Status Concerns and the Organization of Work*

Chaim Fershtman†, Hans K. Hvide‡, and Yoram Weiss§

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Abstract

We study the effects of local status, where workers compare their wage to the wage of other workers within the same firm. We assume a competitive labor market with unobservable effort, where firms condition wages on output as incentive for effort. If workers who care about status are also more productive, such status concerns generate an equilibrium with heterogenous firms where workers who care and workers who do not care about status work together. Such firms provide workers who care about status with stronger incentives to exert effort, compared with workers who do not care. In addition, there will be homogenous firms who employ workers of the same type. The main result is that status concerns increase within firm wage differences and over all wage inequality. The difference from previous studies (e.g., Frank 1984a, 1984b) is that effort is elastically supplied and staus concerns increase ouput. The positive correlation between status concerns and productivity is derived as part of the equilibrium, because workers who care about status signal their stronger motivation through investment in schooling.

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†The Eitan Berglas School of Economics, Tel-Aviv University, Tel Aviv 69978, Israel.

‡NHH, Helleveien 30, 5045 Bergen, Norway.

§The Eitan Berglas school of Economics, Tel-Aviv University, Tel Aviv 69978, Israel.

"For my part, I had rather be the first man among these fellows than the second man in Rome." Julius Caesar, according to Plutarch, ".. in his journey, as he was crossing the Alps, and passing by a small village of the barbarians with but few inhabitants, and those wretchedly poor.."

"Rabbi Masya ben (son of) Charash said, be first to greet every person, and be a tail to the lions rather than head of the foxes." Mishna, Pirkei Avot.

1 Introduction

The typical justifications for team work is that workers complement each other in production. This type of interdependence influences the organization of workers and teams and consequently the market equilibrium. In this paper we consider another type of interdependence which arises from *social* interactions in the work place. Economists have long recognized that workers may care not only about their own wage but also about their relative standing in the distribution of wages. Such concerns arise from several, potentially conflicting, considerations such as fairness and the desire to attain or maintain social status.[1] Following Frank (1985), we wish to investigate the implications of the demand for *local* status, where workers prefer to work in firms in which they obtain a higher wage than their co-workers.[2] The novel feature of our approach is that we recognize that the demand for local status creates an incentive to exert effort, which affects the wage schedules offered by firms and generates internal wage differences.[3] The purpose of the paper is to study the impact of local status concerns, in a competitive market, on the structure of firms, the monetary incentives that they offer and the implications for output and wages.

Local status has the special feature that one person's gain is another one's loss. There-

[1]The relationship between wage inequality, fairness and morale is discussed by Hicks (1963), Reder (1957), and Lazear (1989), among others. The relationship between wages and status has been discussed by Smith (1776), Frank (1985), and Fershtman and Weiss (1993), among others.

[2]Zizo and Oswald (1999) bring experimental evidence showing two third of the subjects were willing to sacrifice their own income, in order to reduce the income of other participants in the experinent.

[3]Auriol and Renault (1999) also analyze the impact of status concerns on incentives in a principal agent model. They allow firms to provide, at no cost, status symbols that are *independent* of wages, and show that higher levels of effort can be elicited.

fore, one would expect firms to hire workers with similar productivity, or, if workers differ in productivity, induce them to narrow their performance differences, so as to reduce wage inequality within firms. However, status concerns can also be a strong motivating factor. A worker who cares about status will exert effort in an attempt to outdo his colleagues. By mixing workers with different productivity, it is possible to elicit more *team* effort, if the more productive workers care more about status. Therefore, it is possible that status concerns will lead to the emergence of mixed firms, with stronger monetary incentives to the workers who care more about status. Thus, in general, status concerns can decrease or increase inequality in performance and rewards.

To study the impact of status concerns, we use a standard principal agent framework in which firms consist of two workers and a principal. The workers' effort is unobserved and wages are paid based on their output, which is a noisy measure of their effort. The outputs of the two workers depend on their own productivity and effort and are, in this respect, independent. However, each worker's utility may depend on the wage of the other workers employed by the firm.[4] Workers may differ in their productivity and in their attitude towards status. The model incorporates the restrictions implied by competitive equilibrium in that workers are free to move across firms and there is a free entry of firms. Equilibrium in such a model is an organization of work (allocation of workers among firms), an incentive structure for each firm such that workers cannot benefit from moving between firms, and finally no firm (or a potential entrant) may improve its profits by changing the mix of its workers or the incentive scheme that it provides.

Initially, we assume risk neutrality and that workers who care about status are the more productive. In line with Frank, we find that in equilibrium, firms then will consist of a mix of status minded workers and workers that do not care about status. Intuitively, such heterogenous firms can create a status surplus compared to homogenous firms. To motivate a positive correlation between productivity and status concerns, we then consider the endogenous determination of workers' productivity through investment in schooling.

[4]The assumption of independence in production allows us to focus on the interactions that results from preferences. In this respect, our approach is similar to Lazear (1989) and Kandel and Lazear (1992) and Rotemberg (1994) that allow the utility of each worker to depend on the effort of other workers. There is a large literature on matching based on productive interactions. The papers by Landers et al., 1996, and Li and Rosen, 1998, have some features that are similar to our model.

We show that separating equilibria exist in which workers who care about status invest in schooling, while those who do not care about status refrain from such investment. This allows firms to sort workers with different preferences for status. We thus incorporate an important and often mentioned role of schools, which is to identify the individuals who are highly *motivated*.

Frank showed that when labor is supplied inelastically, status concerns reduce the wage differences within firms and increase overall wage equality. It remains true in both models that status concerns imply wage compression, whereby the status minded workers receive lower wages lower their expected output. However, in our model, the induced changes in the effort and output of the two agents are sufficiently large to support an increase in internal wage differences, so that status concerns *increase* the overall inequality in wages.

The introduction of risk aversion sharpens some of the results and yields some new ones. In particular, firms provide stronger incentives for effort to status minded workers than for workers that do not care about status, and the wage differences within firms become more pronounced under risk aversion. The reason is quite simple. Conditioned on effort, wages are random, and workers that care about wage differences bear an additional risk, and hence will require additional compensation. We also show that, by conditioning the wage *positively* on the co-workers' output, firms provide insurance against the added risk generated by other workers. This result is in contrast to comparative payments based on a positive correlation in the random shocks, where wages depend *negatively* on the output of co-workers, because co-workers having a high output indicates that luck (rather than effort) was detrimental to output (see Prendergast, 1999, and Gibbons and Waldman, 1999).

An important conclusion of this paper is that status concerns can affect education, wages and output, both at the firm level and in the economy at large. In this respect, our model establishes a link between cultural aspects of a society and its economic performance. However, different societies may differ in culture, implying a different distribution of preferences or different status concerns. In an extension, we discuss several alternative types of status concerns. First, we examine the impact of *global* status concerns, where workers care about the average wage in society, in addition to the wages of their co-workers. We show that, in contrast to local status concerns that weaken wage incentives, global status concerns sharpen these incentives. The reason is that firms internalize only the within firm interactions in effort. Second, we consider the case in which workers observe the effort of their co-workers. Assuming that high relative wage have less influence on status if it is associated with more effort, and that socially minded workers may feel more inclined to exert effort if other workers do, we show that such preferences may change the equilibrium organization of work and that a homogenous firms structure can emerge.

2 The model

Consider an economy with a large number of workers and firms. Firms offer workers a wage contract. Workers choose in which firm to work depending on the contracts they are offered and the characteristics of the firms. There is a free mobility of workers between firms and no entry or exit costs for firms. The output of a worker, y_i, depends only on his own attributes and actions. We let $y_i = t_i e_i + \varepsilon_i$; where e_i denotes his effort, t_i his productivity and ε_i is an iid random shock, normally distributed with $E(\varepsilon_i) = 0$ and $E(\varepsilon_i^2) = \sigma^2$. We assume that firms have a capacity constraint and employ only *two* workers. Each firm's output is the sum of the output of the two workers.

Let w_i be agent i's realized wage and $v(e_i) = \frac{1}{2}e_i^2$ be the cost of his effort. We assume that workers care not only about the their own wage, but also about the difference in wage from the other workers in the firm, which is a measure of their *local* status. Letting w_j be the wage of another worker who is employed by the *same* firm as worker i. The utility function is assumed to be of the form

$$u_i = f(w_i + \delta_i \beta(w_i - w_j) - \frac{1}{2}e_i^2), \tag{1}$$

where β represents the relative importance of local status compared with own consumption, and δ_i, $\delta_i \in \{0, 1\}$ indicates whether or not individual i cares about status. Initially, we assume risk neutrality, so that $f(.)$ is linear. Risk aversion, where $f(.)$ is concave, will be discussed in a separate section.

We assume that the output of each agent is observable and can be contracted upon. We restrict ourselves to contracts in which wages are *linear* in output. Under risk neutrality, it is sufficient to condition the wage of each worker on his own wage to achieve the first best levels of effort. We thus set

$$w_i = s_i + a_i y_i, i = 1, 2. \tag{2}$$

where s_i is the salary and a_i is the 'piece rate'. Later, when we shall discuss risk aversion, we will consider a more general contract space in which wages depend on the output of both workers. Given the contract, workers choose effort to maximize their expected utility, yielding

$$e_i = a_i t_i (1 + \delta_i \beta), i = 1, 2. \tag{3}$$

The implied expected profits made by the firm are,

$$E(\pi) = t_1 e_1 (1 - a_1) + e_2 t_2 (1 - a_2) - s_1 - s_2. \tag{4}$$

Given the characteristics of the workers that join the firm (t_i, δ_i), the risk neutral firm chooses the wage parameters (s_i, a_i); $i = 1, 2$, so that expected profits are maximized and each worker obtains at least his reservation utility r_i. Given our assumption of competitive markets with no entry and exit costs, all firms make zero profits in equilibrium, regardless of the type of agents they employ. The workers' reservation values, r_i are endogenously determined and depend on the contracts offered by other firms. We must therefore solve for an equilibrium that specifies contracts in *all* firms, using the condition that agents cannot benefit by switching employers.

In most of our analysis, we shall assume that there are only two types of workers: Workers of type 1 who care about their local status, i.e., $\delta = 1$, with productivity t_1, and workers of type 2 who do not care about status, i.e., $\delta = 0$, with productivity t_2. We denote the proportions in the population of type 1 and type 2 agents by ξ and $(1 - \xi)$, respectively, where $0 < \xi < 1$. Initially, we assume that firms can observe the type of their employees. Later, we shall discuss signaling of preferences for status, δ_i, through investments in schooling.

3 The determination of effort

Consider the maximization problem of a firm employing two workers, say 1 and 2. The associated Lagrangian is

$$L = E(\pi) + \lambda_1[E(u_1) - r_1] + \lambda_2[E(u_2) - r_2]. \tag{5}$$

For any choice of the incentive parameters (a_1, a_2) the maximization with respect to (s_1, s_2) yields

$$\lambda_i = \frac{1 + 2\delta_j\beta}{1 + \delta_1\beta + \delta_2\beta},\ i, j = 1, 2. \tag{6}$$

The weight given to each agent is a *constant* that depends on the preferences of the two workers, $(\beta, \delta_1, \delta_2)$ but not on their productiveness, (t_1, t_2). It follows that the firm would choose the incentive parameters (a_1, a_2) so as to maximize

$$W = t_1e_1 + e_2t_2 - \lambda_1 v(e_1) - \lambda_2 v(e_2), \tag{7}$$

and the induced effort levels must satisfy

$$e_i = \frac{t_i}{\lambda_i},\ i = 1, 2. \tag{8}$$

Because of the interdependence in preferences, firms with a different mix of workers will provide different incentives to their workers. At equilibrium, some firms will employ agents of identical preferences (i.e., homogenous firms) while other firms may employ agents of different types (i.e., heterogenous firms). The first question that we will consider is the possibility of coexistence of homogenous and heterogenous firms in the market. Such coexistence may give rise to wage dispersion which is not based on ex-ante heterogeneity in preferences or productivity. That is, workers of the same type get different wage simply because they work at different types of firms and are therefore provided with a different compensation scheme.

Given our transferable utility setup, we can determine the incentive structure provided for each type of workers and the consequent effort level before considering the full market equilibrium, because these are independent of the reservation utility levels.

Homogenous firms

Consider, first, a firm that hires two workers, say 1 and 2, with the same preferences, but with possibly different productivities.

Proposition 1 *The effort levels in homogenous firms are independent of whether workers care about (local) status and are given by* $e_1^* = t_1$ *and* $e_2^* = t_2$.

Proof. In a firm that employ two identical workers, equation (7) implies that each worker receives a weight of unity, that is, $\lambda_1 = \lambda_2 = 1$. Thus, using equation (8), we obtain that the induced levels of effort are $e_i = t_i$, $i = 1, 2$. ■

The independence of effort from the status parameter, β, follows from the fact that local status concerns are purely relative and wash out when the firm hires workers with identical preferences.

To implement this first best outcome, the firm offers a contract that gives the incentive $a_i = 1$, if the two agents do not care about status ($\delta_1 = \delta_2 = 0$) and $a_i = \frac{1}{1+\beta}, i = 1, 2$, if the two workers care about status ($\delta_1 = \delta_2 = 1$).

When both workers care about status, incentives are slackened (i.e., $a_i < 1$). Intuitively, agents in such a case are eager to invest more effort as both wish to obtain higher status. If the same incentives were given as to workers who do not care about status, i.e., $a_i = 1$, status minded workers would work too hard, to the point where their marginal product exceed their marginal cost of effort, trying to gain status. The outcome of such a "rat-race" would be that no one gains status. The firm act as a coordinator and mitigates the wasteful competition by reducing the monetary incentive for effort, compensating the workers with a fixed payment.

Heterogenous firms

Consider now a firm that hires two agents, one that cares about status (worker 1), while the other (worker 2) does not. The two workers will be induced to provide effort levels that depend on their preferences, as well as on their productivity. Using (6) and (8), the first best effort for the two types of workers are

$$e_1 = (1 + \beta)t_1, \, e_2 = \frac{(1 + \beta)t_2}{(1 + 2\beta)}. \tag{9}$$

The firm can achieve the first best by setting

$$a_1 = 1;\ a_2 = \frac{(1+\beta)}{(1+2\beta)}. \tag{10}$$

Proposition 2 *A firm employing two workers with different preferences for status gives the status oriented agent a stronger incentive to exert effort. The worker who cares about status exerts more effort than he would in a firm with identical workers, while the worker who does not care about status will exert less effort than he would in a firm with identical workers.*

Again, the firm acts as a coordinator. Imagine that each worker in an heterogenous firm would choose his own effort and obtain all the resulting income. Then the worker who cares about status will choose an effort level $e_1 = (1+\beta)t_1$ and the one who does not care about status would choose $e_2 = t_2$. This is not an efficient outcome, as agent 2 in such a case does not internalize the negative effect of his effort and wage on the status and utility of agent 1. A firm can, with appropriate side payments, increase the utility of both workers by reducing the effort of the worker who does not care about status. The firm has an interest in doing so, because it can then attract workers at lower wages.

Given that heterogenous firms induce the status minded workers to exert more effort, while inducing the workers who do not care about status to reduce their effort, one worker raises his output while the other reduces it. It is natural to ask, therefore, what happens to the total expected output of the firm. We find

Proposition 3 *An increase in the preference for status, β, raises the total expected output of an heterogenous firm if the workers who care about status are more productive, or if β is sufficiently large.*

Proof. The total expected output of an heterogenous firm, y^{het}, is given by

$$y^{het} = t_1^2(1+\beta) + \frac{t_2^2(1+\beta)}{1+2\beta} \tag{11}$$

The derivative with respect to β is $t_1^2 - \frac{t_2^2}{(1+2\beta)^2}$, which is positive if $t_1 > t_2$ or if β is sufficiently large. ■

The main reason for the increase in output is that heterogenous firms shift effort from the low productivity worker who does not care about status, to the high productive workers who cares about status. However, under our assumptions, Proposition 3 holds even if workers who care about status are less productive, because the increase in effort by the status minded worker more then offsets the reduction in effort by his co-worker who does not care about status.[5]

Corollary 1 *A rearrangement in the organization of work, whereby two homogenous firms, one employing two workers who care about status and the other employing two workers who do not care about status exchange one worker, creating two new heterogenous firms, increases total expected output (because under the conditions of Proposition 3, $y^{het} > t_1^2 + t_2^2$).*

4 Market equilibrium

We have seen that the type of workers who join the firm can influence the firm's output and the workers' welfare. We now examine the matching pattern that emerges in a market equilibrium. In particular, we wish to provide conditions on (t_1, t_2, β) for heterogenous firms to be formed and to characterize the wage and employment structure in such equilibria. For this purpose, we make two simplifying assumptions.

Assumption 1: There is a perfect positive correlation between productivity and preferences for status. In particular, all workers with $\delta = 1$ have productivity t_1 and all workers with $\delta = 0$ have productivity t_2, where $t_1 > t_2$.

This assumption will be justified later as a consequence of equilibrium behavior. Perfect correlation allows us to define unambiguously two types of workers.

Assumption 2: One of the types is in strict majority. That is, either $\xi > .5$ or $\xi < .5$.

We consider the following market game. There is a fixed number of agents. Agents may be either of type 1 or type 2 as specified above. The distribution of types is exogenously given and the agents' type is observable. There is a large number of firms with free

[5] This feature relies on the assumed linearity of the marginal disutility from effort, and need not hold if this function is convex.

entry and exit. Firms offer employment contracts that may depend on the agents' type. Workers choose the firm they work for and there is a free mobility of workers among firms.

Since each firm employs exactly two workers, there must be some firms that employ two workers of the majority type.[6] That is, at equilibrium, there are always homogenous firms that employ two workers of the majority type. Since we assume free mobility, workers of the majority type must have the same utility in homogenous and heterogenous firms. If two workers of type j work in the same firm, their expected joint output is $2t_j^2$. Because the two workers have identical preferences and productivity, the wage for each of them equal t_j^2 and they will have the same disutility from work, $\frac{1}{2}t_j^2$. The equality of wages implies that no local status is provided in homogenous firms, and the workers expected utility is, therefore, $\frac{1}{2}t_j^2$. Thus, if j is the majority type, his reservation utility is

$$r_j = \tfrac{1}{2}t_j^2,\ j = 1, 2. \tag{12}$$

We can now calculate the utility of the minority type worker in a heterogenous firms and compare it to what he might get in a homogenous firm consisting of two minority workers. If we can show that the minority workers get a higher utility working with heterogenous firm then, at equilibrium, all workers of the minority type will work in heterogenous firms. If the minority workers get higher utility working with homogenous type firms then, then there are no heterogeneous firms in equilibrium, implying that some firms will hire only type 1 workers and some firms will hire only type 2 workers.

Proposition 4 ***(Industry Structure)*** *Heterogenous firms are always formed in equilibrium, if status minded workers are at least as productive as those who do not care about status, i.e.,* $t_1 \geq t_2$*. When a type* j *is the minority, all workers of this type will be employes in heterogenous firms. When a type* j *is the majority type, then there are some homogenous firms employing two workers of type* j *and some heterogenous firms employing the two different types of workers.*

Proof. Case 1: Workers who care about status are the minority in the population

[6] If there is an uneven number of workers, one majority worker will be self employed. Because we assume no interaction in production, this worker will have the same utility and wages as the majority workers in homogenous firms. Thus, with no loss of generality, we may assume an even number of workers.

($\xi < \frac{1}{2}$). Since there are more workers of type 2 we know that at equilibrium there must be firms that employ two workers of type 2. If an heterogenous firm is formed, employing a type 1 worker together with type 2 worker, then, by (6) and (8), it induces the effort levels:

$$e_1 = (1+\beta)t_1; e_2 = \frac{(1+\beta)t_2}{(1+2\beta)}.$$

By the zero profits condition, the expected wage bill of this heterogenous firm must equal the expected output. Using the above effort levels to calculate the expected output yields that

$$E(w_1) + E(w_2) = t_1e_1 + t_2e_2 = (1+\beta)t_1^2 + \frac{(1+\beta)t_2^2}{(1+2\beta)}. \tag{13}$$

Since $\xi < .5$, a type 2 worker, who is the majority type, must get his reservation utility. Letting $E(w_2)$ be the expected wage of type 2 worker in heterogenous firm, then $E(w_2)$ consists of two terms: the reservation utility $\frac{t_2^2}{2}$ and a compensation for the effort this worker exerts. Thus, at equilibrium, $E(w_2)$ is given by

$$E(w_2) = \frac{1}{2}[\frac{(1+\beta)t_2}{(1+2\beta)}]^2 + \frac{1}{2}t_2^2. \tag{14}$$

We can now subtract from the total wage bill for the two workers, the expected wage of worker type 2, given by to obtain the expected wage of type 1 worker in heterogenous firms.

$$\begin{aligned} E(w_1) &= (1+\beta)t_1^2 + \frac{(1+\beta)t_2^2}{(1+2\beta)} - \frac{1}{2}[\frac{(1+\beta)t_2}{(1+2\beta)}]^2 - \frac{1}{2}t_2^2 \\ &= (1+\beta)t_1^2 - \frac{\beta^2t_2^2}{2(1+2\beta)^2}. \end{aligned} \tag{15}$$

The expected utility of a type 1 worker who is employed by a heterogenous firm depends on his expected wage, his expected local status and the cost of effort he exerts:

$$\begin{aligned} E(u_1) &= E(w_1) + \beta E(w_1 - w_2) - \frac{1}{2}[(1+\beta)t_1]^2 \\ &= \frac{1}{2}(1+\beta)^2 t_1^2 - \frac{\beta(2+3\beta)t_2^2}{2(1+2\beta)}. \end{aligned} \tag{16}$$

We are now able to determine which type of firms will be formed in equilibrium. Recall that if two type 1 workers would work in an homogenous firm each would receive an expected utility $\frac{1}{2}t_1^2$. Thus, heterogenous firms will form at equilibrium only if the expected utility of type 1 workers who work in such a firms is greater than their expected utility when they work for an homogenous firm. Therefore, it remains to compare these two expressions and to check under what condition type 1 workers would prefer to work for an heterogenous firm.

$$\begin{aligned} \Delta E(u_1) &= E(u_1) - \frac{1}{2}t_1^2 \\ &= \frac{1}{2}(2\beta + \beta^2)t_1^2 - \frac{\beta(2+3\beta)t_2^2}{2(1+2\beta)}. \end{aligned} \tag{17}$$

Heterogenous firms will be formed when $\Delta E(u_1) > 0$. In such a situation, if there are only homogenous firms in the market, then a new firm may enter and gain positive profits by providing the above incentives. Workers of both types will be wiling to join such a firm rather than staying in their previous homogenous type firm.[7] Using (17), the condition that guarantees the formation of heterogenous firms is:

$$\frac{t_1^2}{t_2^2} > \frac{(2+3\beta)}{(2+\beta)(1+2\beta)}. \tag{18}$$

It is easy to verify that condition (18) is satisfied whenever $t_1 \geq t_2$.

Case 2: Workers who care about status are the majority in the population ($\xi > \frac{1}{2}$). We follow the same procedure as in the previous case. Because type 1 workers are the majority, there must be some homogenous firms that employ only type 1 workers. Thus, if there are heterogenous firms in equilibrium, the type 1 workers in those firms obtain

[7] Although a type 2 worker will be indifferent between moving and staying, the continuity of the payoff functions imply that it is possible to slightly improve his wage yet retaining the $\Delta E(u_1) > 0$ condition.

their reservation utility, which is their expected utility in an homogenous firm. Therefore,

$$E(w_1)(1+\beta) - \beta E(w_2) - \frac{1}{2}[(1+\beta)t_1]^2 = \frac{1}{2}t_1^2. \tag{19}$$

Using this indifference condition and the zero profits condition (13) we obtain

$$E(w_1) = t_1^2 \frac{1+2\beta+\frac{3}{2}\beta^2}{(1+2\beta)} + t_2^2 \frac{\beta(1+\beta)}{(1+2\beta)^2}, \tag{20}$$

$$E(w_2) = t_1^2 \frac{\beta+\frac{1}{2}\beta^2}{(1+2\beta)} + t_2^2 \frac{(1+\beta)^2}{(1+2\beta)^2}. \tag{21}$$

The expected utility of a type 2 worker who is employed by an heterogenous firm is his expected wage minus his cost of effort. Thus,

$$\begin{aligned} E(u_2) &= E(w_2) - \frac{1}{2}[\frac{(1+\beta)t_2}{(1+2\beta)}]^2 \\ &= t_1^2 \frac{\beta+\frac{1}{2}\beta^2}{(1+2\beta)} + \frac{t_2^2}{2}\frac{(1+\beta)^2}{(1+2\beta)^2}. \end{aligned} \tag{22}$$

Recall that if two type 2 workers would work in an homogenous firm, each would receive an expected utility $\frac{1}{2}t_2^2$. Thus, the utility gain for the type 2 worker from working in an heterogenous firm rather than in an homogenous firm is

$$\begin{aligned} \Delta E(u_2) &= t_1^2 \frac{\beta+\frac{1}{2}\beta^2}{(1+2\beta)} + \frac{t_2^2}{2}\frac{(1+\beta)^2}{(1+2\beta)^2} - \frac{1}{2}t_2^2 \\ &= t_1^2 \frac{\beta+\frac{1}{2}\beta^2}{(1+2\beta)} - \frac{1}{2}t_2^2 \frac{2\beta+3\beta^2}{(1+2\beta)^2}. \end{aligned} \tag{23}$$

Heterogenous firms will be formed only if $\Delta E(u_2) > 0$. Rearranging the above condition yields the same condition as in the previous section in which type 2 workers were the majority type. ■

The intuition for Proposition 4 is clear. If the two types mix, and both types exert the same effort as in homogenous firms, the expected utility of type 1 worker rises while the expected utility of type 2 and expected profits remain the same. By coordinating efforts levels, raising the effort of type 1 worker and reducing the effort of the type 2 worker, the firm can further increase the expected utility of the minority type, keeping the expected utility of the majority type fixed at its reservation value, while holding expected profits constant. Thus, the basic reason for mixing different types is the local status that is generated as a by product if the workers care about status are more productive, or if modifications in effort can support wage difference.

Remark 1 *Mixing occurs even if the workers who care about status are less productive, provided that the modified behavior through changes in effort is strong enough to overcome the negative impact of productivity on local status. The necessary and sufficient condition for mixing is* $\frac{t_1^2}{t_2^2} > \frac{(2+3\beta)}{(2+\beta)(1+2\beta)}$

Remark 2 *Because status concerns are local and fully internalized by the firms, the competitive allocation of workers to firms is Pareto* efficient.

The equilibrium wages of each type depend on their relative supply and the organization of work in the following manner.

Proposition 5 *In equilibrium:*

i) ***Wage compression****. Workers in homogenous firms receive expected wages that equal their expected output. Type* 1 *(type* 2*) workers in heterogenous firms receive expected wages that exceed (fall short of) their expected output.*

ii) ***Within firm wage differences:*** *Type* 1 *workers earn a higher expected wage than type* 2 *workers in heterogenous firms.*

(iii) ***Firm effect on the majority type:*** *(a)If type* 1 *workers are in the majority, then type* 1 *workers who are employed in heterogenous firms are paid a higher expected wage than those in homogenous firms. (b)If type* 2 *workers are the majority,* $\xi < .5$*, their expected wage in heterogenous firms are lower than in homogenous firms.*

(iv) ***Firm effect on the minority type:*** *(a)If type* 1 *workers are in minority, their expected wage exceeds the expected wage of the type* 2 *workers in homogenous firms. (b)If type* 2 *workers are in minority, they earn less (more) than type* 1 *workers in homogenous firms, if the preference for status,* β*, of the type* 1 *workers is small (large) enough.*

(v) ***Across firms wage differences:*** *The mean expected wage in heterogenous firms exceed the mean wage in homogenous firms, if* $\xi < .5$ *or if* $\xi > .5$ *and* β *is large enough.*

Proof. From our previous analysis, we know that $e_j = t_j$, $j = 1, 2$ in homogenous firms and $e_1 = (1+\beta)t_1; e_2 = \frac{(1+\beta)t_2}{(1+2\beta)}$ in heterogenous firms. Thus, the expected outputs are t_j^2, $j = 1, 2$ in homogenous firms and $(1+\beta)t_1^2$, $\frac{(1+\beta)t_2^2}{(1+2\beta)}$ in heterogenous firms. The zero profit condition implies that the expected wage bill equals the expected output. Thus, workers of type j receive $E(w_j) = t_j^2$ homogenous firms. Wages in heterogenous firms depend on the distribution of types in the population as follows.

Case 1 ($\xi < .5$**):** When type 1 workers are the minority then, by (13) and (14), the expected wages for the two types in heterogenous firms satisfy

$$(1+\beta)t_1^2 > E(w_1) = (1+\beta)t_1^2 - t_2^2\frac{\beta^2}{2(1+2\beta)^2} > t_1^2,$$

$$\frac{(1+\beta)t_2^2}{(1+2\beta)} < E(w_2) = \frac{1}{2}[\frac{(1+\beta)t_2}{(1+2\beta)}]^2 + \frac{1}{2}t_2^2 < t_2^2.$$

Thus, heterogenous firms are characterized by wage compression, that is, type 1 workers earn less than their expected output and type 2 workers earn more than their expected output. Also, type 1 workers earn more than type 2 workers, in homogenous or heterogenous firms, because $E(w_1) > t_1^2 > t_2^2 > E(w_2)$. Finally, by (13), the sum of wages in heterogenous firms $(1+\beta)t_1^2 + \frac{(1+\beta)t_2^2}{(1+2\beta)}$ exceed the sum of wages in homogenous firms, $2t_2^2$.

Case 2 ($\xi > .5$.**)**: When type 2 workers are the minority then, by (19) and (20), the expected wages for the two types in heterogenous firms satisfy

$$(1+\beta)t_1^2 > E(w_1) = t_1^2\frac{1+2\beta+\frac{3}{2}\beta^2}{(1+2\beta)} + t_2^2\frac{\beta(1+\beta)}{(1+2\beta)^2} > t_{1,}^2$$

and

$$E(w_1) > E(w_2) = t_1^2\frac{\beta+\frac{1}{2}\beta^2}{(1+2\beta)} + t_2^2\frac{(1+\beta)^2}{(1+2\beta)^2} > \frac{(1+\beta)t_2^2}{(1+2\beta)}.$$

Thus, type 2 workers in homogenous firms earn more than their expected output. Also, their wages fall short of the wages of the type 1 co-workers in heterogenous firms, $E(w_2) < E(w_1)$. The wages of type 2 workers exceed the wages of type 1 workers in homogenous firms, t_1^2, if and only if $\frac{t_1^2}{t_2^2} < \frac{(1+\beta)^2}{(1+2\beta)(1+\beta-.5\beta^2)}$. Finally, by (13), the sum of wages in heterogenous firms $(1+\beta)t_1^2 + \frac{(1+\beta)t_2^2}{(1+2\beta)}$ exceeds the sum of wages in homogenous firms, $2t_1^2$ if $\frac{t_2^2}{t_1^2} > \frac{1+2\beta}{1+\beta}(1-\beta)$. ■

Usually, one would expect the more productive type 1 workers to earn higher wages. With status concerns, however, this may not hold because the more productive workers care about status and are willing to pay for it. The presence of such payment is indicated by the wage compression that occurs in heterogenous firms, whereby the status minded worker transfers part of his output to the worker who does not care about status, as a payment for the association and for the willingness to reduce effort. The size of this payment depends on the relative supply of the two types and the incentives to exert effort provided to the two types of workers. Our results show that, in heterogenous firms, type 1 workers always receive a higher (expected) wage than type 2 workers. The basic reason for this result is the stronger incentive to exert effort provided to the status minded workers and the weaker incentive to exert effort provided to the workers who do not care about status. Thus, if type 2 workers are the majority then they are kept at their reservation utility, and their reduced effort *must* also imply a lower expected wage. On the other hand, the type 1 workers, who exert more effort, are compensated partially by increased status and partially by increased wages. If type 2 workers are in the minority, this effect is mitigated because such workers will be compensated in part for the association with type 1 workers. For sufficiently strong preference for status, the type 2 workers earn more than type 1 workers in homogenous firms.

An important implication of Proposition 5, is that status concerns can cause a positive correlation between the mean wage and internal wage variability across firms:

Corollary 2 *If $\xi < .5$ or $\xi > .5$ and the preference for status, β, is large enough, then firms that pay higher average wages also have higher internal wage differences.*

The surprising aspect of this result is that it can hold even when type 1 workers are in the majority, so that mean productivity in heterogenous firms, $\frac{t_1+t_2}{2}$ is lower than in homogenous firms, t_1. This occurs when the incentive effects of mixing can be strong enough, to induce type 1 workers in heterogenous firms to the extent that total output and wages are higher than in homogenous firms.

So far, we have only discussed the total expected wage payment. We will now examine the specific compensation schedules provided by each type of firm. We can find the equilibrium compensation schedule of type 1 workers employed by an homogenous firm by setting the incentives so as to obtain the first best level of effort and setting the fixed payment to satisfy the zero profits constraint. That is,

$$w_1^{\mathsf{hom}} = s_1^{\mathsf{hom}} + y/(1+\beta) \tag{24}$$

where $s_1^{\mathsf{hom}} = \frac{\beta}{(1+\beta)} t_1^2$. Note that this compensation schedule is independent of the distribution of types in the population.

From our previous analysis, we know that heterogenous firms provide the incentives $a_i = 1$ for type 1 workers. In such a case, the choice of effort will be $e_1 = (1+\beta)t_1$ and the resulting output is $y = (1+\beta)t_1^2$. The overall expected wage of type 1 worker at heterogenous firms is given by (15) or (20). The implied compensation schedule is

$$w_1^{het} = s_1^{het} + y, \tag{25}$$

where

$$s_1^{het} = \begin{cases} -t_2^2 \dfrac{\beta^2}{2(1+2\beta)^2} < 0 & \text{if} \quad \xi < .5 \\ -t_1^2 \dfrac{2\beta+\beta^2}{2(1+2\beta)} + t_2^2 \dfrac{\beta(1+\beta)}{(1+2\beta)^2} < 0 & \text{if} \quad \xi > .5 \end{cases} \tag{26}$$

Type 2 workers who are employed by homogenous firms face the payment schedule $w_2^{\mathsf{hom}} = y$, but working for an heterogenous firm, their payment schedule is

$$w_2^{het} = s_2^{het} + \frac{1+\beta}{1+2\beta} y, \tag{27}$$

where

$$s_2^{het} = \begin{cases} -\frac{1}{2}[\dfrac{(1+\beta)t_2}{(1+2\beta)}]^2 + \frac{1}{2}t_2^2 > 0 & \text{if} \quad \xi < .5 \\ t_1^2 \dfrac{\beta + \frac{1}{2}\beta^2}{(1+2\beta)} > 0 & \text{if} \quad \xi > .5 \end{cases} \tag{28}$$

The negative fixed payment to the status minded workers and the positive fixed payment to the workers who do not care about status reflects the transfers between the two types of workers. One would expect a transfer to type 2 workers when they are in a minority, $\xi > .5$. When these workers are in the majority, $\xi < .5$, they still receive a positive, smaller, transfer. This holds because the status minded workers "pay" not only for the association with less productive workers, but also for their willingness to reduce effort, so as to generate higher local status within heterogenous firms.

5 Effects of status concerns

Having characterized the economy with status concerns, we are now ready to compare the equilibria that arise with and without status concerns.

In the absence of any status concerns, where $\beta = 0$, effort of worker i will be set to equate his marginal cost of effort to his productivity, so that $e_i = t_i$, implying output and wages of t_i^2. Because we assume no interactions in production, aggregate output and the distribution of wages are independent of the organization of work. In contrast, if workers care about status, the effort and output of each worker depend on the type of his co-workers and the matching pattern that emerges in equilibrium influences output and wages.

5.1 Aggregate output

Let there be n firms and $2n$ workers then aggregate output, Y, is

$$Y = \begin{cases} 2n\left(\xi[t_1^2(1+\beta) + t_2^2\frac{(1+\beta)}{(1+2\beta)}] + (1-2\xi)t_2^2,\right) & \text{if} \quad \xi < .5, \\ 2n\left((1-\xi)[t_1^2(1+\beta) + t_2^2\frac{(1+\beta)}{(1+2\beta)}] + [1-2(1-\xi)]t_1^2\right) & \text{if} \quad \xi > .5. \end{cases} \tag{29}$$

As we have shown in Proposition 3, an increase in β raises the output of heterogenous firms if type 1 workers are more productive than type 2 workers. Under this condition, an increase in β must also raise aggregate output, because, given ξ, the number of heterogenous firms is fixed. An increase in ξ has a more complex effect. If $\xi < .5$ then, because the low productivity, type 2, workers are replaced by high productivity, type 1 workers, who also exert more effort when placed in heterogenous firms. However, if $\xi > .5$ then the new type 1 workers are placed in homogenous firms where they exert less effort, so that aggregate output will decline if β is sufficiently high. Specifically, aggregate output will decline if $y^{het} > t_1^2$ (i.e.,if $t_2^2 \frac{(1+\beta)}{(1+2\beta)} > t_1^2(1-\beta)$) and rise otherwise. We conclude that:

Proposition 6 *(a) An increase in status concerns β raises aggregate output.*

(b) For a small β, an increase in the proportion of agents who care about status, ξ, raises aggregate output.

(c) For β sufficiently large, aggregate output rises if $\xi < .5$ and declines if $\xi > .5$ so that aggregate output is maximized when the population is (almost) evenly divided between the two types of agents.

Figure 1 illustrates Proposition 6 and describes the output per worker for $t_1 = 1.5$, $t_2 = 1$, and $\beta = 0, 0.5, 1$.

5.2 Inequality

In the absence of status concerns, there are only two levels of (expected) wages, corresponding to the two productivity groups. With status concerns, the expected wage of each worker depend on the characteristics of co-workers and the equilibrium matching. Consequently, in equilibrium, there are three levels of expected wages. If $\xi < .5$, and type 2 workers are in the majority, then the (expected) wage distribution is

$$\begin{aligned} E(w_2^{het}) &= \frac{1}{2}[\frac{(1+\beta)t_2}{(1+2\beta)}]^2 + \frac{1}{2}t_2^2, \text{ with a weight of } \xi, \\ E(w_2^{\mathsf{hom}}) &= t_2^2, \text{ with a weight of } 1-2\xi, \\ E(w_1^{het}) &= (1+\beta)t_1^2 - \frac{\beta^2 t_2^2}{2(1+2\beta)^2}, \text{ with a weight of } \xi. \end{aligned} \tag{30}$$

Because $E(w_2^{het}) < t_2^2 < t_1^2 < E(w_1^{het})$, it is clear that, for any β, the inequality with status concerns is higher. Moreover, because the difference, $E(w_1^{het}) - E(w_2^{het})$ increases in β, wage inequality rises monotonically with status concerns.

If $\xi > .5$, then type 2 workers, who are in the minority, receive a payment for the association. In this case, the results depend on the strength of the status motive and productivity differences. Assuming a small preference for status and small productivity differences, such that $\beta < 1$ and $\frac{t_1^2}{t_2^2} < \frac{2(1+\beta)}{1+2\beta}$ it can be shown that the inequalities $E^{het}(w_2) < t_2^2 < t_1^2 < E^{het}(w_1)$ still hold[8] and the (expected) wage distribution becomes

$$\begin{aligned} E(w_2^{het}) &= t_1^2\frac{\beta+\frac{1}{2}\beta^2}{(1+2\beta)} + t_2^2\frac{(1+\beta)^2}{(1+2\beta)^2}, \text{ with a weight of } 1-\xi, \\ E(w_1^{\mathsf{hom}}) &= t_1^2, \text{ with a weight of } 2\xi - 1, \\ E(w_1^{het}) &= t_1^2\frac{1+2\beta+\frac{3}{2}\beta^2}{(1+2\beta)} + t_2^2\frac{\beta(1+\beta)}{(1+2\beta)^2}, \text{ with a weight of } 1-\ \xi. \end{aligned} \tag{31}$$

It can be further be shown that, in this range an increase in β raises $E(w_1^{het})$ and reduces $E(w_2^{het})$.

We shall use the absolute Gini that averages the absolute wage differences in the population (see Cowell, 2000) as a descriptive measure of inequality. For both (31) and (32), this measure reduces to

$$I = \xi(1-\xi)[E(w_1^{het}) - E(w_2^{het})].$$

Proposition 7 *Assume that either $\xi < .5$, or that $\xi > .5$, the preference for status is weak, and the productivity differences are small. Then*

(i) An increase in status concerns β raises inequality.

(ii) An increase in the proportion of agents who care about status ξ raises inequality if $\xi < .5$ and reduces inequality if $\xi > .5$.

The conditions that the preference for status is weak, and the productivity differences are small are required only in the case in which type 1 workers are in the majority, $\xi > .5$. In this case, type 2 workers can charge an increasingly higher payment for the association, thereby reducing inequality.

Because average wages equal average output in the economy we can conclude that

Corollary 3 *If the status minded workers are in a minority, $\xi < .5$, then an increase in status concerns raises both the mean wage and wage inequality in the economy.*

[8]For high values of β, the ranking of the t_1^2 and $E(w_2)$ is reversed and a proportion $2\xi - 1$ earn the lowest wage ,t_1^2, a proportion $1-\xi$ earn the middle wage $E(w_2)$ in (21) and a proportion $1-\xi$ earn the highest income, $E(w_1)$ in (22).

This result in Corollary 3, that applies for comparisons across economies with different cultures, replicates the result in Corollary 2, that applies to comparisons across firms in a given economy. The relation between mean performance and variability is positive in both cases, because in our model inequality has incentive effects on effort that *cause* an increase in output.

5.3 Comparison with Frank's results

The results in this section are quite different from those in Frank (1984a, 1984b), where status concerns have no effect on output and decrease rather than increase internal wage differences and wage inequality. The sharp difference in results can be traced to the assumptions about effort.

For comparison with Frank's results, assume that each worker supplies one unit of effort inelastically, but workers differ in productivity and output is random, as before. In this case, each worker in an homogenous firm receives an expected wage of t_i and his expected utility is $t_i - 1/2$. When type 2 workers are in the majority, they receive the same expected wage in homogenous and heterogenous firms, t_2. The zero profits condition for heterogenous firms, implies that type 1 workers receive $E(w_1) = t_1$. Thus, in this case, the majority type 2 workers get the same wages regardless of where they work and within firm differences equal the productivity differences. When $\xi > .5$, the expected wages of the majority type 1 workers in heterogenous firm must be set in such a way that they are indifferent between working for homogenous or heterogenous firms, that is, $E(w_1)+\beta[E(w_1)-E(w_2)]-1/2 = t_1-1/2$. Combining this indifference condition with the zero profit condition yields

$$\begin{aligned} E(w_1) &= \frac{t_1+\beta(t_1+t_2)}{1+2\beta} < t_1, \\ E(w_2) &= \frac{t_2+\beta(t_1+t_2)}{1+2\beta} > t_2. \end{aligned} \tag{32}$$

Therefore for any positive β, $t_1 > E(w_1) > E(w_2) > t_2$ and the within firm difference in expected wages is smaller than the differences in productivities. Moreover, as β rises, both wages approach the mean productivity and wage differences tend to zero. Thus, as

Frank (1984a,b) pointed out, in this case, status concerns reduce the inequality in income, as measured by the absolute Gini. The reason is that, with inelastic supply of effort and in the absence of incentive considerations, the wage structure reflects only the pricing of status. If there is a relative scarcity of the workers who do not care about status, the majority workers who do care will have to pay for the association. However, when the majority of the workers do not care about status, then, in equilibrium, there is no need for the status minded workers to pay for the association, and the wage differences within and across firms are the same. Precisely the same results are obtained if effort is variable but independent of status. For instance, if status is awarded based on comparisons of the productivity levels t_1 and t_2.

In our model, status concerns interact with the willingness of workers to exert effort. As we have shown, despite the wage compression associated with status seeking, the induced changes in effort and output are sufficiently large to support an *increase* in internal wage differences and wage inequality.[9] The different implications for the income distribution are illustrated in figures 2_a and 2_b.

Given the conflicting results on wage inequality, one may ask what results hold for any cost of effort $v(e_i)$ that is rising and convex. Propositions 1 and 2 on effort and Proposition 3 on mixing continue to hold for *any* such cost function. However, our results on output and wages is sensitive to the specification of the disutility from effort. We assume, in this paper, that the marginal disutility from effort is linear. This specification is commonly used in the analysis of linear incentive contracts, because of its tractability. We note that Frank's results continue to hold even if effort is variable but the modified behavior is such that type 1 workers do not increase their effort much, while type 2 workers reduce their effort substantially. In such a case, the organization of work in heterogenous firms reduces output and it is possible to construct examples in which status concerns actually reduces wage differences.[10]

[9]Frank (1985, p. 88-89) discusses briefly the case in which workers supply effort. He argues that such a setup may provide an alternative explanation for why wages are compressed, because firms may put a cap on earnings to prevent an inefficient 'rat-race' competition for status. This statement is consistent with our result that weaker incentives are provided in homogenous firms. The main departure, however, arises in the case of heterogenous firms, where preferences for status differ. In this case, differences in effort and wages are *efficient*, from a collective point of view.

[10]As an extreme example, assume that effort is either 0 or 1 and that the cost of 1 unit of effort is c,

6 Unobservable status concerns

Suppose that the status concerns of workers, δ_i, are not observed by the firms, while the workers' productivity levels, t_i, are observable. Assume further that the workers' productivity is determined by investment in schooling prior to entry into the labor force. For simplicity, we assume two schooling levels (0 and 1) and let the cost of acquiring 1 unit of schooling be x. The productivity level of an agent without schooling is normalized to 1, and the productivity level of an agent with schooling is labeled t_1, where $t_1 > 1$.

Consider now the following two stage model: At the first stage, each agent decides whether or not to invest in education. The second stage is a market game in which firms offer employment contracts and workers choose the firm they work for and the wage contract. Firms offer contracts based on the education level that they observe. The wage contracts do not depend on the agents' type, which is not observable by firms. There is a free entry to the market so firms will enter as long as they can offer contract that yield non-negative profits.

The focus of our analysis is the existence of a separating equilibrium, in which status minded workers acquire schooling, while workers who do not care about status do not acquire schooling. Such a separating equilibrium can justify our previous assumption that $t_1 > t_2$. We continue and refer to socially minded individuals as type 1 agents and to those who do not care about status as type 2 agents.

Proposition 8 *For any given $\beta > 0$ and $t_1 > 1$, there exist an interval for the cost of schooling, x, such that a separating equilibrium exists, where type 1 individuals acquire education, while type 2 individuals do not invest in schooling.*

Proof. See Appendix. ■

The existence of separating equilibria is supported by the fact that a worker who does not care about status and acquires schooling will exert less effort than a status minded

where $c < t_2 < t_1$. Assume that $\xi > .5$. A type 1 worker in homogenous firms will supply 1 unit of effort and get a wage of t_1. When mixed with a type 2 worker, he will exert the same effort and get the same utility. Because he also gets status, his wage must decline. If $t_2 - c$ is small such that $\frac{c}{t_2} > \frac{1+\beta}{1+2\beta}$, the type 2 worker will be induces, in equilibrium, to spend no effort. In this case, output is t_1 and the wage difference is $w_1 - w_2 = \frac{t_1 - 2c}{1+2\beta}$, which (given that $t_2 - c$ is small) is less than $t_1 - t_2$.

worker facing the same incentives. Therefore, his marginal benefit from schooling is lower and he will refrain from investment at same costs at which the social minded workers find it profitable to invest. The higher is the marginal utility from status, β, the larger are the differences in effort and earnings between the two types and, therefore, it will be easier for the socially minded agents to separate themselves. If socially minded workers are in the minority, they pay less to those who do not care about status for the association. Thus, a pretender (i.e., a type 2 worker who acquires schooling) will obtain a higher fixed payment. In this case, a higher cost of schooling is required to separate the two types.

Because schooling raises productivity, it is clear that if the costs of schooling are sufficiently low, everyone will acquire schooling, while if the costs are high, no one will acquire schooling. In either of these cases, schooling has no signaling value. It is still possible for a separating equilibrium to exist, because firms can offer different contracts and workers will self select based on their preferences as in Rothschild and Stiglitz (1976). However, we find signaling through schooling the more interesting case, because it appears that schools do in fact identify not only ability, as suggested by Spence (1974) and others, but also the response to incentives, a factor which we may refer to as motivation.

It has been recognized by many observers that schooling is a source of attaining higher social status (see Weiss and Fershtman, 1998). It is not surprising, therefore, that agents who care about status invest more in schooling. The more subtle issue concerns the impact of status on the monetary returns for schooling. If status is highly valued, then educated workers need not be compensated for the costs of investment, and may in fact have lower earnings, which eventually can detract from their social status. The fact that the market pays a substantial return for schooling, exceeding the return of other investments, suggests that educated workers differ in their attributes from the non educated workers. Most of the empirical research on this problem concentrated on the role of ability, as an unmeasured attribute that explains the returns for schooling. Recent findings indicate that ability has only a small impact on the monetary returns from schooling (see Ashenfelter et al., 1999). Our analysis suggests a potential role for unobserved effort, or motivation, whereby the highly educated are compensated, in part, for additional effort. This view is consistent with the positive correlation between education and measured effort in the form of longer hours (see Coleman and Pencavel, 1993).

7 Risk aversion

We now turn to the case in which workers are risk averse. The purpose of introducing risk aversion is to tie our analysis with the wide literature that examines second best contracts within firms (see Prendergast, 1999, and Gibbons and Waldman, 1999). We show that status concerns affect both the strength of the monetary incentives that firms provide and the way in which firms evaluate relative performance.

We continue to focus on local status and assume, for simplicity, that $f(.)$ is exponential, so that $f_i(x_i) = -e^{-\alpha x_i}$, $i = 1, 2$, where α is the risk aversion parameter and $x_i = w_i + \delta_i^l \beta^l (w_i - w_j) - \frac{1}{2} e_i^2$. Assuming further that ε_i is normally distributed one obtains a certainty equivalent $-exp[E(x_i) - \frac{\alpha \sigma_{xi}^2}{2}]$. Therefore, the optimal contract must maximize expected profits subject to the constraints that $E(x_i) - \frac{\alpha \sigma_{xi}^2}{2} \geq r_i$. Thus, the model conserves the property of transferable utility and equations (5) - (7) continue to hold. The optimal contract must maximize the joint objective

$$W = t_1 e_1 + e_2 t_2 - \lambda_1 [v(e_1) + \frac{\alpha \sigma_{x1}^2}{2}] - \lambda_2 [v(e_2) + \frac{\alpha \sigma_{x2}^2}{2}], \tag{33}$$

where the σ_{xi}^2 terms depend on the choice of contract. We assume a linear contract of the form,

$$w_i = s_i + a_i y_i + b_i y_j \tag{34}$$

Given this wage scheme, worker i chooses the effort level,

$$e_i = a_i t_i + \delta_i \beta (a_i t_i - b_j t_i) \tag{35}$$

and σ_{xi}^2 is given by,

$$\sigma_{xi}^2 = \sigma^2 [(a_i(1 + \delta_i \beta) - \delta_i \beta b_j)^2 + (b_i(1 + \delta_i \beta) - a_j \delta_i \beta)^2]. \tag{36}$$

The first term represents the variability of the utility of worker i resulting from the variability of his own output, and the second term represents the variability of the utility of worker i resulting from the variability of the output of the other worker. If binding contracts on effort and wages could be enforced, the firm would provide perfect insurance and workers would agree to provide the first best level of effort, as under risk neutrality. However, because effort is not contractible, the optimal contract maximizes (33) with respect to the contractual parameters, given (35). Thus, we obtain a second best contract that trades off the incentive for effort against the need for insurance.

The optimization problem of the firm can be solved in two steps. In the first step, the effort levels are kept constant and choose the policy parameters (a_1, a_2, b_1, b_2) are chosen to minimize risk associated with the fixed levels of effort, and in the second step we choose the optimal effort level given that risk is minimized. Inspection of the variance terms in (36) shows that the first term is proportional to e_i, so the first step requires the minimization of the term $(b_i(1+\delta_i\beta) - a_j\delta_i\beta)^2$, which represents the variability of the utility of worker i resulting from the variability of the output of the other worker. This variability is induced by the status preferences $\delta_i\beta$ and the policy parameters b_i and a_j. For any given levels of effort, it is always possible to choose policy parameters that provides *perfect insurance* against shocks in y_j, implying that the second term is set to zero. Moving to the second step, we now obtain that

$$e_i = \frac{t_i}{\lambda_i(1+\frac{\alpha\sigma^2}{t_i^2})}. \tag{37}$$

Compared with the first best solution under certainty, where $e_i = \frac{t_i}{\lambda_i}$, effort is reduced. This reflects the compromise between incentives and insurance. The contractual parameters supporting the solution are,

$$a_i = \frac{1}{\lambda_i(1+\frac{\alpha\sigma^2}{t_i^2})}\frac{1+\delta_j\beta}{1+\delta_i\beta+\delta_j\beta}, \tag{38}$$

and

$$b_i = \frac{1}{\lambda_j(1+\frac{\alpha\sigma^2}{t_j^2})}\frac{1+\delta_i\beta}{1+\delta_j\beta+\delta_i\beta}\frac{\delta_i\beta}{1+\delta_i\beta}. \tag{39}$$

In contrast to the case with risk neutrality, where one could support the first best effort levels without conditioning on the output of the other worker, the second best solution requires that the wage of each worker depends *positively* on the output of *both* workers. The reason is that positive incentives for effort for worker j imply that his wages depend on ε_j. This creates status shocks to worker i. To alleviate this variability in status, the wage of worker i depends positively on the output of worker j. This result is in contrast to comparative payments based on a positive correlation in the random shocks. There, the typical result is that $i's$ wages depend *negatively* on the output of his coworker, because high output of the co-worker indicates that luck (rather than effort) influences i's output (see Prendergast,1999, and Gibbons and Waldman, 1999).

Note that when $\sigma = 0$ (or $\alpha = 0$) we get the same effort level as first best. However, the contractual parameters do *not* converge to the parameters in equations (9) and (10). This reflects the non-uniqueness of the contractual parameters under risk neutrality. In fact, the limiting values of the contractual parameters,

$$a_i = \frac{1 + \delta_j \beta}{1 + 2\delta_j \beta}, \ b_i = \frac{\delta_i \beta}{1 + 2\delta_i \beta} \tag{40}$$

also support the first best, providing the same levels of effort and utility for all agents.

Examining the expressions in (38) and (39), it is readily seen that the presence of risk aversion *magnifies* the impact of status concerns. That is, in heterogenous firms, the worker who does not (does) care about status is induced to provide even less (more) effort than in the case of risk neutrality. This holds because the status externalities affect both the mean and the variance of utility. Except for these differences, the main results that we have proved under risk neutrality continue to hold.

8 Other status concerns

So far, we have considered the effect of local status, when the reference group is one's co-workers. We also assumed that local status depends only the ranking of wages, irrespective of differences in effort. We now describe briefly the effects of some alternative social norms.

8.1 Global status

Assume that meetings occur in two spheres, social sphere where one meets a random person in the society, and professional sphere where one meets those with whom he works. Both groups can be used as reference groups, whereby *local* status is determined by wage comparisons with one's co-workers and *global* status is determined by wage comparisons with the average wage in society. We denote the weights that workers give to these two concerns by $\delta_i\beta^l$ and $\delta_i\beta^g$, respectively, where $\delta_i \in \{0,1\}$.

If workers care only about global status, it does not matter how work is organized and which type of firms are formed. Workers who do not care about status will exert the effort $e_2 = t_2$, while workers who care about global status will choose the effort $e_1 = t_1(1+\beta^g)$, *irrespectively* of the identity of the co-worker. This solution is not efficient, because both types of workers ignore the impact on other type 1 workers and work too much . In other words, global status concerns lead to excessive competition, raising effort and output but reducing welfare.

If workers care about both local and global status, then the effort levels in homogenous firms employing two workers with the same preferences are independent of the local status parameter β^l and are given by $e_i = t_i(1+\delta\beta^g)$. Local status concerns that are purely relative wash out, because they do not affect the total "pie" to be distributed among the three agents. However, global status concerns do influence the outcome. In fact, because the firm does not internalize the social interactions, this outcome is the *same* as would obtain if workers would care only about global status, or are self employed.

To implement this first best outcome, the firm may offer a contract that gives the incentive $a_i = 1$, if the two workers do not care about status, and $a_i = \frac{1+\beta^g}{1+\beta^g+\beta^l}$ if the two workers care about status. The stronger the global concerns, the stronger will be the monetary incentive. In this sense, the firm respects the desire of workers to attain global status. However, the higher is the local status concern β, the weaker is the monetary incentive. Incentives are slackened because an increased effort of one agent has a negative impact on the utility of the other worker in the firm. The optimal scheme forces each worker to internalize this effect. In contrast, the firm does not internalize the effect on workers employed by other firms. Thus, the social inefficiency, that we noted above, persists and workers in homogenous firms still work too much, from a social point of view.

If workers in the same firm differ in preferences, then the first best effort levels of the worker who cares about status and, of the worker who does not care, respectively, are

$$e_1 = (1 + \beta^g + \beta^l)t_1,\ e_2 = \frac{(1 + \beta^g + \beta^l)t_2}{(1 + \beta^g + 2\beta^l)}. \tag{41}$$

The firm can achieve the first best by setting

$$a_1 = 1;\ a_2 = \frac{(1 + \beta^g + \beta^l)}{(1 + \beta^g + 2\beta^l)}. \tag{42}$$

We conclude that:

Proposition 9 *A firm employing two workers with different preferences for status gives the worker with the higher demand for local status a stronger incentive to exert effort. The worker who cares about local status exerts more effort than he would in a firm with identical workers, while the worker who does not care about local status will exert less effort than he would in a firm with identical workers. Stronger local status concerns weakens the wage incentives given by the heterogenous firm, but stronger global status concerns sharpens the wage incentives.*

Because we assume that workers who care about status are more productive, it still holds that output is enhanced if heterogenous firms are formed. However, it is not true any more that combining workers into mixed firm enhances efficiency, because workers who work alone or in homogenous firms work too much from a social point of view. Compared with the inefficient equilibrium with self employed or homogenous firms, the heterogenous firm induces type 1 workers to work more, which impairs efficiency and induces type 2 worker to work less, which enhances efficiency. The overall impact on efficiency is not clear.

8.2 Comparisons of effort

One may assume that, within firms, workers observe the effort of their co-workers, in addition to their output (see Lazear, 1989, and Kandel and Lazear, 1992). In such a case, local status and the costs of effort may depend also on comparisons of effort. For instance, the status of a high wage person may be modified downward if he exerts more effort to achieve this outcome. In addition, socially minded workers may feel more inclined to exert effort if others do. We can capture these two considerations by adding a term $\delta_i \alpha (e_i - e_j)^2$ to the utility function, where $\alpha < 0$.

If a mixed firm is formed then the first best levels of effort are now chosen to maximize

$$W = t_1 e_1 + e_2 t_2 + \lambda_1 [\delta_1 \alpha (e_1 - e_2)^2 - v(e_1)] + \lambda_2 [\delta_2 \alpha (e_2 - e_1)^2 - v(e_2)], \qquad (43)$$

where λ_i are given by (6) Note that, for $\alpha < 0$, the common "pie", W, is concave and the two effort levels are complements (i.e., $\frac{\partial W^2}{\partial e_1 \partial e_2} > 0$).

The effort levels in homogenous firms are the same as before, by $e_i = t_i$, independently of α and β. However, the effort levels in heterogenous firms are now

$$\begin{aligned} e_1 &= (1+\beta) \frac{t_1(1 + 2\beta - 2\alpha) - 2t_2 \alpha}{(1+2\beta)(1-2\alpha) - 2\alpha}, \\ e_2 &= (1+\beta) \frac{t_2(1 - 2\alpha) - 2t_1 \alpha}{(1+2\beta)(1-2\alpha) - 2\alpha} < e_1. \end{aligned} \qquad (44)$$

It is still true that the workers who care about status are induces to exert more effort, however the difference in effort between the two types declines monotonically when the parameter α declines and the two effort levels become more complementary. In the limit, as α approaches -∞ both workers would exert the *same* effort $\frac{t_1+t_2}{2}$. To see that this cannot be an equilibrium, recall that, with transferable utility, a heterogenous firm survives competition only if the maximized joint "pie" is larger than the *sum* of the utilities that the two workers can obtain by joining homogenous firms, or becoming self employed. It is thus necessary that $W > t_1^2 + t_2^2$. However, because $\alpha < 0$, W must be smaller than the total output, $t_1 e_1 + e_2 t_2$, which approaches a limit $\frac{(t_1+t_2)^2}{2}$ that is smaller than $t_1^2 + t_1^2$. Thus, with modest demand for wage superiority but large aversion to discrepancies in effort, heterogenous firms will *not* be formed.

This simple observation resembles a known result from tournament theory that, if workers' productivities differ then homogenous, rather that heterogenous firms, are formed. It is more efficient to have a tournament between similar workers, because the maximal incentive for effort is given when the density is at its peak and the probability of receiving a prize is most sensitive to effort (Lazear and Rosen, 1981, MacLaughlin, 1988).[11] The basic difference between our setting and tournaments is that in our setting there is a *direct link* between relative effort (wages) and utility, while in tournaments the *contract* creates a link between relative effort and utility, where, in fact, there are no interactions in costs or outputs.[12] Nevertheless, it remains true that if we use "tournament like" preferences where, the maximal incentives for effort is provided when effort levels are similar, then mixing is not optimal.[13]

9 Concluding Remarks

This paper has several implications for incentive contracts. The first implication is that incentives depend on the organization of firms. Homogenous firms with only status minded workers are characterized by low-powered incentives because workers in such firms have a strong intrinsic desire to climb the internal status hierarchy, and would over-exert effort if they received high-powered incentives. In heterogenous firms, on the other hand, the worker who cares about status will face high-powered incentives, while the worker who does not care about status will face low-powered incentives, due to the one-way negative income externality in such firms. Because we argue that status minded workers are more likely to invest in schooling, one may test directly whether workers with schooling get stronger incentives to exert effort. Although it is well known that work hours tend to increase with education, we are not aware of studies of the relation between schooling and incentives within firms.

The second implication is that the organization of firms will not be arbitrary, but is

[11] Assuming that types are known. When types are not known there can be adverse selection, in that low productivity types are attracted to the major leagues, since average prizes are higher.

[12] Another difference is that we assume that enough instruments exist to achieve a first best when agents differ. With additional instruments like handicaps, the equilibrium mixing will be indeterminate under tournament rewards, because it is assumed that output of agents are independent and there are no status externalities, as in our model. Handicaps in asymmetric tournaments are considered by Lazear and Rosen (1981), MacLaughlin (1988), and Meyer (1992).

[13] Lazear (1989), considers a similar kind of interaction in effort where workers can spend effort to make the other look worse, in the context of tournaments. He shows that firms respond by raising wage equality and by avoiding the mixing of workers with different preferences for sabotage.

determined by the competitive forces. Heterogenous firms form in equilibrium, because such firms can create a status surplus compared to homogenous firms. Thus, their formation and subsequent choice of incentives depends on supply and demand conditions, as indicated by the relative number and productivity of workers who care about status. Since agents that care about status have a stronger incentive to invest in human capital, such workers will endogenously be more productive than workers that care less about status.

The third implication concerns the relationship between wage differences and morale. If relative wages affect morale, what should the relative wage between high-productivity workers and low productivity workers be? The trade-off involves taking into consideration that paying more the high-productivity workers increases their morale but also decreases low-productivity workers morale. However, we argue that the firm can coordinate the workers effort levels in such away that the low productivity worker is compensated for lower wages through reduced effort. Moreover, in the equilibrium of our model, the sorting is such that low-productivity workers do not care about status and hence do not get a negative morale shock if wages of high-productivity workers are increased.

In addition, our analysis has some implications for wage differences across firms and between workers with different schooling. We argue that, because of the interaction between status and effort, firms with higher wage inequality are able to pay higher mean wages. The same idea can be applied to other situations where local status matters. For instance, integration of schools that raises the variance in learning ability may raise average achievement, because the top students will be more motivated to excel. We also show that observationally identical workers, with the same schooling, may have different wages, depending on the characteristics of their co-workers, because they are placed differently in the internal status hierarchy and moreover get different incentives to exert effort. For example, the single star of an academic department may have stronger incentives to publish and may receive a higher wage than an equally able researcher in a top academic department.

Most of our results depend on the assumption that individuals have different preferences for status, generating trade opportunities between status and wages or status and effort. The result that heterogeneity in preferences raises aggregate output suggests the possibility that such preferences are evolutionarily stable. But this issue must be left for future research.

References

[1] Ashenfelter, O., Harmon, C. and H. Oosterbeek (1999). "A Review of Estimates of Schooling/Earnings Relationship with Tests for Publication Biases," Industrial Relations Section, Princeton University, Working Paper No. 425.

[2] Auriol E. and R. Renault (1999). "Symbols in Organizations," Department of Economics, University of Toulouse.

[3] Coleman, M. and J. Pencavel (1993). "Changes in the Work Hours of Male Employees since 1940," *Industrial and Labor Relations Review*, 46, 653-76.

[4] Cowell, F. A. (2000). "Measurement of Inequality." *Handbook of Income Distribution*, Vol. 1, North Holland edited by A. Atkinson and F. Bourguignon.

[5] Fershtman, C. and Y. Weiss (1993). "Social Status, Culture and Economic Performance," *Economic Journal* 103, 946-959.

[6] Frank, R. (1984a). "Interdependent Preferences and the Competitive Wage Structure," *Rand Journal of Economics*, 15, 510-520.

[7] Frank, R. (1984b). "Are Workers Paid Their Marginal Products?" *American Economic Review*, 74, 549-70.

[8] Frank, R. (1985). *Choosing the Right Pond*, Oxford: Oxford University Press.

[9] Gibbons, R. and M. Waldman (1999). "Careers in Organizations: Theory and Evidence." *Handbook of Labor Economics*, Vol. 3, edited by O. Ashenfelter and D. Card.North Holland

[10] Hicks, J. R (1963). *The Theory of Wages* (second edition) London: MacMillan.

[11] Kandel, E. and E. Lazear, (1992). "Peer Pressure and Partnerships," *Journal of Political Economy*, 100, 801-813.

[12] Landers, R., Rebitzer J. and L. Taylor (1996). "Rat Race Redux: Adverse Selection in the Determination of Work Hours in Law Firms," *American Economic Review*, 86, 329-348.

[13] Lazear, E. (1989). "Pay Inequality and Industrial Politics," *Journal of Political Economy*, 97, 561-80.

[14] Lazear, E. and S. Rosen (1981). "Rank-Order Tournaments as Optimum Labor Contracts. *Journal of Political Economy*," 89, 841-64.

[15] Li, H. and S. Rosen (1998). "Unraveling in Matching Markets. *American Economic Review*," 88, 371-87.

[16] Maclaughlin, K. J. (1988). "Aspects of Tournament Models: A Survey," *Research in Labor Economics*, 9, 225-56.

[17] Meyer, M. (1982). "Learning from Coarse Information: Biased Contests and Career Profiles," *Review of Economic Studies*, 58, 15-41.

[18] Prendergast, C. (1999). "The Provision of Incentives in Firms," *Journal of Economic Literature*, 37: 7-63.

[19] Reder M. (1957). *Labor in a Growing Economy.* New-York: Wiley.

[20] Rotemberg, J. (1994). Human Relations in the Workplace. *Journal of Political Economy*, 102, 684-717.

[21] Rothschild, M. and J. Stiglitz (1976). "Equilibrium in Competitive Insurance Markets; An Essay on the Economics of Imperfect Competition," *Quarterly Journal of Economics*, 90, 629-650.

[22] Smith, A (1776). *The Wealth of Nations.* Reprinted by Modern Library, New-York, *1937.*

[23] Spence, M. (1974). *Market Signaling.* Cambridge: Harvard University Press.

[24] Weiss, Y. & C. Fershtman. (1998). Social Status and Economic Performance: A Survey. *European Economic Review, 42*, 801-820.

[25] Zizzo D. and A. Oswald (1999). "Are People Willing to Pay to Reduce Others' Incomes?" Department of Economics, Oxford University.

10 Appendix: proof of Proposition 8

We shall now present the bounds on the costs of schooling such that a separating equilibrium exists. We start out with the case $\xi < 0.5$ and then consider the case $\xi > 0.5$.

Case 1($\xi < 0.5$): If a type 1 agent joins an homogenous firm employing two workers with no schooling (and where the other worker is of type 2) his pay schedule will be $w_2^{\mathsf{hom}} = y$. In such a case, he exerts the effort $1+\beta$. His total wage will be $1+\beta$. His co-worker, who is of type 2, will have the same incentives but his choice of effort is 1 and his expected wage is 1. The local status of the type 1 worker will be β^2, implying expected utility of $\frac{1}{2}(1+\beta)^2 - \beta$. However, the same worker may join an heterogenous firm as an uneducated worker accepting the wage schedule

$$w_2^{het} = -\frac{1}{2}[\frac{(1+\beta)}{(1+2\beta)}]^2 + \frac{1}{2} + \frac{1+\beta}{1+2\beta}y. \tag{A1}$$

Given such a contract, the agent exerts the effort $\frac{(1+\beta)^2}{1+\ 2\beta}$. This effort level yields the total wage

$$-\frac{1}{2}[\frac{(1+\beta)}{(1+2\beta)}]^2 + \frac{1}{2} + \frac{1+\beta}{1+2\beta}\frac{(1+\beta)^2}{1+\ 2\beta} = \frac{1+2\beta+\beta^2/2}{(1+2\beta)}. \tag{A2}$$

In such a firm, his co-worker will be an educated type 1 worker with productivity t_1, and who chooses the effort level $(1+\beta)\ t_1$ and gets the total wage

$$E^{mi}(w_1) = (1+\beta)t_1^2 - \ \frac{\beta^2}{2(1+2\beta)^2}. \tag{A3}$$

The local status in such a case will be

$$\beta\{\frac{1+2\beta+\beta^2/2}{(1+2\beta)} - (1+\beta)t_1^2 + \ \frac{\beta^2}{2(1+2\beta)^2}\} = \beta\frac{1+4\beta+5\beta^2+\beta^3}{(1+2\beta)^2} - \beta(1+\beta)t_1^2. \tag{A4}$$

The agent's expected utility in this case is

$$\frac{1+2\beta+\beta^2/2}{(1+2\beta)} + \beta\frac{1+4\beta+5\beta^2+\beta^3}{(1+2\beta)^2} - \beta(1+\beta)t_1^2 - \frac{1}{2}[\frac{(1+\beta)^2}{(1+2\beta)}]^2$$

Comparing the two options yields that as long as $t_1 > 1$,

$$\frac{1}{2}(1+\beta)^2 - \beta > \frac{1+6\beta+11\beta^2+8\beta^3+\beta^4}{2(1+2\beta)^2} - \beta(1+\beta)t_1^2, \tag{A6}$$

which implies that if a player type 1 chooses not to get education, he will be better off joining a homogenous firm. Intuitively, if he joins an heterogenous firm, the agent gets lower incentives for effort and a negative local status. Although uneducated workers are paid a positive fixed amount to join heterogenous firms, this amount is not sufficient to reverse the other effects, as seen in (A6). Thus, the necessary condition for separating equilibrium is that a type 1 agent is better off from educating and joining an heterogenous firm, rather than not educating and joining an homogenous firm. Specifically,

$$\frac{1}{2}(1+\beta)^2 t_1^2 + \frac{2\beta+3\beta^2}{2(1+2\beta)} - x > \frac{1}{2}(1+\beta)^2 - \beta. \tag{A7}$$

Rearranging this condition yield the following necessary condition:

$$(1+\beta)^2 t_1^2 - 2x > \frac{1-2\beta^2+2\beta^3}{(1+2\beta)}. \tag{A8}$$

Now suppose that an agent of type 2 deviates and acquires schooling, then he will be considered a member of the type 1 minority and work in an heterogenous firm as an educated worker getting the wage schedule $w = y - \frac{\beta^2}{2(1+2\beta)^2}$. In such a case, this agent will choose an effort level of t_1, implying expected utility of $\frac{1}{2}t_1^2 - \frac{\beta^2}{2(1+2\beta)^2} - x$. Thus, a necessary condition for a separating equilibrium is that agent type 2 is better off not getting education. That is,

$$\frac{1}{2} > \frac{1}{2}t_1^2 - \frac{\beta^2}{2(1+2\beta)^2} - x. \tag{A9}$$

Rearranging yields the following condition

$$2x > (t_1^2 - 1) - \frac{\beta^2}{(1+2\beta)^2}. \tag{A10}$$

Putting the two conditions (A8) and (A10) together yields that a separating equilibrium exists only when

$$(1+\beta)^2 t_1^2 - \frac{1-2\beta^2+2\beta^3}{(1+2\beta)} > 2x > t_1^2 - \frac{1+4\beta+5\beta^2}{(1+2\beta)^2}. \tag{A11}$$

It is easy to verify that the l.h.s. of (A11) is greater than the r.h.s. as long as $t_1 > 1$. Thus, the above equation define a range for x for which there exists a separating equilibrium.

Case 2 ($\xi > 0.5$): In this case type 2 agents are the minority. Consider now the separating equilibrium in which there are heterogenous firms and homogenous firms that employ two workers of type 1. The homogenous firms offer the employment contract w_1^{hom} given by (27) for educated workers and the heterogenous firms offer the employment contract w_1^{het} given by equation (28) and (30) for educated workers and the contract w_2^{het} given by (31) and (33) for uneducated workers. In such a case, type 2 workers do not get education and accept the contract from an heterogenous firm and type 1 workers acquire education and accept one of the two employment contracts offered to them. Their utilities will be,

$$E(u_1) = \frac{1}{2}t_1^2 - x,\ E(u_2) = t_1^2\frac{\beta+\frac{1}{2}\beta^2}{(1+2\beta)} + \frac{(1+\beta)^2}{2(1+2\beta)^2}. \tag{A12}$$

Suppose that an agent of type 1 deviates and skips education. In that case, he can get a position as a type 2 worker in a heterogenous firm, where his co-worker will be an educated type 1 worker. The compensation scheme that he will get in such a case is

$$w_2^{het} = t_1^2\frac{2\beta+\beta^2}{2(1+2\beta)} + \frac{1+\beta}{1+2\beta}y. \tag{A13}$$

Given such a contract, the agent exerts the effort $\frac{(1+\beta)^2}{1+\ 2\beta}$. This effort level yields the total wage $t_1^2\frac{2\beta+\beta^2}{2(1+2\beta)} + \frac{(1+\beta)^3}{(1+\ 2\beta)^2}$. His type 1 co-worker, who got education and has the productivity t_1, chooses the effort level of $(1+\beta)\ t_1$ and gets a total wage of

$$E^{mj}(w_1) = t_1^2\frac{1+2\beta+\frac{3}{2}\beta^2}{(1+2\beta)} + \frac{\beta(1+\beta)}{(1+2\beta)^2}.$$

The local status in such a case will be

$$\begin{aligned} & \beta\{t_1^2\frac{2\beta+\beta^2}{2(1+2\beta)}+\frac{(1+\beta)^3}{(1+\ 2\beta)^2}-t_1^2\frac{1+2\beta+\frac{3}{2}\beta^2}{(1+2\beta)}-\frac{\beta(1+\beta)}{(1+2\beta)^2}\} \\ = \ & \beta\frac{(1+\beta)(1+\beta+\beta^2)}{(1+2\beta)^2}-\beta\frac{1+\beta+\beta^2}{(1+2\beta)}t_1^2. \end{aligned} \tag{A14}$$

The agent's expected utility will be in this case

$$\begin{aligned} & t_1^2\frac{2\beta+\beta^2}{2(1+2\beta)}+\frac{(1+\beta)^3}{(1+\ 2\beta)^2}+\beta\frac{(1+\beta)(1+\beta+\beta^2)}{(1+2\beta)^2}-\beta\frac{1+\beta+\beta^2}{(1+2\beta)}t_1^2-\frac{1}{2}[\frac{(1+\beta)^2}{(1+2\beta)}]^2 \\ = \ & \frac{(1+\beta)(1+3\beta+\beta^2+\beta^3)}{2(1+2\beta)^2}-\frac{\beta^2}{2}t_1^2. \end{aligned} \tag{A15}$$

Thus, a necessary condition for a separating equilibrium is that player of type 1 is better off not deviating. i.e.,

$$\frac{(1+\beta)(1+3\beta+\beta^2+\beta^3)}{2(1+2\beta)^2}-\frac{\beta^2}{2}t_1^2<\frac{1}{2}t_1^2-x, \tag{A16}$$

which after simplification gives the condition

$$2x<(1+\beta^2)t_1^2-\frac{(1+\beta)(1+3\beta+\beta^2+\beta^3)}{(1+2\beta)^2}. \tag{A17}$$

Now suppose that an agent of type 2 deviates and chooses to acquire schooling. In such a case, he will be considered as a type 1 worker and will be able to choose to work in an homogenous firm or in heterogenous firm. Working in an homogenous firm, he will get the payment schedule of $w^{\mathsf{hom}}=\frac{\beta}{(1+\beta)}t_1^2+\frac{y}{(1+\beta)}$. Given these compensation, his choice of effort is $e=\frac{1}{(1+\beta)}t_1$, which yields the utility of $\frac{\beta}{(1+\beta)}t_1^2+\frac{t_1^2}{2(1+\beta)^2}-x$. On the other hand, working in an heterogenous firm as an educated worker, the agent will get the wage schedule $w=y-t_1^2\frac{2\beta+\beta^2}{2(1+2\beta)}+\frac{\beta(1+\beta)}{(1+2\beta)^2}$. In such a case, the agent will choose an effort level of t_1, implying expected utility of $\frac{1}{2}t_1^2-t_1^2\frac{2\beta+\beta^2}{2(1+2\beta)}+\frac{\beta(1+\beta)}{(1+2\beta)^2}-x$. Comparing the expressions in yields that if player 2 is deviating he is better off working for an heterogenous firm, provided that β is not too large.

Thus, a necessary condition for a separating equilibrium is that agent type 2 is better off not getting education. That is,

$$t_1^2\frac{2\beta+\beta^2}{2(1+2\beta)}+\frac{(1+\beta)^2}{2(1+2\beta)^2}>\frac{1}{2}t_1^2-t_1^2\frac{2\beta+\beta^2}{2(1+2\beta)}+\frac{\beta(1+\beta)}{(1+2\beta)^2}-x, \tag{A18}$$

which after rearranging yields the condition

$$2x>t_1^2\frac{1-2\beta-2\beta^2}{(1+2\beta)}-\frac{1-\beta^2}{(1+2\beta)^2}. \tag{A19}$$

Putting the two conditions (A17) and (A19) together yields that a separating equilibrium exists only when

$$(1+\beta^2)t_1^2-\frac{(1+\beta)(1+3\beta+\beta^2+\beta^3)}{(1+2\beta)^2}>2x>t_1^2\frac{1-2\beta-2\beta^2}{(1+2\beta)}-\frac{1-\beta^2}{(1+2\beta)^2}. \tag{A20}$$

It is easy to verify that the l.h.s. of (A20) is greater than the r.h.s. as long as $t_1>1$. Thus the above equation defines a range for x for which there is a separating equilibrium. It is also readily seen that the lower bound of the range is higher when $\xi<.5$. The upper bound will be higher when $\xi<.5$ only if β is not too high, that is if $8+16\beta-3\beta^2>0$.

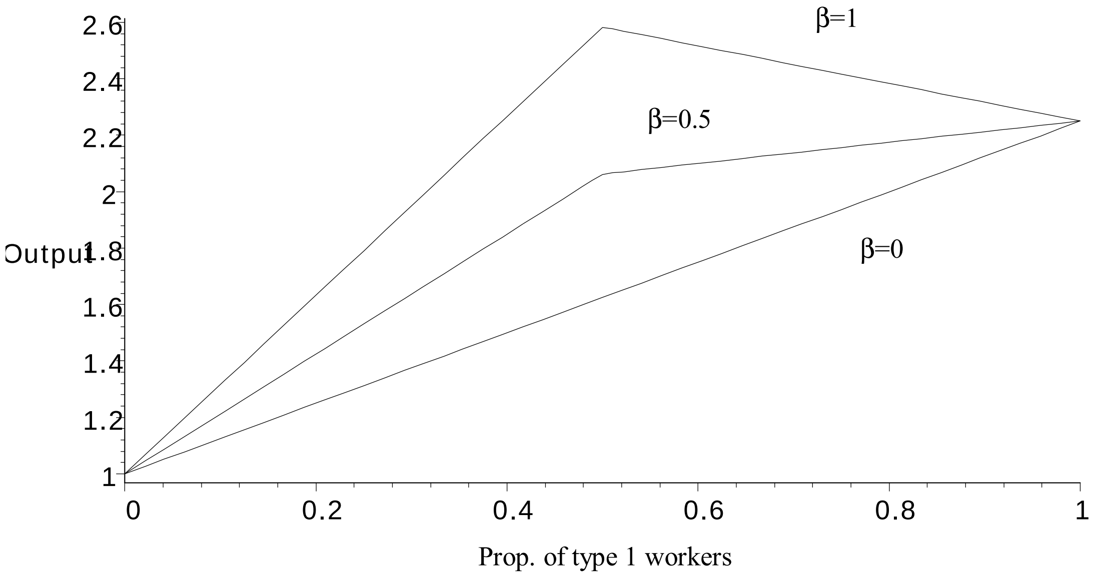

Figure 1: Output per worker for different level of status concerns, β

Figure 2a: Equilibrium wage distribution for different status preferences, ξ < ½

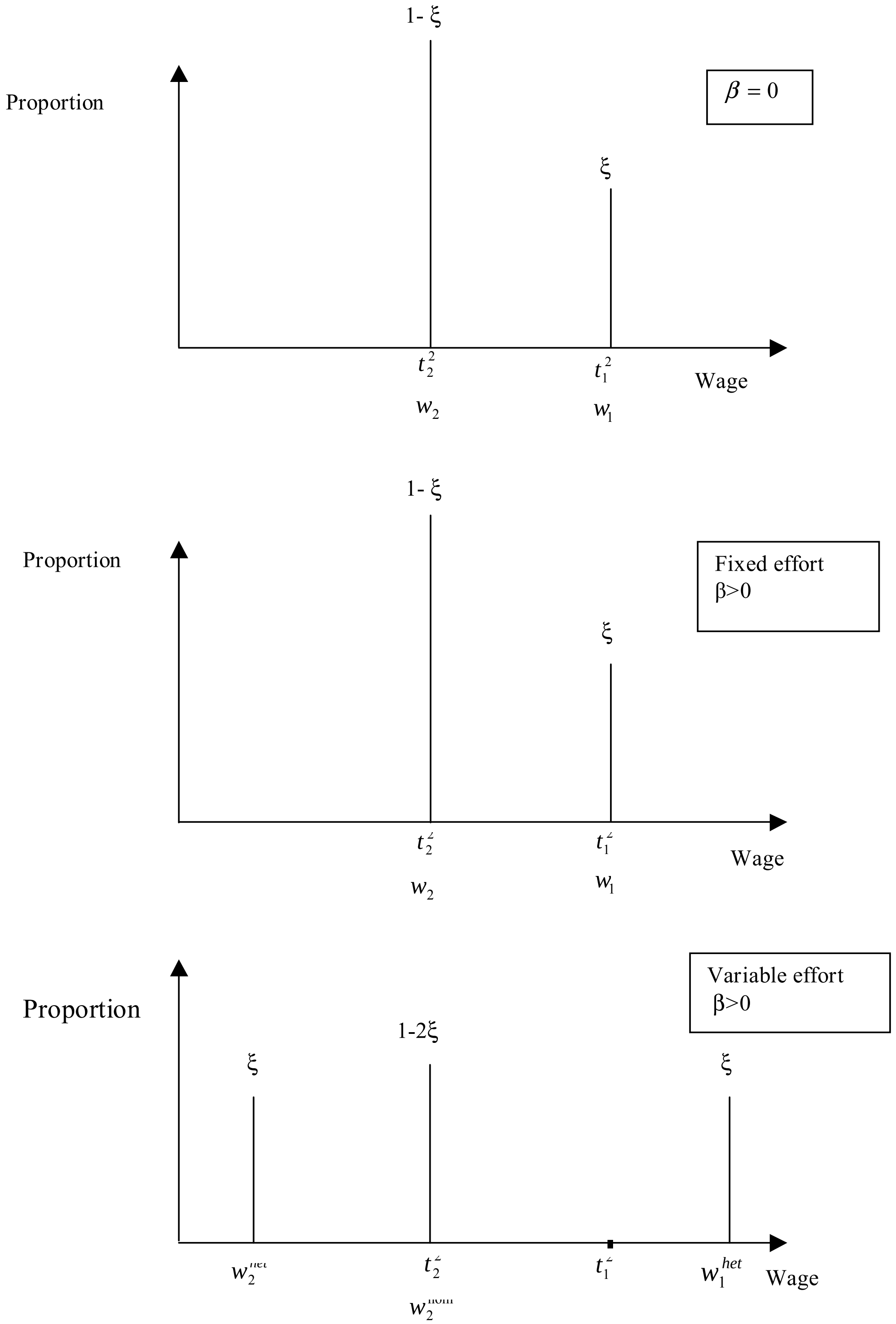

Figure 2b: Equilibrium wage distribution for different status preferences, $\xi > ½$