Status and Incentives

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This paper introduces status as reflecting an agent's claim to recognition in her work. This is a scarce resource: increasing an agent's status requires that another agent's status be decreased. Higher status agents are more willing to exert effort in exchange for money; better-paid agents would exert higher effort in exchange for improved status. The results are consistent with actual management practices: (i) egalitarianism is desirable in a static context; (ii) in a long-term work relationship, juniors' compensation is delayed; and (iii) past performance is rewarded by pay increases along with 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. Finally we are also grateful to Andrew Clark for proof reading the entire manuscript and improving the English. All remaining errors are ours.

1 Introduction

Although economists have generated 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 goods 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 goods, although a poor substitute for money according to standard economic theory, are an effective means of providing incentives due to their trophy value: they remind the winner and others of her/his successful 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 between employees, the opposite point is often made that it is appropriate to adopt an egalitarian approach by expunging symbolic differences (see Pfeffer, 1994). A substantial body of research has emerged 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 differences between

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

organization members can be assessed.

Typically, sociologists refer to social status as capturing 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, although 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 reverse causality: higher status is the basis for earning 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 al.* (1996) study how CEO compensation is 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-agent 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. This may be traced back to Frank (1984)[4] and has found its most compelling support in the evolutionary argument developed by Fershtman and Weiss (1998). The proponents of an alternative "instrumental" approach, where

[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 to 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 following) 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.

status indirectly affects an individual's consumption level, criticize the direct approach as lacking robustness: the results are sensitive to the specification of preferences (see Postlewaite, 1998). In Section 2 we argue in favor of preferences which are 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 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: the wage distribution, the distribution of scarce non-monetary resources (such as offices, furniture, computers, locker rooms, and dining facilities), conspicuous awards or, most commonly, positions in the organization's hierarchy. Although some of these attributes clearly provide material benefits (more independence, greater 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 the pure status ranking that might ensue, for instance, from the ranking of positions in a formal hierarchy. The choice of 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 possessing similar production technologies. For instance in the auto industry Toyota has seven layers of management between its CEO and the 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 towards a reduction in the number of management layers over the period, controlling for various variables pertaining to the firm's structure, and in particular its size. This suggests that firms are to an extent able to adjust their hierarchies, and that this ability may be used to provide work incentives. In order to underline the relationship between status and work incentives we abstract from the technical role played by the hierarchy and leave the principal a great deal of latitude to act as a social engineer.

Leaving technology to one side, the principal still faces two categories of constraints. First,

the status bestowed upon agents should be deemed legitimate in order to significantly affect their behavior. Our results show that, for incentive purposes, the principal will only choose to award different status levels to agents who have had different past performance: thus legitimacy may reasonably be rooted in these performance differences. 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, when status is derived from a person's position in a formal hierarchy, increasing one agent's status necessarily improves her position in the hierarchy relative to others who will mechanically suffer some loss. In other words, status in organizations is a scarce resource.

Our results show that career profiles differ greatly according to whether 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 compensation is performance-based, so that wages reflect productivity differences. Indeed, in one-shot work relations, status may not be handed out as a reward for good past performance. The relevant question is then whether an employer would *ex ante* choose to differentiate status amongst *a priori* identical workers. The answer is no. Although agents with high status are more responsive to monetary incentives, the resulting benefits are outweighed by the reduced 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 introduce benefits from 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 as low a status as possible along with no monetary incentives. Their work motivation stems solely from promotion prospects. For incentive purposes promotions bring more substantial rewards for those who have been more successful in the past: they end up with prestigious positions and are paid above their marginal product. Because individual preferences exhibit complementarities between status and money, symbolic and material rewards reinforce

each other. By concentrating both types of compensation 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 profits, this loss is more than compensated by the benefits associated with sharper incentives for junior employees. In other words an employer who is able to commit organizes an internal labor market where pay is attached to jobs, rewards are delayed in time and higher incomes are associated with greater recognition (e.g. a higher rank in the hierarchy). Whereas wage differences are small early on in the career they become substantially larger than productivity differences as tenure rises. We show that these results are robust to the introduction of income risk aversion, a case for which a standard repeated moral hazard model would prescribe smoothed consumption over time (see for instance Rogerson, 1985, Chiappori et al., 1994).

More complicated issues would arise were we to take into account equilibrium status allocations 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 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, 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 through a

[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 only to a certain extent. For instance Lazear and Oyer (2004), exploiting Swedish data, show that in the long term wages are determined externally, presumably reflecting centralized bargaining.

comparison of work relations in the US and 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 between organization members when the work relationship is short term.

2.1 The organization

The organization (bureau, subdivision, firm) is supervised by a risk-neutral principal. There are $n \geq 2$ workers indexed by $i = 1, ..., n$. These 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 to maximize expected profit, with profit π being 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 (with a price normalized to 1) and w_i is agent i's wage.

Each worker contributes to the collective outcome by exerting effort $e_i \geq 0$. The harder agent i works (the higher e_i is), the greater is the probability of 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 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: employee preferences and the allocation of status in the organization.

2.1.1 Employees' preferences

A key feature of our approach is the specification of agents' preferences, which assumes some complementarity between status and income. We posit 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, with 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 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 the predictions in the 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 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 conditions on preferences in Assumption 2, ensures the convexity of the 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, the indifference curves relating these two variables for a given effort level are strictly decreasing. This reflects substitution between status and income. However, preferences over status and income are strictly convex so that there is not 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 when she has 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 low job satisfaction results in high turnover and absenteeism rates.[10] Tahlin (1999) found in a study on job mobility in Sweden that, all else equal, people with low status (i.e., a low prestige score according to Treiman, 1977) are more likely to make voluntary job shifts than people with high status. It should be expected that low satisfaction also results in shirking which, contrary to absence and resignation, is not readily observable.[11]

We now examine how the trade-off between effort and status is affected by individual 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-level hierarchy of human needs, with the following 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 compensation. A human resource management guide indicates that using goods 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 a charity or fine arts reflects such a shift in tastes caused by higher income. [12]

The next section describes how the organization may decide to allocate status amongst 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 $S \subset \mathbb{R}^n_+$, where the ith component measures the status of agent i. The scarcity of status is reflected by the property that it is not possible to improve one agent's status without reducing 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, Cornelius 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]

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

That overall status sums up to n is a normalization: any other strictly positive constant would produce the same results. However, n has the convenient property that, when no status disparity is introduced, all agents have status 1, so that our results may easily be compared to those from the classical moral hazard literature with quasi-linear individual 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, in a given period. This is consistent with our interpretation of preferences, where recognition induces work satisfaction which in turn induces greater 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 affect agents' status in future periods, all the more so if 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 the optimal incentive scheme in the first-best situation where each agent may fully commit to a contractible effort level as well as to unconditional participation in the organization. This first-best analysis is meant to provide intuition about the solution that the principal would ideally prefer, rather than to make a statement about the welfare implications of our setup. Since the only binding constraint is the agents' *ex-ante* participation constraint, it is optimal for the

[13] The linear functional form is a consequence of the convexity assumption. It is somewhat restrictive and is designed to facilitate 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 defined only over status rankings.

principal to offer each agent participation in a lottery where one sole winner receives all of the status and is the only employee 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 of them, with each receiving this total status with some probability. The added status for each agent when she is paid exactly compensates her for the lower probability of being paid. This allows the firm to pay 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 total wage bill. We 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 this result is quite robust.[16]

Actual work relations allow for much less commitment on the part of the agent than that which was postulated here. We therefor 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 outlaws 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 have been were agents to have had identical status with probability 1. The individual probability of winning 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. which 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 $\underline{U} + \psi(e^*)$, as 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 choose 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 in running lotteries over 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 high performance (i.e., $\underline{w}_i + \Delta w_i$ and $\underline{w}_i$ are agent i's wages associated with 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 $s_i\Delta w_i$. Effort is independent of $\underline{w}_i$ due to income risk neutrality. Moreover, as can be seen from Equation (A1) in Appendix A, the sign restrictions on the third derivatives of μ and ψ ensure that e^* is concave.

[17] It is *a priori* less obvious whether the added constraints rule out lotteries altogether. Proposition 2 shows that they in fact do.

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

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

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 higher status goes hand-in-hand with 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 in the principal providing more than full incentives. Part (ii) is also quite standard: given that the agent is risk neutral over income, the principal abstains from giving full incentives only when she is restricted in the choice of the low performance wage. The novel insight appears in part (iii). This states that agents with different 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 unequal treatment in monetary as well as symbolic rewards. This logic is exploited fully in the first-best solution, where all of

the status and money is concentrated on one agent. This enables the principal to reduce the wage bill by taking advantage of the complementarity between status and income in the agent's preferences. However, as the following 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 compensation scheme).

Proof: See Appendix A.

Assumption 3 is a technical condition that is provided in the Appendix and which 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 higher 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 those

[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 status equal to 1. Then (ii) in Proposition 1 implies that all agents be rewarded Δq for high performance.

agents with higher status less. This however conflicts with the result established in Proposition 1 that, if status and wages can 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 using economic tools of the equity theory in social psychology, according to which it is harmful to introduce differences between 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 examples such 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 profitability far above that of the rest of the Steel industry, cannot be explained by technological advantage (its technology is similar to that of most of its competitors). It is in fact due to its innovative human resource management. In line with the results of 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, as against a dozen on average for the rest of the industry. Nucor relies on direct monetary rewards to provide work incentives. The average Nucor salary is comparable to the average salary of its competitors, but its structure is more incentive-based.

In a short-term relationship only technological constraints motivate the introduction of hierarchies. 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 than in the previous section to provide work incentives. She can indeed replicate the static contract, but she can also propose an intertemporal incentive scheme that links future rewards to past performance. We study this problem within an overlapping generations set-up 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 who will not be around in the next one. Hence each cohort stays for only 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 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 starting 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 effort 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;

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

[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 the Code du Travail). Firms have been prosecuted for violating this rule.

Stage 6 - workers choose an effort level according to their current monetary incentive and status (which may depend on how successful they were 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] The expected utility of an old agent exerting effort e_{pt} whose past performance has been $p \in \{l, h\}$ (l stands for "low" and h 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 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') $\qquad EU_{pt} \geq \underline{U},\ p \in \{h, l\} \qquad$ 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') $\qquad e_{1t} = e^*\big(s_{1t}\Delta w_{1t} + \delta\Delta U_{t+1}\big) \qquad$ and $\qquad e_{pt} = e^*\big(s_{pt}\Delta w_{pt}\big) \qquad p \in \{h, l\}.$

The population is large and so can be represented by a continuum with a measure normalized to 2. Then, at each period, the proportion of old who were 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 level of performance. The feasibility constraint on status allocation is:

(F') $\qquad s_{1t} + \gamma_t s_{ht} + (1-\gamma_t)s_{lt} = 2 \qquad$ 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

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

static model the principal faces three types of constraints at each period: (F'), (IR'), (IC'). She must pick the 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:

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

The initial conditions, γ_0, c_{h0} and c_{l0}, are given exogenously. Finally, we define a steady state as 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 regarding their role in intertemporal incentive schemes.

3.2 Incentives and promotions

In view of the various constraints pertaining to the dynamic profit optimization problem, we might expect that the exact nature of the solution will depend critically on which of these constraints are binding. Although this is to some extent true, the results in the next proposition are quite general.

Proposition 3 (incentives through promotion) Under Assumptions 1, 2 and 3, in any 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 incentives.[22] Junior workers earn the same salary independent of their performance. They are induced to exert effort by the prospect of a future promotion. That is, pay is attached to the job, and earnings profiles only become individual specific as careers unfold. When old, an agent's status and monetary incentive scheme depend on her past performance. As in the static context, it is optimal to combine higher wage and 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. Better past performance brings about higher status as well as greater monetary compensation. This solution allows advantage to be taken of the 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 the effect of income shocks resulting from good or bad performances over time; this is the preference for consumption smoothing emphasized by Malcomson and Spinnewyn (1988). This implies that it is not optimal to delay all rewards and penalties as prescribed by Proposition 3. One obvious difference between the model in this paper and the standard repeated moral hazard framework relates to the agents' attitude towards income risk. We now briefly explore the robustness of our results to the introduction of risk aversion in agents' preferences.

[22] As noted above, 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.

3.3 Robustness

In our treatment of risk aversion we will at the same time discuss the robustness of our results to changes 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 as 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 overturned. There are two possible ways of making the returns to status concentration decreasing: either the left-hand side of the status feasibility constraint could be made strictly quasiconvex or utility could be written as strictly concave in status. The second route is followed in the argument below. 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 minimal status holds 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 higher income and higher status. Becker, Murphy and Werning (2000) obtain related results in their examination of 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.

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

4 Job tenure and career profiles

Combining Propositions 2 and 3, our results suggest 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 high performance are delayed over time and pay rises are associated with changes in status, which are usually achieved by a move up the hierarchy (i.e. promotion). Differences in productivity will then be reflected in wages for senior employees only. That is, earnings profiles are upward-sloping and differences in earnings across individuals widen with seniority. By way of contrast, if commitment is not possible, no status differentiation occurs, and incentives are provided via direct monetary rewards. Employees with different productivity are paid different wages, so that individual earning profiles diverge early in the career. To assess the relevance of this theory, we now confront these predictions with a number of stylized facts.

The feasibility of an internal labor market hinges on employees' expected tenure within the organization. A comparison of work relations in the United States and 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 ages 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 in Japan 65% of male workers with at least 5 years tenure in the job when aged 20-24 will be in the same job 15 years later, compared to an analogous figure of 30% in the United States. These differences have been remarkably stable since the early 1970s.[26]

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

[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 ending falls with tenure.

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

The analysis presented here implies that, when young, Japanese core workers will be at the bottom of the hierarchy and receive relatively low wages, independent of their education level. Differentiation comes later in the career so that the earnings profile increases with seniority with increasing disparities between individuals. By contrast, in the US young workers, who are very mobile, do not accept delayed rewards. Their earnings profiles are relatively steeper when young (i.e. under 35). Earnings, which better reflect workers' productivity, are also more differentiated by education. This implies that earnings disparities are greater for young workers in the US than in Japan.

According to the Bureau of Labor Statistics, individual real earnings in the US increase more rapidly when young than when old.[27] Young American workers facing flat tenure-earnings profiles change jobs 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 is true 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. under age 35) the level and variance of earnings are low. As predicted by our theory, differentiation appears with seniority and pay rises are coupled with changes 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, which are borrowed from Brown et al. (1997) pp. 117 and 118, illustrate the results discussed above.

[Figures 1 and 2]

Figure 1 shows earnings by age and education in the automobile and electrical industries

[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 ages 25 and 29, and then to 2.4 percent between ages 30 and 34 (US Department of Labor 2000).

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

in Japan and the US; Figure 2 presents earnings profiles by age and education at the national level. In Japan differentiation in earnings appears after age 35, and the earnings gap between different types of workers widens with age.[29] In contrast, in the US earnings increase (sharply for educated workers) in junior years but less so afterwards, and the earnings gap between educated and less-educated workers widens up to age 35-39. As the industries here are fairly standardized, this probably does not reflect any differences in technology, but rather different management practices.

We have treated job mobility differences between these two countries as given, and argued that they could explain differences in compensation policy in a way that is consistent with our theoretical analysis. There could be any number of other underlying differences between the two economies that we do not control for which might jointly explain both mobility differences and differences in work compensation practices. Furthermore, our theoretical predictions are, in some respects, similar to those resulting from other theories which try to explain internal labor markets. In the next section we place our contribution in this existing literature.

5 Related work on internal labor markets

Our analysis provides a novel theoretical underpinning for understanding why promotions might be preferable to direct monetary incentives, and also predicts how individual earnings profiles over time are affected by the expected duration of the work relationship. Although these two issues are closely 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 great deal of attention. The use of large prizes attributed only at specific times over 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 back-loaded compensation structures in order to retain

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

their workers. In light of this theory, the different compensation policies in the US and Japan might reflect greater investment in firm-specific human capital in Japanese than in American firms. The interpretation proposed here provides additional insights in two ways. First, the firm-specific human capital explanation establishes a causal link between commitment and delayed monetary rewards. As delayed pay rises are a means of fostering commitment by employees, any exogenous increase in this commitment will reduce the firm's incentive to delay rewards. The firm-specific human capital hypothesis is thus inconsistent with the data if, as is often argued, there are cultural reasons for the differences in job mobility for young workers in Japan and the US. [30] Our analysis on the contrary assumes that commitment is exogenous but would also hold were commitment to be induced by the prospect of garnering future rewards. Second, empirical tests of the firm-specific human capital motive are at best inconclusive. Farber (1999) tries to explain the high returns to tenure with this theory, but only finds little support for it.[31] By way of contrast, our theory states that monetary rewards are delayed so as to match with the change in status resulting from promotion, as this is the most cost-effective way of providing incentives to young employees. We jointly explain 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 Japanese ILMs.

The extensive use of promotions for incentive purposes has also been widely discussed in the literature. Direct monetary transfers allow for fine tuning of the incentive scheme, contrary to promotions which are discrete and irregular. One reason 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 evaluate. Promotions may then be viewed as prizes in a tournament between employees, as in Lazear and Rosen (1981). This leaves open the question of why, in practice, promotions involve both changes in status and pay rises, and why they are used so extensively (and not only when absolute performance is unobservable). The theory presented here provides

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

[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".

a link between wage profiles, hierarchical structure and tenure in firms.

Another way of linking the wage profile to the worker's position in the firm's hierarchy is to think of promotions as a way of screening employees. 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 more productive workers with tasks where performance is more sensitive to productivity. They argue that their setting explains many observed characteristics of compensation schemes, and notably the fact that pay rises are larger when they coincide with promotion. These pay rises reflect higher productivity and would not have occurred were the move up the hierarchy not to have corresponded 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 any conflict between the incentive and screening objectives by creating separate career ladders for scientists and engineers, so that they can be promoted without having to go into management. Similarly, faculty members in universities, or doctors in hospitals are generally promoted without changing jobs. 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 estimate of the rise in marginal productivity associated with a job higher up in the firm's hierarchy. In our setting, promotions involve no job changes, and the concentration of rewards towards 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 this theory is that promotion systems and hierarchies must meet various functional goals such as production efficiency and screening, encouraging investment in firm-specific 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 extremely useful to appeal to

[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 is A), the more pyramid-like is the incentive hierarchy. Indeed when A is very large success is rare; promotion is extremely prestigious and the associated pay raise is huge (it diverges to infinity in the limit). On the other hand if high performance is easy to achieve, a seniority-based promotion system may be optimal (i.e., everybody is successful and is promoted).

different types of data to examine 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) use a panel of 300 publicly-traded U.S. firms, over the period 1986-1999, to see whether perks (i.e., executive jets, chauffeur-driven cars, and country club memberships) are managerial excesses, as generally argued in the corporate finance literature, a strategy to minimize income tax liability, or rather are designed to enhance managers' status or productivity. They find little empirical support for the tax explanation and, at best, mixed evidence for the private benefit explanation. However, they do find that pay and perks are positively correlated (even when controlling for firm size, industry and year), and that larger, older, and more hierarchical organizations offer more perks. They also find that the more productive employees at the top of a firm's hierarchy tend to receive 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 empirically to enhance employees' effort. He explains this result via a process of substitution between domestic tasks and work. Unfortunately he does not consider status. Additional insights could likely be gained from the exploitation of 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 consider how personnel management practices differ across firms characterized by different turnover rates, and thus different degrees of commitment. [33]

6 Conclusion

The paper has argued that social recognition plays a major role in the work place. Social aspects are all the more significant given that much of labor relations takes place outside of the market and is 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

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

main findings are that while it is costly to introduce differentiation between identical coworkers in a static environment, such differentiation may prove to be a relatively powerful incentive device in a dynamic setting. In the intertemporal incentive scheme, pay is attached to job, rewards are delayed in time and higher income is associated with greater recognition. From an empirical perspective the proposed framework yields predictions on the shape of the compensation scheme in relation to the hierarchical structure in ILMs and spot markets. Stylized facts are consistent with our results.

Our theoretical analysis predicts that internal labor markets are a superior mode of work organization. If this is the case we 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 commit to keep employees, but also be large enough or growing fast enough to propose stimulating career paths. For firms in recession or in unstable economic environments flexibility matters, so that commitment is not always possible. There will then be no benefit in creating a hierarchical structure for incentive purposes. In recent years there has been a significant move towards delayering in industrial countries. For instance Bauer and Bender (2001) examine on a representative German employer-employee data set and reveal that between 1993 and 1995 50.73% of the 251 firms sampled reduced their number of hierarchical levels. In the same spirit, using a panel of 300 US firms, Rajan and Wulf (2003) find that firms' depth (i.e., the number of positions between the CEO and division heads) fell by more than 25% between 1986 and 1999.[34] According to our analysis, this may reflect a weakening of employer commitment, which could itself be explained by an anticipated rise in the job loss rate. There is indeed 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).

References

Abowd, J., Haltiwanger, J. and Lane, J. (2004): Integrated longitudinal employer-employee data for the United States. *American Economic Review*, fol. 94.2, p 224-229.

Adams, J.S. (1965): Inequity in Social Exchange. in L. Berkowitz (ed.) *Advances in Social Psychology,* 2, p 267-299. New-York: Academic Press.

Auriol, E. and Renault, R. (2001): Incentives Hierarchies. *Annales d'Economie et de Statistique*, vol 63-64, p 261-282.

Ball, S. and Eckel, C. (1996): Buying Status: Experimental Evidence on Status in Negotiation. *Psychology and Marketing.*, vol 13, 381-405.

Ball, S. and Eckel, C.(1998): The Economic Value of Status. *Journal of Socio-economics*, vol 17.4, p 495-514.

Ball, S., Eckel, C., Grossman, P.J. and Zame, W. (2001): Status in Markets. *Quarterly Journal of Economics*, vol. 155.1, p 161-181.

Bauer, T. and Bender, S. (2001): Flexible Wages Systems and the Structure of Wages: Evidence from Matched Employer-Employee Data, CEPR DP2980

Baum, J.F., and Youngblood, S.A. (1975): Impact of an Organizational Control Policy on Absenteeism, Performance and Satisfaction. *Journal of Applied Psychology*; 60, p 688-694.

Becker, G.S. (1962): Investment in Human Capital: A Theoretical Analysis. *Journal of Political Economy*, Suppl 70, p 9649.

Becker, G.S., Murphy, K.M. and Werning, I (2000): Status, Lotteries and Inequality, mimeo.

Belliveau, M.A., O.Reilly, III C. A., and Wade, J.B. (1996): Social Capital at the Top: The Effects of Social Similarity and Status on CEO Compensation. *Academy of Management Journal*; vol. 39, No 6, p 1568-1593.

Brown, C., Nakata, Y., Reich, M. and Ulman, L. (1997): Work and Pay in the United States and Japan, New York: Oxford University Press.

Centers, R and Bugental, D. (1966): Extrinsic and Intrinsic Job Motivations Among Different Segments of the Working Population. *Journal of Applied Psychology*; 50, 193-197.

Chiappori, P.A., Macho, I., Rey, P. and Salanié, B. (1994): Repeated Moral Hazard: The Role of Memory, Commitment and the Access to Credit Markets. *European Economic Review.* 38.8, 1527-1555.

Davis, S. and Haltiwanger, J. (1999): Gross Job Flows. In *Handbook of Labor Economics*, Vol. 3, Ashenfelter, O. and D. Card, eds. 2711-2805.

Day, R.C., and Hamblin, R.L. (1964): Some effects of Close and Punitive Style on Supervision. *American Journal of Sociology*; 69, p 499-510.

Department of Labor (2000): Number of Jobs Held, Labor Market Activity, and Earnings Growth

Over Two Decades: Results from a Longitudinal Survey Summary, *News Bureau of Labor Statistics* (see www.bls.gov/news.release/nlsoy.nr().htm)

Doeringer, P.B. and Piore, M. (1971): International Labour Market and Manpower Analysis, Heath Lexington Books.

Dubey, P. and Geanakoplos, J. (2004): Grading exams: 100,99,...,1 or A, B, C? Incentives in games of status. Cowles Foundation D.P. No. 1467.

Dunette, M., Campbell, J. and Hakel, M.D. (1967): Factors Contributing to Job Satisfaction and Job Dissatisfaction in Six Occupational Groups. *Organizational Behavior and Human Performance*. 2, p 143-174.

Farber, H. (1997): The Changing Face of Job Loss in the United States, 1981-1995. *Brookings Papers on Economic Activity*, p 35-128.

Farber, H. (1999): Mobility and Stability: The Dynamics of Job Change in Labor Markets, in *Hanbook of Labor Economics*, vol 3 Edited by Ashenfelter and Card, Elsevier Science, p 2439-2483.

Fershtman, C., Hvide, H.K. and Weiss, Y. (2001), Status Concern and the Organization of Work, mimeo.

Fershtman, C., H.K. Hvide and Weiss, Y. (2005), Cultural Diversity, Status Concerns and the Organization of Work, *Research in Labor Economics*, forthcoming.

Fershtman, C.and Weiss, Y. (1998): Social rewards, externalities and stable preferences, *Journal of Public Economics*, 70, 53-73.

Frank, R. (1984): Interdependent Preferences and the Competitive Wage Structure, *Rand Journal of Economics*, 15, 510-520.

Frank, R. (1985): Choosing the Right Pond: Human Behavior and the Quest for Status, *Oxford University Press*.

Fussell, P. (1983): A Guide Through the American Status System. Touchstone.

Gerhart, B. and Milkovich, G. (1992), Employee Compensation: Research and Practice, in *Hanbook of Industrial & Organizational Psychology*, Consulting Psychologists Press, Inc., second edition, vol 3, chapter 9, 481-569.

Ghemawat, P. (1995): Competitive Advantage and Internal Organization: Nucor Revisited. *Journal of Economics and Management Strategy.* 3.4, 685-717.

Greenberg, J. (1988): Equity and Workplace Status: a Field Experiment. *Journal of Applied Psychology*, vol. 73 p 606-613.

Groshen, E.L. and Levine, D. (1998): The Rise and Decline (?) of U.S. Internal Labor Markets, mimeo.

Hashimoto, M. and Raisian, J. (1985): Employment Tenure and Earnings Profiles in Japan and

the United-States. *American Economic Review,* vol. 75,4, p 721-735.

Hofstede, G. (1980): Culture's Consequences: International Differences in Work-Related Values, Beverly Hills, CA: Sage.

Jacobs, L. and Herbig P. (1998): Japanese Product Development Strategies, *Journal of Business & Industrial Marketing*, Vol 13, No 2, p 132-154.

Jemmott, B. and Gonzalez, E. (1989): Social Status, the Status Distribution and Performance in Small Groups. *Journal of Applied Social Psychology*; 19, p 584-598.

Lazear E.P., (1979): Why is There Mandatory Retirement. *Journal of Political Economy*, vol. 87, 1261-1284.

Lazear, E. (1989): Pay Equity and Industrial Politics. *Journal of Political Economy,* 97, 561-580.

Lazear, E. (1991): Labor Economics and the Psychology of Organizations. *Journal of Economic Perspectives,* vol. 5 No. 2, 89-110.

Lazear, E. and Rosen, S. (1981): Rank-Order Tournaments as Optimal Labor Contracts. *Journal of Political Economy*, 89, 841-864.

Lazear, E. and Oyer, P. (2004): The Structure of Wages and Internal Mobility. *American economic Review*, AEA Papers and Proceedings, vol. 94 no.2, 212-216.

Lillard, L., and Reville, R. (1997): Intergenerational Mobility in Earnings and Occupational Status. Unpublished manuscript, Rand, Santa Monica, CA.

Maslow, A. (1954): Motivation and Personality. 2nd edition 1970. Harper & Row.

Malcomson, J. and Spinnewyn, F. (1988): The Multiperiod Principal-Agent Problem. *Review of Economic Studies*. 55, 391-408.

Milgrom, P. (1988): Employment contracts, Influence Activities, and Efficient Organization Design. *Journal of Political Economy,* 96, 42-60.

Milgrom, P. and Roberts, J. (1992): Economic Organization and Management. Prentice Hall. 09-1146.

Nelson, B. (1994): 1001 Ways to Reward Employees. Workman Publishing.

Oyer, P. (2005): Salary or benefits. Mimeo, Stanford Graduate School of Business.

Perrot, S. (1999): Statut Social et Incitation au Travail. mimeo, Université des Sciences Sociales de Toulouse.

Pfeffer J. (1994): Competitive Advantage through People: Unleashing the Power of the Work Force. Harvard Business School Press.

Postlewaite, A. (1998): The social basis of interdependent preferences, *European Economic Review*, 42, 779-800.

Rajan, R.G., and Wulf, J. (2003): The Flattening Firm: Evidence from Panel Data on the

Changing Nature of Corporate Hierachies. mimeo.

Rajan, R.G., and Wulf, J. (2004): Are Perks Purely Managerial Excess? mimeo.

Rogerson, W. (1985): Repeated Moral Hazard. *Econometrica.* 53, 69-76.

Salop, J. and Salop, S. (1976): Self-Selection and Turnover in the Labor Market. *Quarterly Journal of Economics*, vol 90, p 619-627.

Tahlin M. (1999): Opposites Attract? How Inequality Affects Mobility in the Labor Market, working paper 2/1999, SOFI.

Topel, R.H. and Ward, M.P. (1992): Job Mobility and the Careers of Young Men. *Quarterly Journal of Economics* 197, 2, p 439-79.

Treiman, D J., and Ganzeboom, B. (1990): Cross-national Comparative Status-attainment Research. *Social Stratification and Mobility*, vol. 9, p 105-127.

Treiman, D.J. (1977): Occupational Prestige in Comparative Perspective, New York: Academic Press.

Varma, A., Beatty, R.W., Schneier, C.E. and Ulrich, D.O. (1999): High Performance Work Systems: Exciting Discovery or Passing Fad?, *Human Resource Planning*, vol 22, No 1, p 26-37.

Veblen, T. (1899): The Theory of the Leisure Class: an Economic Study of Institutions. London: Allan and Unwin; reprinted New-York; Modern Library, 1934.

Weber, M. (1922): Economy and Society. Translated and reprinted; Berkeley, University of California Press, 1978.

Weiss, Y. and Feshtman, C. (1998): Social Status and Economic Performance: A Survey. *European Economic Review*, vol. 42.3-5, p 801-20.

Wood, N. (1998): What Motivates Best? *Sales and Marketing Management*, vol. 150,9, p 70-74.

Appendix A

Proof of Proposition 1 The 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 marginally decreasing 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 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 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 $\alpha_j'(0) - \alpha_i'(0) = \frac{w_i}{s_i} - \frac{w_j}{s_j} + \Delta q\big(\frac{\phi(s_i\Delta q)}{s_i} - \frac{\phi(s_j\Delta q)}{s_j}\big)$. 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 derivative of profit with respect to ϵ at $\epsilon = -$ is $\beta_j'(0) - \alpha_i'(0) = \frac{w_i}{s_i} + \big[\frac{\phi(s_i\Delta q)\Delta q}{s_i} - \frac{\phi(s_j\Delta q)\Delta q}{s_j}\big] + \big[\frac{\phi(s_j\Delta q)\Delta q}{s_j} - \frac{\phi(s_j\Delta w_j)\Delta w_j}{s_j}\big]$, 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 $s_i = x_j$, the 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 equal 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:

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

This 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 zero low-performance wage and for whom (IR) is not binding 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 can only be possible 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 this situation can not be part of any optimal solution.

Proof of Proposition 3. Consider a steady state. There then 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 the proof of 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 held constant. 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 any 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 this 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, this 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 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 simplify the 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 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

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

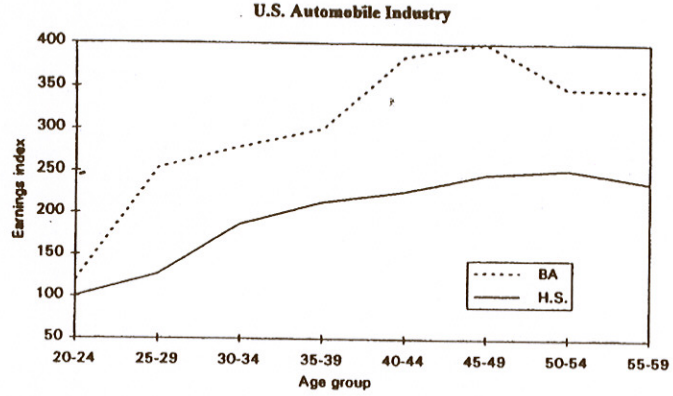
It can easily be shown that if this is done for all states of nature, effort levels and intertemporal expected utility are unchanged while the agent's utility when old increases. Suppose that $h(w) = w$. Then (A8) becomes $w_2' = \frac{g(s_1)w_1 + \delta g(s_2)w_2}{\delta g(s_1+s_2)}$. Since g is strictly 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) can be written as

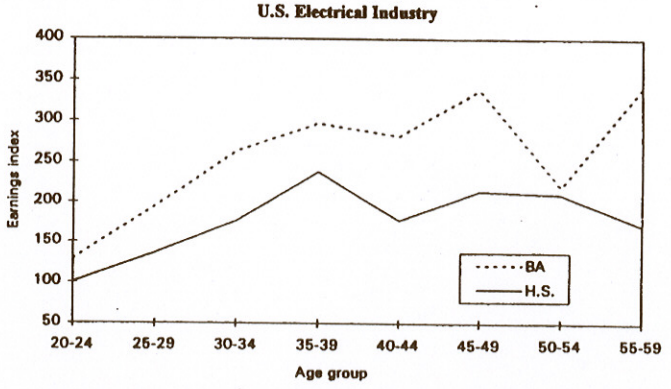
$$h(w_2') = \frac{1}{\delta}\frac{s_1}{s_1 + s_2}h(w_1) + \frac{s_2}{s_1 + s_2}h(w_2). \tag{A9}$$

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 $\delta w_2' < w_1 + \delta w_2$.

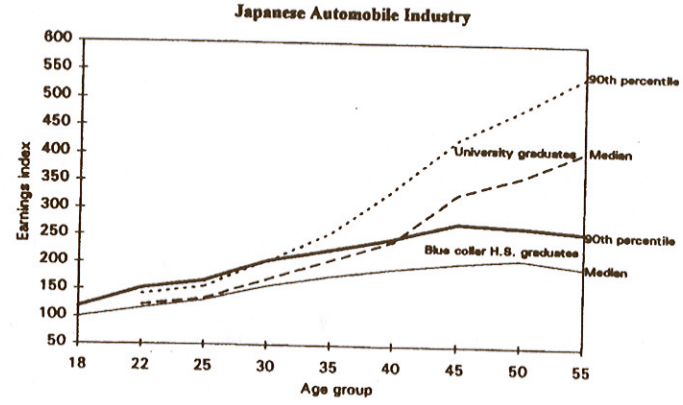


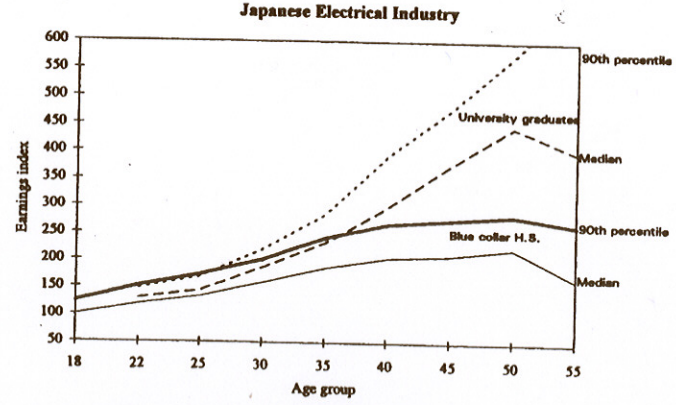


Earnings by Age and Education, United States, 1989–1991

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.





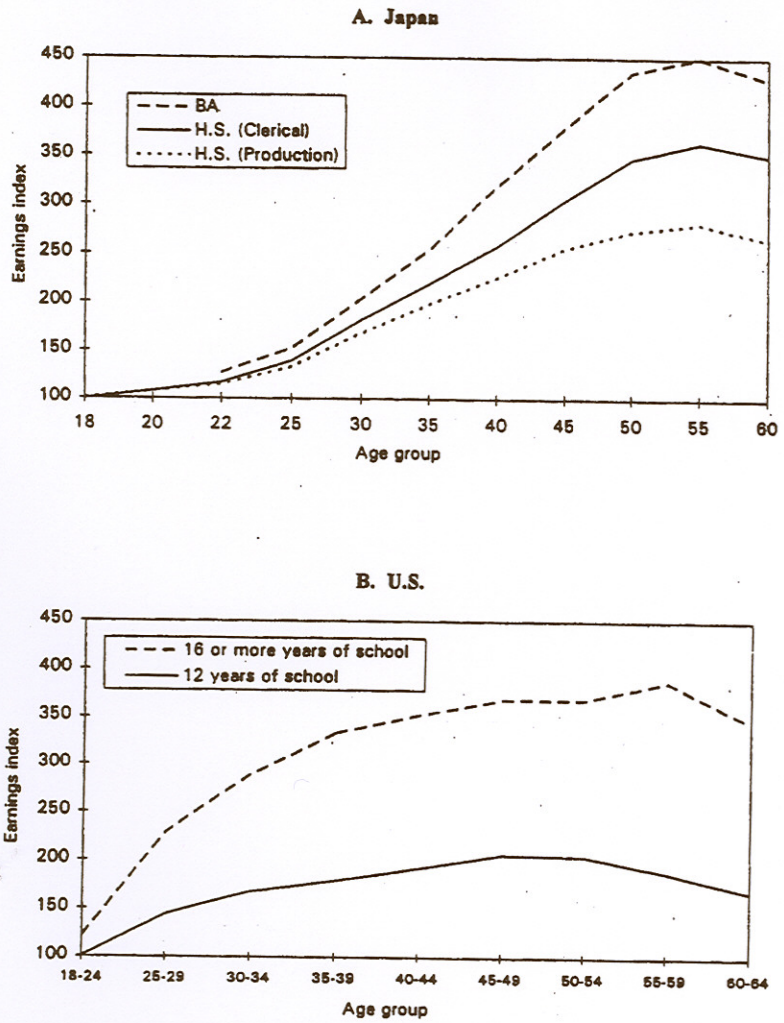
Earnings by Age and Education, Japan, 1988

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