

Under assumptions 1 and 2, the agent's utility is strictly concave in effort and therefore has a unique maximum point. Agent i's optimal effort, $e^*(s_i\Delta w_i)$, solves the following first order condition,

$$\frac{\psi'(e^*(s_i\Delta w_i))}{\mu'(e^*(s_i\Delta w_i))} = s_i\Delta w_i. \tag{4}$$

Standard comparative statics shows that, from the concavity of μ and the convexity of ψ, e^* is increasing in $s_i\Delta w_i$. It is independent of $\underline{w}_i$ due to income risk neutrality. Moreover, as can be seen from Equation (A1) in Appendix A, sign restrictions on third derivatives of μ and ψ ensure that e^* is concave.

Taking into account additional constraints, the principal's program may be written as

$$\max E\sum_{i=1}^{n}\Big\{\mu(e_i)(\Delta q - \Delta w_i) - \underline{w}_i + \underline{q}\Big\} \tag{5}$$

[17] It is *a-priori* less apparent whether the added constraints rule out lotteries all together. Proposition 2 shows that they do.

subject to

$$\sum_{i=1}^{n} s_i = n, \qquad \text{with probability 1,} \tag{6}$$

$$s_i[\mu(e_i)\Delta w_i + \underline{w}_i] - \psi(e_i) \geq \underline{U} \qquad \forall\ i = 1, ..., n, \text{ with probability 1,} \tag{7}$$

$$e_i = e^*(s_i \Delta w_i) \qquad \forall\ i = 1, ..., n \text{ with probability 1.} \tag{8}$$

We omit *ex-ante* participation constraints since they are implied by interim participation constraints. The following proposition states three conditions that should hold in an optimal allocation and which, in short, say that a higher status goes hand-in-hand with a higher income.

Proposition 1 Under Assumptions 1 and 2, an optimal solution has the following properties with probability 1.

(i) $\Delta w_i \leq \Delta q \quad \forall i = 1, ..., n.$

(ii) $\Delta w_i = \Delta q$ or $\underline{w}_i = 0 \quad \forall i = 1, ..., n.$

(iii) $s_i < s_j$ if and only if $\underline{w}_i = \underline{w}_j = 0$ and $\Delta w_i < \Delta w_j$, or $\underline{w}_i < \underline{w}_j$.

Proof: See Appendix A.

Part (i) is the standard result that there is no point for the principal in giving more than full incentives. Part (ii) is also quite standard: given that the agent is risk neutral regarding income, the principal abstains from giving full incentives only when she is restricted in the choice of the low performance wage. The novel insight is in part (iii). It states that agents with differing status, either receive different low performance wages (the higher status agent being better paid) or receive different incentives (the larger high performance reward going to the higher status agent). That is, different status levels imply an unequal treatment in monetary as well as symbolic rewards. This logic is exploited fully in the first best solution, where the whole status and money is concentrated on one agent. It enables the principal to save on the wage bill by taking advantage of the complementarity between status and income in the agent's preferences. However, as the next proposition shows, the lack of commitment on the agents' part, makes unequal treatment among agents suboptimal.

Proposition 2 (symbolic egalitarianism) Under Assumptions 1, 2 and 3, in order to maximize instantaneous profit, it is optimal to give identical agents identical contracts (same status, same monetary scheme).

Proof: See Appendix A.

Assumption 3 is a technical condition that is provided in the Appendix and is used to establish the result when limited liability constraints may be binding. As we now show, it is quite straightforward to establish the result when limited liability does not bind. Consider the case where at least one agent, i, receives a strictly positive low performance wage. Then it is easy to show that if some other agent's status differs from that of agent i, profit may be increased. To see this, note that (iii) in Proposition 1 implies that the agent with the larger status necessarily has a strictly larger expected utility (which is therefore strictly above $\underline{U}$). Moreover her low performance wage must be strictly positive since it is at least as large as that of agent i (see (iii) in Proposition 1). Hence the low performance wage of the agent with a larger status may be decreased without violating her incentive constraint nor her individual rationality constraint so that profit would increase. The situation where the principal chooses to give strictly positive low performance wages arises when $\underline{U}$ is large enough, namely when[18]

$$\underline{U} > \mu(e^*(\Delta q))\Delta q - \psi(e^*(\Delta q)). \tag{9}$$

Appendix A analyzes the case where $\underline{U}$ is low so that limited liability may be binding.

The argument above uses the property that status and wages are substitutes in the agent's utility so that, if status differs across agents, the principal may save on wages by paying less those agents whose status is higher. This however conflicts with the result established in Proposition 1 that, if status and wages may be adjusted jointly, they should be used as complements. It is therefore never optimal to differentiate status across agents.

Proposition 2 is a first formulation with the tools of economics of the equity theory in social

[18]This lower bound is obtained as follows. The status of the agent getting the worst treatment may not exceed 1. Since, from (i) in Proposition 1, monetary incentives may not exceed Δq, if (9) holds, her individual rationality constraint requires that she receives a strictly positive low performance wage. From our previous argument all agents must therefore have an equal status of 1. Then (ii) in Proposition 1 prescribes that all agents be rewarded Δq for a high performance.

psychology according to which it is harmful to introduce differences among workers performing identical tasks (see Adams, 1965). Indeed, hierarchical differences among workers are an obstacle to communication, cooperation, and commitment for those who are in lower positions. Pfeffer (1994) argues that "symbolic egalitarianism" is a key feature of human resource management in successful companies. He describes such examples as the car manufacturer NUMMI, where the executive dining room has been eliminated, or the manager of the contract manufacturer Selectron giving up his/her private office. The well documented story of Nucor Corporation is another striking illustration (see Ghemawat, 1995). The success of the company, which is known for a profitability way above the rest of the steel industry, cannot be explained by a technological advantage (its technology is similar to that of most of its competitors). It is explained by its innovative human resource management. In line with the results in Proposition 2, external signs of hierarchical differences are systematically eliminated (no personal secretary, common parking lot, everybody flying economy class, and so on). Moreover the number of layers in the executive hierarchy has been restricted to 4 against a dozen on average for the rest of the industry. Nucor relies on direct monetary rewards to provide work incentive. The average Nucor salary is comparable to the competitors' average salary, but its structure is more incentive based.

In a short term relationship only technological constraints motivate the introduction of a hierarchy. We now turn to the study of incentive schemes in long term work relationships.

3 Status and promotions

3.1 Overlapping generations in the organization

Work relationships between individuals and organizations are in general medium to long term.[19] As workers stay longer than one period within the organization, the principal has more instruments to provide them with work incentives than in the previous section. Indeed she can replicate the static contract, but she can also propose an intertemporal incentive scheme that links future rewards to past performances. We study this problem within an overlapping generations setup

[19] For more on this see Milgrom and Roberts (1992).

with an infinite horizon. At each date, the organization comprises two "generations": the "young" (juniors) who enter the organization in the current period and the "old" (seniors) who joined the organization in the previous period and will not be around in the next one. Hence each cohort only stays two periods. Lotteries are ruled out and we assume that the principal is able to commit. Finally we restrict the analysis to equitable contracts: all young agents at period t are offered the same two period contract. Thus identical agents (i.e. with identical résumés) receive an identical treatment. Proposition 2 suggests that this restriction is reasonable.[20] The timing for a cohort joining the organization at date t is as follows.

date t:

stage 1, the new cohort is offered contracts stipulating a beginning status, a monetary incentive scheme and a promotion system (future status and wages depending on past performance);

stage 2, agents choose whether or not to participate;

stage 3, agents choose efforts based on current monetary incentives and status as well as promotion prospects;

stage 4, outputs are observed, transfers and promotions occur;

date $t+1$:

stage 5, agents choose whether to stay or to leave;

stage 6, workers choose an effort level according to their current monetary incentive and status (which may depend on how successful they have been in the first period);

stage 7, outputs are observed, transfers occur, workers retire.

Stage 5 implies that, as is the case in actual work contracts, an agent may not commit for two periods. Hence an individual rationality constraint for old agents must be imposed.

Each agent's intertemporal utility is additively separable with a discount factor of $\delta < 1$.[21]

[20] Internal equity, which fulfills the requirement of status legitimacy, is often mandatory by law. For instance in France it is against the law to pay identical jobs differently. The rule is "à travail égal, salaire égal" (articles L.133-5, 4ème alinéa and L.136-2, 8ème alinéa in Code du Travail). Firms have been prosecuted for violating this rule.

[21] In this specification, we do not allow for income and consumption in a given period being different. Our results below would not be affected by introducing a credit market as long as workers do not have a better access to that market than the principal.

The expected utility of an old agent exerting effort e_{pt} whose past performance has been $p \in \{l, h\}$ (l is for "low" and h is for "high") is as in equation 3:

$$EU_{pt} = \big[\mu(e_{pt})\Delta w_{pt} + \underline{w}_{pt}\big] s_{pt} - \psi(e_{pt}). \tag{10}$$

A young agent's expected intertemporal utility for an effort e_{1t} is

$$EU_{1t} = s_{1t}\big[\mu(e_{1t})\Delta w_{1t} + \underline{w}_{1t}\big] - \psi(e_{1t}) + \delta\big[\mu(e_{1t})\Delta U_{t+1} + EU_{l(t+1)}\big]. \tag{11}$$

where $\Delta U_t = EU_{ht} - EU_{lt}$. Individual rationality constraints are:

(IR') $\qquad EU_{pt} \geq \underline{U},\ p \in \{h, l\} \qquad \text{and} \qquad EU_{1t} \geq (1+\delta)\underline{U}.$

Let e^* be implicitly defined by equation (4). It is easy to check that the incentive compatibility constraints for young and old agents may be written as,

(IC') $\qquad e_{1t} = e^*\big(s_{1t}\Delta w_{1t} + \delta\Delta U_{t+1}\big) \qquad \text{and} \qquad e_{pt} = e^*\big(s_{pt}\Delta w_{pt}\big) \qquad p \in \{h, l\}.$

The population is large so that it may be represented by a continuum with a measure normalized to 2. Then, at each period, the proportion of old who have been successful when young, denoted γ_t, is equal to the probability $\mu(e_{1,t-1})$ that, in the previous period, a young agent had a high performance. The feasibility constraint on status allocation is:

(F') $\qquad s_{1t} + \gamma_t s_{ht} + (1-\gamma_t)s_{lt} = 2 \qquad \text{with } \gamma_t = \mu(e_{1,t-1}).$

Let $c_{1t} = (s_{1t}, \underline{w}_{1t}, \Delta w_{1t})$ denote the contract of a young agent at date t, and $c_{pt} = (s_{pt}, \underline{w}_{pt}, \Delta w_{pt})$ denote the date t contract for an old agent with performance $p \in \{h, l\}$ at date $t-1$. As in the static model the principal faces three types of constraints at each period: (F'), (IR'), (IC'). She must pick a sequence of contract combinations $< (c_{1t}, c_{ht}, c_{lt}) >$ that maximizes intertemporal profit subject to those constraints. The principal has the same discount factor as workers, $\delta < 1$, so that there is no exogenous bias against, or in favor, of delayed monetary rewards. Her intertemporal profit may be written as:

$$\sum_{t=0}^{+\infty} \delta^t E\Pi_t = \sum_{t=0}^{+\infty} \delta^t \Big\{ \mu(e_{1t})\big(\Delta q - \Delta w_{1t}\big) - \underline{w}_{1t} + \gamma_t\Big[\mu(e_{ht})\big(\Delta q - \Delta w_{ht}\big) - \underline{w}_{ht}\Big] \tag{12}$$
$$+(1-\gamma_t)\Big[\mu(e_{lt})\big(\Delta q - \Delta w_{lt}\big) - \underline{w}_{lt}\Big] + 2\underline{q}\Big\}.$$

Initial conditions, γ_0, c_{h0} and c_{l0}, are exogenously given. Finally we define a steady state to be a situation in which (c_{1t}, c_{ht}, c_{lt}) is independent of time (i.e. all generations are offered the same intertemporal contract).

We now show that viewing promotions as an instance of status differentiation among workers yields valuable insights as to their role in intertemporal incentive schemes.

3.2 Incentives and promotions

In view of the various constraints that pertain to the dynamic profit optimization problem, one would expect that the exact nature of the solution depends very much on which of these constraints are binding. Although this is true to some extent, the results in the next proposition are quite general.

Proposition 3 (incentives through promotion) Under Assumptions 1, 2 and 3, in a steady state of a profit maximizing solution we have

$$s_1 = \underline{w}_1 = \Delta w_1 = 0, \tag{13}$$

$$s_h > s_l. \tag{14}$$

$$\underline{w}_h \geq \underline{w}_l \text{ and } \Delta w_h \geq \Delta w_l, \tag{15}$$

where at least one of the inequalities in (15) is strict.

Proof: See Appendix A.

The above proposition provides a crisp characterization of the optimal intertemporal incentive scheme. It is optimal to endow young agents with the lowest possible status level while providing them with no direct monetary incentive.[22] Junior workers earn the same salary independent of performance. They are induced to exert effort by the prospect of a future promotion. That is, pay is attached to job and earnings profiles become individual specific only as careers unfold. When old, an agent's status and monetary incentive scheme depend on her past performance.

[22] As explained earlier utility could easily be rewritten to allow for non zero lower bounds (e.g., $u(w, s, e) = (w + 1)(s + 1) - \psi(e)$). The important point is that there are such lower bounds.

As in the static context, it is optimal to combine a higher wage with a higher status. However, in contrast with the egalitarian solution of Proposition 2, it is optimal to introduce some differentiation between generations and among old agents. A higher past performance induces a higher status as well as higher monetary compensations. This solution allows for taking advantage of complementarities between status and income by concentrating benefits in both dimensions on one state of nature. This is reminiscent of the first-best solution in the static problem where all of the status and wages are concentrated on one individual.

An important result in the literature on repeated moral hazard is that the optimal long term incentive contract should involve some memory: the type of incentives currently given to an agent depends on her past performance (see for instance Rogerson, 1985, and Chiappori et al., 1994). The idea is that, if agents are risk averse, it is optimal to spread over time the effect of income shocks resulting from good or bad performances; this is the need for consumption smoothing emphasized by Malcomson and Spinnewyn (1988). It implies that it is not optimal to delay all rewards and penalties as prescribed by Proposition 3. An obvious difference between the model of this paper and the standard repeated moral hazard framework is the agents' attitude towards risk on income. We now briefly explore the robustness of our results to the introduction of some income risk aversion in the agents' preferences.

3.3 Robustness

In our treatment of risk aversion we concurrently discuss the robustness of the results to a change in the status technology. In the model considered here, the status constraint is linear and utility is linear in status. This may loosely be interpreted in saying that there are constant returns to concentrating status on one group of individuals. It might be expected that, if those returns were sufficiently decreasing, the result that the young should have a minimal status would be upset. There are two possible options for making returns to concentrating status decreasing: either the left-hand side of the status feasibility constraint could be made strictly quasiconvex or utility could be made strictly concave in status. The second route is followed in the argument below.

Let us rewrite instantaneous utility as

$$u(w, s, e) = g(s)h(w) - \psi(e),\ s \geq 0,\ w \geq 0,\ e \geq 0, \tag{16}$$

where h and g are concave and strictly increasing functions satisfying $h(0) = g(0) = 0$.

Proposition 4 Suppose that the agent's instantaneous utility is linear in income (h linear) or linear in status (g linear) and that there is sufficiently little discounting. Then in any steady state of an optimal solution we have $s_1 = \underline{w}_1 = \Delta w_1 = 0$.

Proof: See Appendix A.

The result that young agents should receive a minimal status is upheld when either income risk aversion is introduced or utility is strictly concave in status. Because earnings and status are complements, individuals are willing to take gambles in which winners receive both a higher income and a higher status. Becker, Murphy and Werning (2000) obtain related results while studying the evolution of inequalities when individuals care about income and status and the two are complements.[23] Here the principal exploits the complementarity to elicit effort at a lower wage cost.

4 Job tenure and career profiles

Combining Propositions 2 and 3 our results indicate that an organization will resort to status differentiation for incentive purposes only when it can set up an internal labor market (ILM)[24]. More specifically, in a long term relationship, rewards for a high performance are delayed in time and a pay increase is associated with a change in status, which usually is achieved by a move up in the hierarchy (i.e., a promotion). Differences in productivity are then reflected in wages only for senior employees. That is, earnings profiles are upward sloping and differences in earnings across individuals widen with seniority. In contrast, if commitment is not possible, no

[23] They do not consider a problem of moral hazard. They obtain the nice result that starting from different distributions of wealth, society ends up with a unique unequal distribution.

[24] According to Doeringer and Piore (1971) the main features of an internal labor market are: long term employment relationships, limited port of entry for hiring, career paths within the firm and promotion from within.

status differentiation is introduced and incentives are provided through direct monetary rewards. Employees with different productivity are paid different wages so that individual earnings profiles split apart early on in the career. To assess the relevance of the theory we now confront these predictions with some stylized facts.

The feasibility of an internal labor market hinges on the employees' expected tenure within the organization. A comparison of work relations in the United States and in Japan illustrates the two situations of strong and weak commitment. According to the US Bureau of Labor Statistics the average person in the US holds 9.2 jobs from age 18 to age 34. More than half of these jobs are held between the age of 18 and 24 (Department of Labor 2000).[25] By contrast in Japan labor mobility is low for young core workers. For instance 3/4 of Japanese engineers will have only one employer during their entire career (Jacobs and Herbig, 1998). Hashimoto and Raisian (1985), using data from the 1960s and 1970s, indicate that among male workers holding a job for at least 5 years when they are 20-24 years old, 65% retain that job 15 years later in Japan against 30% in the United-States. These differences have been remarkably stable since the early 1970s.[26]

The present analysis predicts that, while young, Japanese core workers are put at the bottom of the hierarchy and receive relatively low wages, independently of their education level. Differentiation comes later in the career so that the earnings profile is increasing with seniority with increasing disparities among individuals. By contrast, in the US young workers who are very mobile do not accept delayed rewards. Their earnings profiles are relatively steeper at young ages (i.e., under 35). Earnings, which better reflect workers' productivity, are also more differentiated across education levels. This implies that the disparity in earnings is higher for young workers in the US than in Japan.

According to the Bureau of Labor Statistics real earnings of individuals in the US increase

[25] This does not mean that there is no internal labor market in the US. ILMs do exist and they are quite stable (see Groshen and Levine, 1998). However they tend to begin late in the career (i.e., after age 35). As Farber (1999) shows, most new jobs in the US end early, and the probability of a job discontinuation declines with tenure.

[26] For updated data see Brown et al 1997 p. 31.

more rapidly at young ages than at older ages.[27] Young American workers who face flat tenure-earnings profiles change job to increase their earnings. Topel and Ward (1992) found considerable returns to between-job mobility in a study of white male high-school graduates. The reverse happens in Japan, where earnings profiles increase with age at an increasing rate. "White-collar and blue-collar pay tables are integrated into a single table that erases distinctions between the two categories. There is also no major gap between production workers and craft workers. New workers are placed at the bottom of the ability rank table and given simple assignments." (Brown et al., 1997 pp 105). This implies that for young workers (i.e., below age 30) the level and variance of earnings are low. As predicted by our theory, differentiation appears with seniority and a pay raise is coupled with a change in status. "Much of the career-based pay increases take place only when, and if, workers are promoted to managerial positions that are not in the union, generally after age 35." (Brown et al., 1997 p. 111).[28] Figures 1 and 2 that are borrowed from Brown et al. (1997) pp. 117 and 118 illustrate the results discussed above.

[Figures 1 and 2]

Figure 1 depicts earnings by age and education in the automobile industry and in the electrical industry in Japan and in the US; Figure 2 gives earnings profiles by age and education at the national level. In Japan differentiation in earnings comes after age 35 and the earnings gap between different type of workers widens with age.[29] In contrast in the US earnings increase (sharply for educated workers) in junior years but not necessarily afterwards and the earnings gap between educated and non educated workers widens until age 35-39. Since the industries studied are standardized these dissimilarities may not be attributed to differences in the technology. They reflect different management practices.

We have treated job mobility differences between the two countries as given and argued that they could explain differences in compensation policies in a way that is consistent with our the-

[27] From the age of 18 to 24, real hourly earnings grow on average by 6.6 percent per year. This growth rate falls to 4 percent between age 25 and age 29 and then to 2.4 percent between age 30 and age 34 (US Department of Labor 2000).

[28] University graduates may reach management in 10 years, typically by the time they reach ages 35 to 40. High school graduates may reach management in twenty-two years, and most have reached a management grade by age 50.

[29] This is true until 55. After that age companies encourage workers to retire.

oretical analysis. There might be many other underlying differences between the two economies that could jointly explain differences in mobility as well as differences in work compensation practices that we are not controlling for. Furthermore, our theoretical predictions are, in some respects, similar to those of other theories that aim at explaining internal labor market. In the next section we describe the extent of our contribution in relation to that existing literature.

5 Related work on internal labor markets

Our analysis provides a novel theoretical underpinning for why promotions might be preferable to direct monetary incentives and also predicts how an individual's earnings profile over time is affected by the expected span of the work relationship. Although these two issues are tightly intertwined, they have been to a large extent considered separately in the existing literature.

The relationship between tenure and pay in internal labor markets has attracted a lot of attention. The use of large prizes only attributed at specific times in a career is often interpreted as an attempt by firms to improve employee attachment (see for instance Becker, 1962, Salop and Salop, 1976, or Lazear, 1979). Lazear (1979) argues that firms that want to invest in firm specific human capital offer a back-loaded compensation structure to retain their workers. In light of this theory, the differences between compensation policies in the US and in Japan reflect more investment in firm specific human capital in Japanese firms than in US firms. The interpretation we propose here provides some additional insights in two ways. First the firm specific human capital explanation establishes a causal link between commitment and delayed monetary rewards. According to that theory, delayed pay increases are a means of fostering commitment on the part of employees so that, if such commitment is stronger for some exogenous reason, there is less motive for delaying rewards. Hence the firm specific human capital hypothesis is inconsistent with the data if, as is often argued, differences in job mobility for young workers in Japan and the US are due to cultural differences.[30] Our analysis on the contrary assumes that commitment is

[30]Hofstede (1980) identified four dimensions along which dominant patterns of culture can be ordered: power distance, uncertainty avoidance, individualism, masculinity. Later he added long-term orientation. Japan scores higher than the US on all dimensions except for individualism.

exogenous but would also apply if commitment were induced by the prospect of garnering future rewards. Second, the firm specific human capital motive is hard to asses empirically. Farber (1999) who tries to explain the high return to tenure by testing the firm-specific human capital theory, does not find much support for it.[31] By contrast, our theory states that monetary rewards are delayed so as to be associated with changes in status resulting from promotions, because this is the most cost effective way of providing incentives to young employees. We jointly explains the timing of monetary rewards and the use of promotions as an incentive tool. As we argued above, the coincidence of pay increases with promotions is a well documented characteristic of the Japanese ILMs.

The extensive use of promotions for incentive purposes has also been widely discussed. Direct monetary transfers allow for a better fine tuning of the incentive scheme contrary to promotions which are discrete and rare. One explanation for the use of discrete incentive schemes is that it is not always possible to assess absolute performance whereas relative performances are somewhat easier to establish. Then promotions may be viewed as a prize in a tournament between employees as in Lazear and Rosen (1981). This leaves open the question of why, in practice, promotions involve a change in status along with a pay raise and why they are used so extensively (and not only when absolute performances are unobservable). The present theory provides a link between wage profiles, hierarchical structure and tenure in firms.

Another possible way of linking the evolution of wage earnings over time with the evolution of a worker within the firm's hierarchy is to view promotions as a means of screening employees. For instance Gibbons and Waldman (1999) propose a model where there is no room for work incentives and workers' productivity is heterogenous. Promotions are then used as a screening device to match the more productive workers with the tasks where performance is more sensitive to the worker's productivity. They argue that their setting explains many observed characteristics of compensation schemes and notably the fact that salary increases are larger when they are associated with a promotion. Such pay increases exactly reflect productivity increases and would

[31] He concludes that "the capital that accrues with tenure has a strong industry-specific rather than firm-specific component. To the extent that this is the case, it is harder to argue that the accrual of firm-specific capital is what drives the decline in the probability of job change with tenure".

not occur if the move upwards in the hierarchy did not correspond to a change in the individual's job. Yet, as Milgrom and Roberts (1992, Chapter 11) note, some companies such as 3M or IBM have sought to avoid a conflict between the incentive and screening objectives, by creating separate career ladders for scientists and engineers so that they may be promoted without having to go into management. Similarly, faculty members in universities, or physicians in hospitals are generally promoted without changing job. Furthermore, as Lazear (1991) points out, when promotions do involve an actual change in the employee's tasks, the associated wage increases are oftentimes out of proportion with any reasonable guess on the increase in marginal productivity resulting from switching to a job higher in the firm's hierarchy. In our setting, promotions involve no job changes and the concentration of rewards at the end of the career implies that those who are promoted are paid above their marginal productivity.[32]

One difficulty with using data on promotions to test the theory is that promotion systems and hierarchies must meet various functional goals such as production efficiency and screening, encouraging firm-specific investment in human capital as well as providing work incentives to employees by creating stimulating career paths within the firm. These potentially conflicting objectives lead to identification problems. It would therefore be very useful to resort to different type of data to evaluate how status differentiation is used jointly with monetary rewards to provide work incentives. For instance our results are consistent with the common practice of offering executives a variety of perks. Rajan and Wulf (2004) test on a panel of 300 publicly traded U.S. firms, over the period 1986-1999, whether perks (i.e., executive jets, chauffeur driven cars, country club membership) are managerial excesses, as generally argued in the corporate finance literature, a strategy to take advantage of income tax rates discrepancies or else are aimed at enhancing the managers' status or productivity. They find little empirical support for the tax explanation and, at best, mixed evidences for the private benefit explanation. By

[32]In Auriol and Renault (2001) we investigate the implications of Proposition 3 for the specific shape of the optimal incentive hierarchy assuming that $\mu(e) = \min\{e, 1\}$ and $\psi(e) = A\frac{e^2}{2}$. We find that the harder it is for an employee to improve performance through effort (i.e., the larger A), the more pyramid-like is the incentive hierarchy. Indeed when A is very large success is rare; it is extremely prestigious to get promoted and the associated pay raise is huge (it diverges in the limit). On the other hand if a high performance is easily achieved a seniority based promotion system may be optimal (i.e., everybody is successful and is promoted).

contrast they find that pay and perks are positively correlated (even when controlling for firm size, industry and year), and that larger, older, more hierarchical organizations offer more perks. They also find that more productive employees at the top of a firm's hierarchy tend to get more perks. They conclude that perks may likely serve to enhance managers' status and firms' productivity. Oyer (2005), focusing on broader types of benefits, argues that benefits may be motivated by productive efficiency. For instance, company-provided meals or child-care services are found to empirically enhance employees' effort. He explains this result by the substitution between domestic tasks and work. Unfortunately he does not consider the status issue. Some additional insight could be gained by exploiting large panels of firms and individuals such as that of the LEHD program at the US Census Bureau described by Abowd *et al.* (2004). In particular, it would be interesting to look at how personnel management practices differ across firms characterized by different turnover rates and thus, different degrees of commitment.[33]

6 Conclusion

The paper argues that social recognition has a major role in the work place. Social aspects are all the more significant that much of labor relations take place outside the market and are medium to long term. Our analysis relies on the following two premises: recognition and income are complements and recognition is scarce because it is valued in relative terms. Our main findings are that, while it is costly to introduce differentiation between identical coworkers in a static environment, such a differentiation may prove to be quite a powerful incentive device in a dynamic setting. In the intertemporal incentive scheme, pay is attached to job, rewards are delayed in time and a larger income is associated with more recognition. From an empirical perspective the proposed framework yields predictions on the shape of the compensation scheme in relation with the hierarchical structure in ILMs and in spot markets. Stylized facts are consistent with our results.

Our theoretical analysis predicts that internal labor markets are a superior mode of work

[33]Davis and Haltiwanger (1999) provide evidence that different job reallocation rates across firms induces different turnover rates and that firms are very heterogenous with regard to job reallocation.

organization. If this is the case one may wonder why firms do not resort to them more systematically. This might not be always possible. To organize an internal labor market, firms need not only to commit to keep employees, but also to be large enough or growing to propose stimulating career paths. For firms in recession or in unstable economic environment flexibility matters so that commitment is not possible. There is then no benefit to creating a hierarchical structure for incentive purposes. In recent years there has been a significant move towards delayering in industrial countries. For instance the study by Bauer and Bender (2001) on a representative German employer-employee data set reveals that between 1993 and 1995 50.73% of the 251 firms sampled went through a reduction in hierarchy levels. Similarly using a panel of 300 US firms over the years 1986-1999, Rajan and Wulf (2003) find that the firms' depth (i.e., the number of positions between the CEO and division heads) has decreased by more than 25% over the period.[34] According to our analysis, this evolution may be the result of a weakening employer's commitment which could be explained by an anticipated increase in the job loss rate. Indeed there is evidence of such an increase during the 1990s (see Farber, 1997).

[34]For instance General Electric (chemical division) cut the number of pay grades from 22 to 5 (Gerhart and Milkovich, 1992).

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Appendix A

Proof of Proposition 1 Proofs of conditions (i) and (ii) are straightforward: First note that, for a given status level, s_i, total surplus is a strictly concave function of effort, which reaches a maximum at $e^*(s_i\Delta q)$. Thus if $\Delta w_i > \Delta q$, total surplus may be increased by decreasing Δw_i. Then profit may be increased while keeping the agents' utility unchanged by increasing $\underline{w}_i$. By a symmetric argument, if $\Delta w_i < \Delta q$ and $\underline{w}_i > 0$, profit could be increased by increasing Δw_i and decreasing $\underline{w}_i$.

Proof of condition (iii): First note that in the optimal incentive scheme we must have: $(\underline{w}_i, \Delta w_i) = (0,0) \Leftrightarrow s_i = 0$. Thus if $s_i = 0$ the result holds. Second, when $s_j > s_i > 0$, we prove the result by showing that if (iii) does not hold the principal can increase her profit by decreasing marginally the status of agent j and increasing by the same amount the status of agent i while adjusting their wages to exactly compensate for the change in utility.

Let ϕ be the composition of μ and e^*, $\phi = \mu \circ e^*$. The probability μ being increasing and concave in effort, ϕ is concave as long as e^* is concave, which is the case under assumptions 1 and 2. This can be seen from

$$e^{*\prime\prime}(x) = \frac{(e')^3[x\mu'''(e) - \psi'''(e)] + 2(e')^2\mu''(e)}{\mu'(e)}. \qquad (A1)$$

Consider a change in status for some agent i by some amount ϵ and consider some changes in wages that keep the agent's utility constant: since effort is chosen optimally by the agent, when taking the derivative of utility with respect to ϵ the envelop theorem implies that only the direct impact of changes in status and wages need be considered. First suppose that $\underline{w}_i > 0$ so that from (ii), $\Delta w_i = \Delta q$. Then let $\alpha_i(\epsilon)$ be the low performance wage that keeps utility constant. Thus $\alpha_i(0) = \underline{w}_i$ and the derivative of $(s_i+\epsilon)[\alpha_i(\epsilon)+\Delta q\phi((s_i+\epsilon)\Delta q)]$ with respect to ϵ must be zero so that $\alpha_i'(\epsilon) = -\frac{\alpha_i(\epsilon)+\Delta q\phi((s_i+\epsilon)\Delta q)}{s_i+\epsilon}$ (where the derivative with respect to the term inside ϕ is ignored due to the envelop condition on effort). If $\underline{w}_i = 0$ then utility may be kept constant by setting the reward for a high performance at a level $\beta_i(\epsilon)$ such that $(s_i+\epsilon)\beta_i(\epsilon) = s_i\Delta w_i$. Hence $\beta_i(0) = \Delta w_i$ and $\beta_i'(\epsilon) = -\frac{\beta_i(\epsilon)}{s_i+\epsilon}$. Finally note that if we consider the profit generated by

agent i's work, its derivative with respect to ϵ evaluated at $\epsilon = 0$ is merely the change in the expected wage bill $\alpha_i'(0)$ or $\phi(s_i\Delta w_i)\beta_i'(0)$. In the former case, since $\Delta w_i = \Delta q$, the effort level maximizes profit subject to the individual rationality constraint and thus the envelop theorem applies. In the latter case, there is no change in effort since $(s_i + \epsilon)\beta(\epsilon)$ is kept constant.

Now assume $s_j > s_i > 0$. We show that profit may be increased by an $\epsilon > 0$ transfer of status from j to i along with an adjustment in wages so that both agents' utility levels remain unchanged. From (i) and (ii), if (iii) does not hold, three cases may arise.

Case 1: $\underline{w}_i > \underline{w}_j > 0$ (and $\Delta w_i = \Delta w_j = \Delta q$). The derivative of profit with respect to ϵ evaluated at $\epsilon = 0$ is $\alpha_j'(0) - \alpha_i'(0) = \frac{\underline{w}_i}{s_i} - \frac{\underline{w}_j}{s_j} + \Delta q\big(\frac{\phi(s_i\Delta q)}{s_i} - \frac{\phi(s_j\Delta q)}{s_j}\big)$. This derivative is strictly positive because, $\phi(s\Delta q)$ being concave and equal to 0 when $s = 0$, $\frac{\phi(s\Delta q)}{s}$ is decreasing in s.

Case 2: $\underline{w}_i > \underline{w}_j = 0$ and $0 < \Delta w_j < \Delta w_i = \Delta q$. The of profit with respect to ϵ at $\epsilon = -$ is $\beta_j'(0) - \alpha_i'(0) = \frac{\underline{w}_i}{s_i} + \big[\frac{\phi(s_i\Delta q)\Delta q}{s_i} - \frac{\phi(s_j\Delta q)\Delta q}{s_j}\big] + \big[\frac{\phi(s_j\Delta q)\Delta q}{s_j} - \frac{\phi(s_j\Delta w_j)\Delta w_j}{s_j}\big]$, which is positive because $\frac{\phi(s\Delta q)}{s}$ is decreasing in s, (see case 1) and $\phi(s\Delta w))\Delta w$ is increasing in Δw.

Case 3: $0 < \Delta w_j < \Delta w_i \leq \Delta q$. The derivative of profit with respect to ϵ for $\epsilon = 0$ is $\beta_j'(0) - \beta_i'(0) = \big[\frac{\phi(s_i\Delta w_i)\Delta w_i}{s_i} - \frac{\phi(s_i\Delta w_j)\Delta w_j}{s_i}\big] + \big[\frac{\phi(s_i\Delta w_j)\Delta w_j}{s_i} - \frac{\phi(s_j\Delta w_j)\Delta w_j}{s_j}\big]$, which is strictly positive because $\frac{\phi(s\Delta q)}{s}$ is decreasing in s, (see case 1) and $\phi(s\Delta w))\Delta w$ is increasing in Δw.

Finally, the "if" part of Condition (iii) does hold since if $s_i = x_j$, monetary incentive for the two agents will be the same.

We prove Proposition 2 under the following assumption

Assumption 3 *The functions μ and ψ satisfy*

$$\frac{\psi''(e)}{\psi'(e)} \leq -\frac{2\mu''(e)}{\mu'(e)}. \tag{A2}$$

Proof of Proposition 2. We have shown in the text, after Proposition 2, that if $\underline{w}_i > 0$ for some i then all agents in the organization must have equal status, and thus by virtue of Proposition 1(iii), the same contract.

Now consider agents for whom $\underline{w}_i = 0$ and (IR) does not bind. Setting the first derivative of expected profit with respect to Δw_i to 0, the optimal solution $\Delta w^*(s_i)$ must satisfy

$$\frac{\partial E\Pi}{\partial \Delta w_i} = s_i e^{*\prime}(s_i \Delta w^*(s_i))\mu'(e^*(s_i \Delta w^*(s_i)))(\Delta q - \Delta w^*(s_i)) - \mu(e^*(s_i \Delta w^*(s_i))) = 0. \qquad (A3)$$

Applying the inverse function theorem, we have $\Delta w^{*\prime}(s_i) = -\frac{\partial^2 E\Pi}{\partial \Delta w_i \partial s_i} / \frac{\partial^2 E\Pi}{\partial \Delta w_i^2}$. The second partial with respect to Δw_i is:

$$\frac{\partial^2 E\Pi}{\partial \Delta w_i^2} = s_i^2(\Delta q - \Delta w_i^*)[e^{*\prime\prime}\mu'(e^*) + (e^{*\prime})^2\mu''(e^*)] - 2s_i e^{*\prime}\mu'(e^\star). \qquad (A4).$$

It is strictly negative if e^* is concave which is true by Assumptions 1 and 2. The cross partial is

$$\frac{\partial^2 E\Pi}{\partial \Delta w_i \partial s_i} = (\Delta q - \Delta w_i^*)\Big[s_i \Delta w_i^*\big(e^{*\prime\prime}\mu'(e^\star) + (e^{*\prime})^2\mu''(e^*)\big) + e^{*\prime}\mu'(e^*)\Big] - \Delta w_i^* e^{*\prime}\mu'(e^*). \quad (A5)$$

The expression in (A5) is strictly negative, if the expression in the bracket is negative. The expression in the bracket is the derivative of $\gamma(x) = xe^{*\prime}(x)\mu'(e^*(x))$ with respect to $x = s_i \Delta w_i^*$. Using the first order conditions for optimal effort, we obtain that $\gamma(x) = e^{*\prime}(x)\psi'(e^*(x))$. Thus, using (A1), $\gamma'(x) = e^{*\prime\prime}\psi'(e^*) + (e^{*\prime})^2\psi''(e^*) = (e^{*\prime})^2\psi'(e^*)\Big[\frac{e^{*\prime}[x\mu'''(e^*) - \psi'''(e^*)]}{\mu'(e^*)} + \frac{2\mu''(e^*)}{\mu'(e^*)} + \frac{\psi''(e^*)}{\psi'(e^*)}\Big]$ which is negative by Assumptions 1, 2 and 3. Hence the partial derivatives in (A4) and (A5) have the same sign so that $\Delta w^{*\prime}(s_i) < 0$. Proposition 1(iii) combined with the fact that $\Delta w^*(s)$ is strictly decreasing in s, implies that all agents with a zero low performance wage and with a not binding (IR) must have identical status levels.

Finally suppose that there are two agents i and j with $\underline{w}_i = \underline{w}_j = 0$ and such that (IR) is binding for i only. Then, from Proposition 1(iii), this is possible only if $s_i < s_j$. We have shown above that $\frac{\partial^2 \Pi}{\partial w_i^2} < 0$ so that profit is concave in Δw_i. Hence, since the (IR) constraint for j is not binding we must have $\Delta w_j = \Delta w^*(s_j)$ which is optimal if the (IR) constraint is ignored. Similarly, the (IR) constraint being binding for i implies that $\Delta w_i > \Delta w_i^*(s_i)$ so that $\Delta w^*(s_i) < \Delta w^*(s_j)$ which contradicts our result above that Δw^* is decreasing in status. Thus such a situation may not be part of an optimal solution.

Proof of Proposition 3. Consider a steady state. Then there exists (c_1, c_l, c_h) such that $(c_{1t}, c_{lt}, c_{ht}) = (c_1, c_l, c_h)$ for all t. The proof proceeds in three steps.

Step 1: $c_1 = (0,0,0)$.

If $s_1 = 0$, then it is optimal to set $\underline{w}_1 = \Delta w_1 = 0$. Thus proving the result amounts to showing that $s_1 = 0$. Suppose to the contrary that $s_1 > 0$. At some date t the principal may switch to

$$c_1^{'} = (0,0,0),\ c_h^{'} = (s_h + s_1, \frac{\delta s_h \underline{w}_h + s_1(\underline{w}_1 + \Delta w_1)}{\delta(s_h + s_1)}, \frac{s_h \Delta w_h}{s_h + s_1}),$$

$$c_l^{'} = (s_l + s_1, \frac{\delta s_l \underline{w}_l + s_1 \underline{w}_1}{\delta(s_l + s_1)}, \frac{s_l \Delta w_l}{s_l + s_1}). \qquad (A6)$$

If each generation from t on is offered these contracts, the young's expected intertemporal utility is maintained. Basically, the young's wages are transferred from the first to the second period while being divided by the ratio of the original period 1 status to the new second period status $\frac{s_1}{s_1 + s_p}$, $p \in \{l, h\}$, so that the increase in status exactly compensates for the decrease in income. The new intertemporal utility is

$$EU_1' = -\psi(e_1) + s_1 \underline{w}_1 + [1 - \mu(e_1)]\delta[-\psi(e_l) + s_l \underline{w}_l + \mu(e_l) s_l \Delta w_l]$$

$$+\mu(e_1)[\Delta w_1 + \delta[-\psi(e_h) + s_h \underline{w}_h + \mu(e_h) s_h \Delta w_h], \qquad (A7)$$

which is the intertemporal utility in the original contract. On the other hand, the utility of an old agent is increased (by $\frac{s_1 \underline{w}_1}{\delta}$ for the l type and $\frac{s_1(\underline{w}_1 + \Delta w_1)}{\delta}$ for the h type). Furthermore, all effort levels are maintained. Finally, the intertemporal wage bill for each generation is lower: that is $(\frac{\mu(e_1)s_1}{s_h + s_1} + \frac{(1-\mu(e_1))s_1}{s_l + s_1}) Ew_1 + \delta\mu(e_1)\frac{s_h}{s_h + s_1} Ew_h + \delta(1 - \mu(e_1))\frac{s_l}{s_l + s_1} Ew_l < Ew_1 + \delta\mu(e_1) Ew_h + \delta(1 - \mu(e_1)) Ew_l$. Hence, a steady state with $s_1 > 0$ cannot be part of an optimal solution.

Step 2: If $U_h > U_l$, then $(s_h > s_l)$ and $(\underline{w}_h \geq \underline{w}_l$ and $\Delta w_h \geq \Delta w_l)$ must hold.

First note that the arguments used to prove Proposition 1(iii) may be applied to the old population at each period so that $(s_h > s_l)$ implies $(\underline{w}_h \geq \underline{w}_l$ and $\Delta w_h \geq \Delta w_l)$. Furthermore, if $U_h > U_l$, we cannot have $s_l \geq s_h$, since it would imply that wages for type l old workers should be at least as high as those of type h old workers, which contradicts $U_h > U_l$.

Step 3: $U_h > U_l$.

Since young agents have no status, proving the result amounts to showing that a steady state in which the young's effort is zero cannot be part of an optimal solution. In such a steady state, at

each date, only the old exert effort. Now suppose that at some date t, the principal commits to giving only half of the status to the old at date $t+1$. Then she is in a position to implement the egalitarian solution of Proposition 2 which is optimal in the static problem. That is, all agents can be awarded identical status and wages and they all exert the same effort: in particular young agents are not induced to exert additional effort by the prospect of future utility differentials since there are none. Since the solution in which only the old (i.e., one fraction of the agents) exert effort is also feasible in the static problem, it yields a strictly lower per period profit than the egalitarian solution. Thus the young's effort must be strictly positive in the steady state of an optimal solution. Since the young exert effort in spite of a zero status, we must have $U_h > U_l$.

Proof of Proposition 4. Consider a steady state. An agent may face four possible states of nature depending on her performance in each of the two periods (i.e., ll, lh, hl, hh). To ease notation, the reference to the state of nature is dropped in the remainder of the proof. For one such state of nature, let s_1 and w_1 denote the agent's status and wage when young and, s_2 and w_2 denote the agent's status and wage when old. Let $v = g(s_1)h(w_1) + \delta g(s_2)h(w_2)$. Now suppose that $s_1 > 0$. If the principal switches to a solution (s_1', w_1', s_2', w_2'), with $s_1' = w_1' = 0$ and $s_2' = s_1 + s_2$, v is unchanged as long as

$$h(w_2') = \frac{g(s_1)h(w_1) + \delta g(s_2)h(w_2)}{\delta g(s_1 + s_2)}. \tag{A8}$$

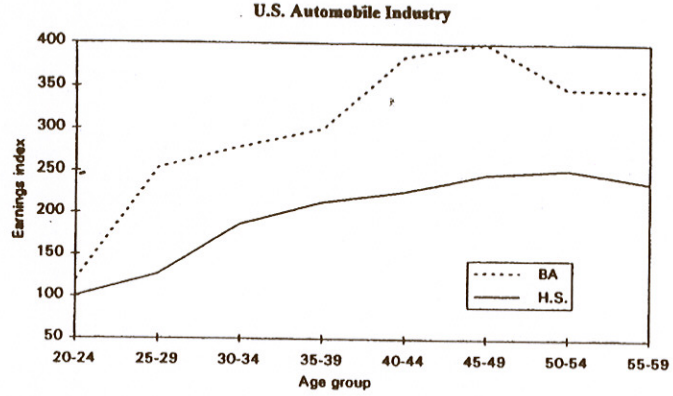
It is readily verified that if this is done for all states of nature, effort levels and intertemporal expected utility are unchanged while the agent's utility when old increases. Suppose that $h(w) = w$. Then (A8) becomes $w_2' = \frac{g(s_1)w_1 + \delta g(s_2)w_2}{\delta g(s_1+s_2)}$. Since g is strictly increasing, the discounted wage bill $\delta w_2'$ is lower than $w_1 + \delta w_2$. Thus the principal is better off. Suppose that $g(s)$ is linear. Then (A8) reads

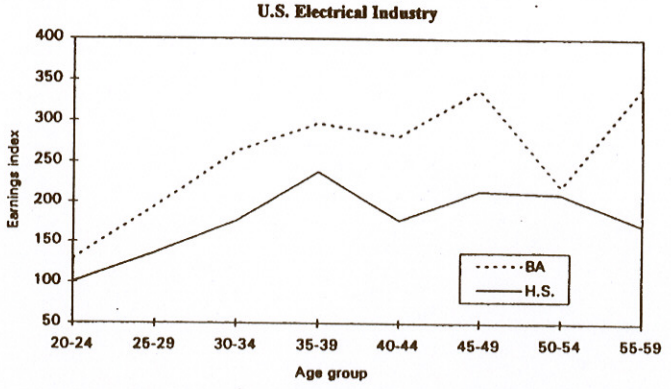
$$h(w_2') = \frac{1}{\delta}\frac{s_1}{s_1 + s_2}h(w_1) + \frac{s_2}{s_1 + s_2}h(w_2). \tag{A9}$$

Strict monotonicity and concavity of h imply

$$h\left(w_1 + w_2\right) > h(\frac{s_1 w_1 + s_2 w_2}{s_1 + s_2}) \geq \frac{s_1 h(w_1) + s_2 h(w_2)}{(s_1 + s_2)}. \tag{A10}$$

Thus, for δ close to 1, since h is strictly increasing, if w_2' satisfies (A9), then $\delta w_2' < w_1 + \delta w_2$.

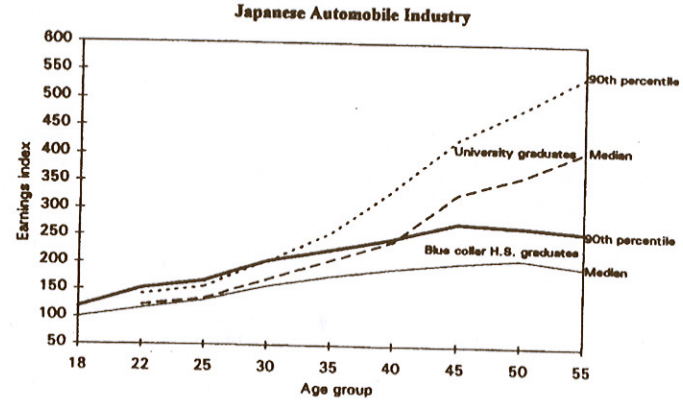


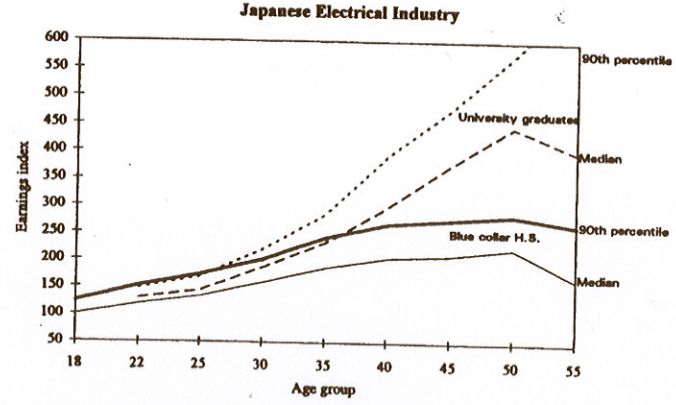


Earnings by Age and Education, United States, 1989–1991

Source: Computed by the authors from the Current Population Surveys, March 1989, 1990, 1991.

Note: Positive earners only; earnings averaged over 1989–1991 to enhance cell sizes; SIC code: A, 351; B, 441; C, 341.





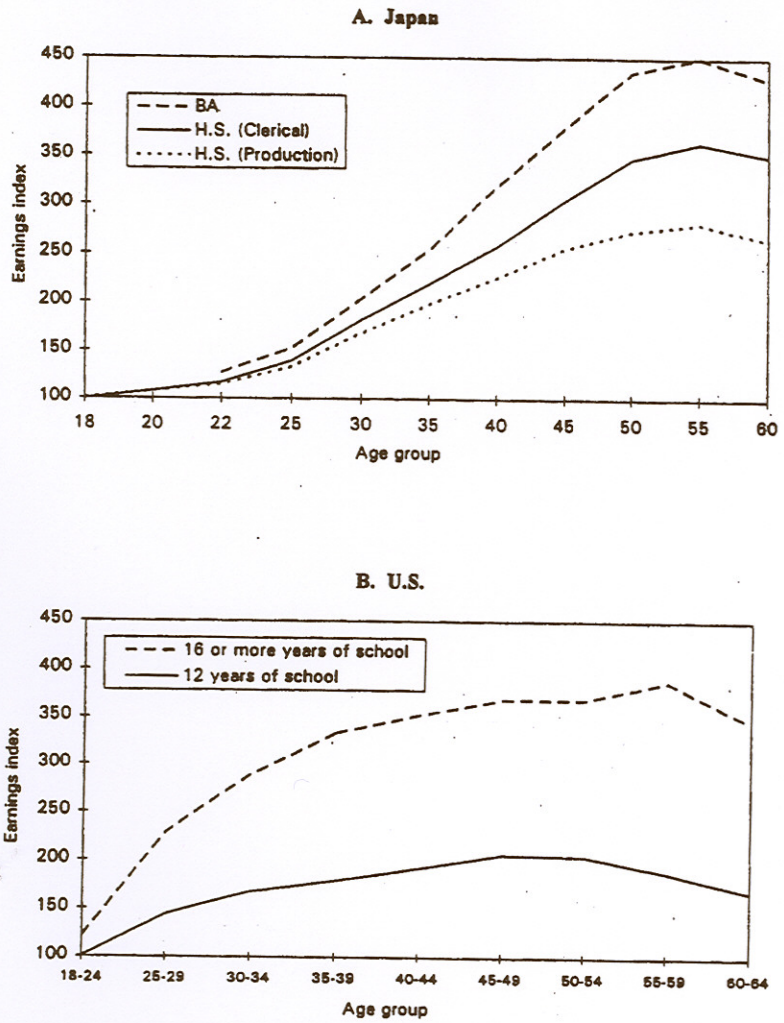
Earnings by Age and Education, Japan, 1988

Source: Nakata (1991a). The underlying data are from *Basic Survey of Wage Structure,* Japan Ministry of Labor.

Note: Data are for establishments with ten or more regular workers.

Figure 4.7 and 4.8– p 116-117
From Brown et al (1997)

Figure 1



Earnings by Age and Education, 1990

Sources: A: Computed by the authors from *Basic Survey of Wage Structure,* Japan Ministry of Labor. B: Computed by the authors from the Current Population Survey, March 1990.

Note: A: Regular male workers, scheduled earnings. B: Male private wage and salary workers, annual earnings.

Figure 4.9 – p 118
From Brown et al (1997)

Figure 2