Social Preferences, Sorting, and Employment Contracts

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Abstract

This paper studies equilibrium employment contracts if workers have private information on their skills and their propensity for inequity aversion. Inequity averse workers suffer if other workers in their reference group get different rents defined as income net of production costs. Social preferences are shown to cause no sorting effects unless contract choices influence what workers consider to be their reference group. In this case inequity aversion induces a monopsonist to either distort production quantities or to exclude workers with low skills. Further, competition can promote the emergence of efficient sorting opportunities, thereby rendering inequity aversion irrelevant. But depending on the definition of reference groups, competition can also aggravate distortions.

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1 Introduction

Numerous surveys and empirical studies forcefully suggest that workers’ fairness concerns have a strong influence on firms’ employment decisions and remuneration schemes.\(^1\) Fairness therefore plays an important role in the areas of personnel management and organizational behavior. In fact, Akerlof and Yellen (1988) summarize that “all textbooks on compensation consider it self-evident that the most important aspect of a compensation scheme is its accordance with workers’ conceptions of equity.”(p.45) Experiments confirm that social comparisons influence the effectiveness of monetary incentives, but they also show that individual behavior is highly heterogeneous where the underlying preferences appear to be private information.\(^2\) Yet given a choice individuals should then be expected to sort into incentive schemes according to their preferences, and firms must take into account that their incentive structure does not only influence their employees’ behavior, but also affects what kind of workers they attract in the first place. Further, sorting might implicate that social preferences have very little impact in market environments, especially if competition promotes the emergence of sorting opportunities.

This paper investigates the interaction between sorting and optimal employment contracts if workers have private information on their skills and their propensity for inequity aversion. It shows that inequity aversion has no sorting effects unless workers’ contract choices influence what constitutes their reference groups. Yet in the presence of such reference group effects, inequity aversion can aggravate the distortions created by asymmetric information. Further, the definition of reference groups determines whether competition eliminates or possibly amplifies the impact of social preferences.

In particular, the model considers firms that face a continuum of workers who have either high skills or low skills and who are either selfish or inequity averse. Whereas selfish workers only care for their rents defined as income minus skill-dependent production costs, inequity

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\(^1\)See Blinder and Choi (1990), Campbell and Kamiani (1997), and Bewley (1999).

\(^2\)Examples include Schotter, Bull, and Weigelt (1999), Fehr, Gächter, and Kirchsteiger (1997), and Fehr, Klein, and Schmidt (2007).
averse workers suffer a utility loss if other workers in their reference group get different rents. Since each worker’s type is private information, firms face a problem of rent-extraction under asymmetric information. Inequity averse workers are not willing to burn money to reduce favorable inequity so that their utility is strictly increasing in their own rent as long as they remain in the same reference group. As inequity averse and selfish workers with identical skills get the same rent when accepting identical employment contracts, they have identical preferences over employment contracts, and there is no sorting according to their propensity for inequity aversion - unless contract choices affect reference groups. Empirical evidence suggests the latter. To investigate the resulting implications, workers who reject all offered employment contracts are taken to only compare themselves with other unemployed workers; workers who accept an employment contract are assumed to only compare themselves with other employed workers.

The paper proceeds to show that a monopsonistic firm optimally chooses one of two regimes: it either employs all workers, or it employs all but inequity averse workers with low skills. What regime is optimal depends on the mass of inequity averse workers with low skills. To illustrate the impact of inequity aversion suppose the firm wants to employ all workers. Asymmetric information causes rent inequity in the firm as incentive compatibility requires that workers with high skills receive information rents. Inequity averse workers with low skills need compensation for their suffering from inequity aversion. To reduce the associated costs, the firm lowers production by its employees with low skills to reduce the information rents of the workers with high skills and thus the rent inequity. Alternatively, it excludes the inequity averse workers with low skills. In both cases inequity aversion aggravates distortions caused by asymmetric information.

Whereas inequity aversion affects monopsony employment contracts via the trade-off between efficiency and rent-extraction, competition allocates all rents to the workers and essentially forces firms to offer employment contracts that maximize workers’ rents. But skill differences then generate rent inequity in the market. The consequences of this rent inequity

\[3\] This point will be extensively discussed at the end of the paper.
depend on the definition of reference groups. If all employed workers form a reference group, workers are exposed to rent inequity whenever they accept an employment contract. To avoid suffering from this rent inequity, inequity averse workers with low skills might reject employment in equilibrium. Compared to a monopsony competition can then aggravate the distortions created by social preferences. But if employed workers only compare themselves with other workers who work in the same firm, inequity averse workers do not suffer from rent inequity when they work in a firm with a homogeneous workforce. Competition then induces at least some firms to specialize in workers with particular skills, and all workers are employed in equilibrium.

The paper is related to the following strands of the literature. In their experimental study Lazear, Malmendier, and Weber (2006) find evidence that many subjects are willing to pay in order to avoid situations in which they might feel obliged to share. Further, Dohmen and Falk (2006) shows that social preference affect how individuals sort into incentive schemes. The present paper suggests that if subjects are driven by social preferences, such avoidance behavior results from self-manipulation of reference groups. Further, it shows that sorting can have negative consequences: in a monopsony workers can avoid rent inequity be rejecting all employment contracts, but unemployment is highly inefficient.

The theoretical analysis is most closely related to Sappington (2004) who investigates the impact of equity concerns on optimal screening contracts. However, he does not consider the case of competition. Further, he derives conditions under which equity concerns can be rendered irrelevant, but does not characterize optimal employment contracts in case inequity aversion causes distortions since inequity cannot be avoided at zero costs. Most importantly, he does not analyze the sorting properties and associated reference group effects of incentive contracts that arise if workers differ in their propensity for social comparisons.

There also exists a number of papers that study the impact of social preferences in the context of moral hazard. For example, see Itoh (2004), Demougin, Fluet, and Helm (2006), Englmaier and Wambach (2005), Bartling and von Siemens (2006), and the papers cited therein. In all of them principals can observe agents’ preferences, while competition and sorting are not considered.
2 Model

Firms, Contracts, and Sequence of Actions

Consider a labor market with a continuum of workers whose total mass is normalized to one. The sequence of actions is the following. First, firms can try to employ workers by simultaneously offering them employment contracts. An employment contract \( y = (q, t, n) \) defines a production quantity \( q \in \mathbb{R}^+ \) and income \( t \in \mathbb{R} \) for given identity \( n \in \mathbb{N} \) of the firm. Contracts that set identical production quantities and incomes but are offered by different firms are thus treated as distinct. Let \( Y = \mathbb{R}^+ \times \mathbb{R} \times \mathbb{N} \) be the space of all contracts. Firms can offer any number of contracts. Let \( Y \subseteq Y \) denote the total set of offered contracts. In a second stage, workers simultaneously choose among the offered contracts. They can also get an outside option by refusing all offers. In the following workers who accept an employment contract are called employed, whereas workers who reject all offers are called unemployed.\(^5\) Finally, contracts are enforced.

Workers, Types, and Information

Workers differ in their skills and their propensity for inequity aversion. Each worker has either high skills or low skills and is either inequity averse or selfish. Let \( \Theta = \{h_i, h_s, l_i, l_s\} \) describe the type space. Types are private information but it is common knowledge that each worker has type \( \theta \in \Theta \) with ex-ante probability \( p(\theta) \). Particularly, a worker has high skills with probability \( \pi \in ]0, 1[ \) and a worker with high skills is inequity averse with probability \( \gamma_h \in ]0, 1[ \) while a worker with low skills is inequity averse with probability \( \gamma_l \in ]0, 1[ \). Types are independent across individuals, but skills and inequity aversion might correlate.

Workers’ Preferences

All workers primarily care for their rents. The rent of an unemployed worker is taken to be independent of his type and normalized to zero. The rent of a worker of type \( \theta \) who accepts

\(^5\) Workers who reject all offered contracts might equally take up employment in an industry in which skills do not affect workers’ equilibrium rents.
an employment contract \( y = (q, t, n) \) is defined as

\[
 u(y, \theta) = t - \psi(\theta) c(q)
\]  

(1)

where the function \( \psi : \Theta \to \mathbb{R}^+ \) describes how skills affect production costs. An employed worker’s rent is thus his utility from income minus his production costs. Production costs are assumed to be independent of workers’ propensity for inequity aversion, thus \( \psi(ji) = \psi(js) \) for \( j \in \{h, \ell\} \). Workers with high skills have lower costs than workers with low skills, thus \( \psi(\ell k) > \psi(h k) \) for \( k \in \{i, s\} \). The function \( c : \mathbb{R}^+ \to \mathbb{R}^+ \) is strictly increasing, strictly convex, and twice differentiable. It is normalized to zero at the origin and fulfills the Inada conditions \( \lim_{q \to 0} c'(q) = 0 \) and \( \lim_{q \to \infty} c'(q) = +\infty \).

Whereas selfish workers are exclusively interested in their own rents, inequity averse workers also have equity concerns. In a seminal contribution Adams (1963) applies equity theory as pioneered by Festinger (1957) to social comparisons at the workplace. She argues that workers desire a fair balance between inputs and outcomes - in the present setting production costs and income. According to this definition individuals account for production costs in their social comparisons. Inequity averse workers are thus taken to suffer if other workers in their reference group get different rents. Equity theory further assumes that individuals compare themselves with “similar” others. The following assumptions are consistent with this view and help to illustrate the role of reference groups in sorting. First, no worker cares for firms’ profits. Second, all unemployed workers form their own reference group. Thirdly, the analysis distinguishes two cases concerning the employed workers: these workers’ reference groups either contain only the employees of the same firm, or they are formed by all the employed workers. Both cases coincide in a monopsony.

Formally, let the suffering of a worker with type \( \theta \) who accepts contract \( y \in Y \) be

\[
 S (y, \theta) = \alpha(\theta) \sum_{y' \in Y} \sum_{\theta' \in \Theta} \eta(y, y', \theta') \max\{u(y', \theta') - u(y, \theta), 0\}
 + \beta(\theta) \sum_{y' \in Y} \sum_{\theta' \in \Theta} \eta(y, y', \theta') \max\{u(y, \theta) - u(y', \theta'), 0\}.
\]  

(2)

6
This formalization adapts Fehr and Schmidt (1999) to the case with a continuum of agents. \( \alpha(\theta) \) and \( \beta(\theta) \) measure how much the worker suffers from disadvantageous and advantageous inequity. Both parameters are zero for selfish workers, and they are equal to some strictly positive constant \( \alpha \) and some weakly positive constant \( \beta \) for inequity averse workers. The suffering from rent inequity thus does not depend on skills. Because it seems unreasonable that inequity averse workers burn money to reduce advantageous inequity, \( \beta \) is taken to be strictly smaller than one. Finally, a worker’s suffering from rent inequity is influenced by the composition of his reference group. Rents can depend on the workers’ types, but types are private information. Consequently, workers must form beliefs. Let \( \eta(y, y', \theta') \) denote a particular fraction of the reference group of a worker who accepts contract \( y \). It contains all workers the worker believes to accept contract \( y' \) and be of type \( \theta' \).

Define the total utility of a worker with type \( \theta \) who accepts contract \( y \in Y \) as

\[
U(y, \theta) = u(y, \theta) - S(y, \theta).
\]

For notational simplicity the dependency on the set of offered contracts and the worker’s beliefs is suppressed. All unemployed workers get zero rent and therefore do not suffer from inequity aversion. Workers’ outside option is consequently normalized to zero. Further, the assumption on \( \beta \) implies that an inequity averse worker’s total utility is strictly increasing in his rent as long as he remains in the same reference group. Workers maximize total utility.

**Profits and Efficiency**

Consider a firm that offers a menu \( Y_n \subseteq Y \) of contracts. Let \( \nu(y) \) be the mass of workers who accept contract \( y \in Y \). Production is sold at a price of one. Then the firm makes profit

\[
R_n = \sum_{y \in Y_n} \nu(y) (q - t).
\]

There are thus no complementarities in production, and profits are not affected by what types of workers are employed. Firms maximize expected profit. Leaving any suffering from rent inequity aside, the efficient production quantity \( q^e(\theta) \) of a worker of type \( \theta \in \Theta \) should maximize total surplus in an employment relationship. By the assumptions on the cost
function $c$ it is strictly positive and implicitly defined by
\[ c'(q^c(\theta)) = 1/\psi(\theta). \] (5)

Workers of equal skills therefore have identical efficient production quantities. The generated total surplus is strictly positive so that it is efficient if all workers are employed.

**Strategies and Equilibrium Behavior of the Workers**

The paper focuses on pure strategy equilibria that are symmetric in the sense that all workers share the same equilibrium strategy. A worker’s strategy is a family of functions that specify type-dependent acceptance decisions $a: Y \times \Theta \rightarrow \{0, 1\}$ for all sets $Y \subseteq \mathcal{Y}$ of offered contracts. Thus, $a(y, Y, \theta)$ describes whether workers of type $\theta$ accept contract $y \in Y$. These functions take on a value of one at an accepted contract. Since an inequity averse worker’s utility might be affected by the composition of his reference group, workers must form completely specified beliefs for all sets $Y \subseteq \mathcal{Y}$ of offered contracts. Extending the previous notation let $\eta(y, y', \theta', Y)$ describe beliefs given a set $Y$ of offered contracts. Workers’ equilibrium acceptance decisions are required to maximize utility for all sets of offered contracts given the believed compositions of reference groups. Beliefs are consistent with workers’ acceptance decisions and Bayes’ rule. Workers equilibrium acceptance decisions $a^* : Y \times \Theta \rightarrow \{0, 1\}$ thus form a Bayesian equilibrium.

### 3 Inequity Aversion and Sorting

As only pure strategies are considered, each type of worker accepts at most one contract. Workers’ equilibrium behavior for a given set $Y$ of offered contracts is thus characterized by the set $\tilde{\Theta} \subseteq \Theta$ of types who accept one of the offered contracts and by the contracts $y(\theta)$ that are accepted by workers of type $\theta \in \tilde{\Theta}$. As usual it is assumed that workers accept a contract in case they are indifferent to rejecting all offered contracts. In equilibrium contracts must then satisfy

\[ u(y(\theta), \theta) - S(y(\theta), \theta) \geq 0 \quad \text{for all } \theta \in \tilde{\Theta} \] (6)
\[ u(y, \theta) - S(y, \theta) < 0 \quad \text{for all } \theta \notin \tilde{\Theta} \text{ and } y \in Y \] (7)
\[ u(y(\theta), \theta) - S(y(\theta), \theta) - [u(y, \theta) - S(y, \theta)] \geq 0 \quad \text{for all } \theta \in \tilde{\Theta} \text{ and } y \in Y \] (8)
(7) and (8) are incentive constraints that ensure that employed workers prefer their contract to all other offers, while it is optimal for unemployed workers to reject all offered contracts. (6) are participation constraints that guarantee that employed workers prefer their contract to rejecting all offered contracts. Since the firm does not care for rent inequity, inequity aversion can enter optimal employment decisions and employment contracts only via the constraints above. The following arguments investigate the incentive and participation constraints of inequity averse workers.

Incentive Constraints of Inequity Averse Workers

The assumption $\beta < 1$ implies that an inequity averse worker’s utility is strictly increasing in his rent when choosing among contracts whose acceptance leaves his reference group unchanged. Like a selfish worker he then optimally opts for the rent-maximizing alternative. Since selfish and inequity averse workers with equal skills get identical rents when accepting identical contracts, they have identical preferences over contracts that sort them into the same reference group. The argument is captured in the following proposition. All proofs are in the appendix.

Proposition 1. (Inequity Aversion and Incentives) Consider two contracts $\{y, \tilde{y}\} \in Y$. Suppose that a worker who accepts $y$ has the same reference group as a worker who accepts $\tilde{y}$. Then $u(y, js) \geq u(\tilde{y}, js)$ implies $u(y, ji) - S(y, ji) \geq u(\tilde{y}, ji) - S(\tilde{y}, ji)$ for any $j \in \{h, \ell\}$ and for any composition of the reference group.

Proposition 1 has strong implications concerning the incentive constraints of inequity averse workers. Consider inequity averse and selfish workers with identical skills who choose among contracts whose acceptance sorts them into the same reference group. If these workers accept some of these contracts in equilibrium, then Proposition 1 and incentive compatibility imply that both types of workers must get the same rent. Further, inequity averse workers weakly prefer the contract of the selfish workers with identical skills to all alternative contract choices that sort them into the same reference group. Therefore, the incentive constraints of selfish

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6This relates to Heidhues and Riedel (2006) who consider the impact of allocative social preferences in a perfectly competitive exchange economy.
workers directly implicate the corresponding incentive constraints of inequity averse workers with equal skills. In much of the ensuing analysis the incentive constraints of inequity averse workers can thus be ignored.

**Participation Constraints of Inequity Averse Workers**

Due to their low costs inequity averse workers with high skills can get the highest rent within any reference group. By the assumption on $\beta$ they want this maximum rent so that in equilibrium any rent inequity in their reference group must be to their advantage. Further, no worker accepts a contract unless he gets a weakly positive rent. Rent inequity in any reference group thus cannot exceed the rent of the workers with high skills. As unemployed workers get zero utility, the assumption $\beta < 1$ then yields that it can be individually rational for inequity averse workers with high skills to accept a contract as long as they receive a weakly positive rent. Inequity aversion drops out of their participation constraint. This argument does not apply to inequity averse workers with low skills. Any equilibrium rent inequity must be to these worker’s disadvantage, and suffering from unfavorable rent inequity is not restricted by assumption. Therefore, inequity aversion can and will substantially affect the acceptance decisions of inequity averse workers with low skills.

**Reference Groups and Sorting**

Proposition 1 implies that reference group effects are crucial for sorting. If contract choices do not affect reference groups, inequity averse workers simply opt for the rent-maximizing alternative and inequity aversion has no effect. If contract choices do affect reference groups, then an inequity averse worker might prefer a contract with a low rent to a contract with a high rent if he suffers less from rent inequity in case he accepts the former. Workers with equal skills can thus be separated across reference groups according to their propensity for inequity aversion. The following sections analyze the resulting effects of inequity aversion on equilibrium employment decisions and employment contracts.
4 Monopsonistic Firm

This section studies the impact of inequity aversion on a monopsonist’s optimal employment decisions and employment contracts. Workers’ acceptance decisions and the firm’s contract offers are then required to form a Bayesian equilibrium: the firm maximizes expected profit given workers’ acceptance decisions. The firm would like to extract its employees’ rents. But rents usually depend on the employees’ types, and types are private information. Thus, the firm faces a problem of rent extraction under asymmetric information. This is related to the literature on mechanism design. Since the revelation principle applies if an agent’s utility depends on the entire allocation and on other agents’ types, it is possible to restrict attention to direct revelation mechanisms when looking for optimal mechanisms.\(^7\) The fraction of workers with a certain type is fixed by the law of large numbers, and the firm cannot learn anything about one worker from another as types are independent. The optimal deterministic mechanism is thus embedded in the previously described game in which the firm offers a menu of employment contracts the workers can choose from.

The firm then chooses a set \(\tilde{\Theta} \subseteq \Theta\) of types it wants to employ and contracts \(y(\theta)\) it would like workers of type \(\theta \in \tilde{\Theta}\) to accept. The optimal deterministic mechanism maximizes the firm’s expected profit

\[
R = \sum_{\theta \in \tilde{\Theta}} p(\theta) \left( q(\theta) - t(\theta) \right).
\]

Contracts are required to be Bayesian incentive compatible in the sense that they satisfy the constraints (6) to (8): there exists a Bayesian equilibrium in which workers take the desired contract choices.

First-Best Benchmark Case

To isolate the impact of asymmetric information suppose the firm can observe workers’ types. By the following argument it then acts as if there was no inequity aversion: it employs all workers and workers get contracts that specify their type’s efficient production quantity and exactly compensates them for their production costs. Due to the assumptions

\(^7\)See Myerson (1979).
on the workers’ cost function the firm can always make some strictly positive profit by employing one type of worker. Making zero profit by not employing any workers thus cannot be optimal. Further, if some types of employed workers get a strictly positive rent, the firm can lower the income levels of all workers with the highest rent by an equal amount. This reduces or leaves inequity within the firm unaffected, and thereby weakly facilitates participation for all types of workers. As the income payments are lowered while production is unchanged, this increases profits and the firm optimally extracts all its employees’ rents. Finally, if no employee gets a positive rent, the firm can increase profits by employing previously unemployed types with a contract that extracts all rents. Optimal production follows from maximizing profit for each type of worker.

Note that equilibrium employment decisions and employment contracts remain the same if only workers’ skills but not their propensity for inequity aversion are observable. The firm can then extract all rents. As all workers get zero rent, there is no rent inequity, and inequity aversion has no impact.

**Monopsonistic Firm’s Potentially Optimal Contractual Alternatives**

If skills are private information, workers with high skills must receive an information rent if they are to accept their type’s contract. If workers with low skills get no rent, asymmetric information causes rent inequity. If the participation constraint of the inequity averse workers with low skills binds, then these need compensation for their suffering from inequity. The firm would like not to pay this extra compensation to selfish workers with low skills. This renders separation of workers according to their propensity for inequity aversion desirable. But in a monopsony all employees are in the same reference group. Proposition 1 then implies that it is impossible to separate selfish and inequity averse workers with equal skills within the firm.

Since screening is limited, the following arguments show that the firm essentially faces only two potentially optimal alternatives. First, not employing any workers is clearly not optimal. Second, employing only workers with low skills or all workers with low skills and only some workers with high skills is not incentive compatible: unemployed selfish workers with high
skills get zero utility, but a strictly positive utility by accepting the employment contract for
the workers with low skills. By the argument in Section 3 this also holds for inequity averse
workers with high skills. Thirdly, employing only some workers with high skills is not optimal
as the firm can then increase profits by employing all workers with high skills. Fourthly, it is
not optimal to exclude only the selfish workers with low skills as the firm can then increase
profits by employing these workers with the contract of the inequity averse workers with low
skills. Selfish workers with low skills accept this contract since they have identical production
costs as inequity averse workers with low skills and never suffer from any rent inequity. Their
participation also decreases the fraction of employees with high skills in the firm. By changing
the composition of the reference group, this facilitates participation of the inequity averse
workers with low skills. As argued before participation of the inequity averse workers with
high skills is no issue. Finally, if only workers with high skills are employed, the firm can
in addition employ selfish workers with low skills by offering them a “null contract” that
specifies zero production and zero income. The properties of the cost function $c$ imply that
it is then optimal to have these workers produce a strictly positive quantity. Employing only
workers with high skills is thus strictly dominated by employing all workers with high skills
and selfish workers with low skills. The ensuing analysis studies the remaining alternatives:
to employ all workers, or to employ all but the inequity averse workers with low skills.

**Alternative 1: Excluding the Inequity Averse Workers with Low Skills**

Suppose first that the firm wants to exclude the inequity averse workers with low skills.
Proposition 1 yields that all workers with high skills get the same contract. Apart from that
inequity aversion has no impact on optimal employment contracts as inequity averse workers
with low skills are not employed and receive their outside option by definition, and the
arguments in Section 3 imply that the constraints concerning the inequity averse workers with
high skills can be ignored. Concerning the remain constraints the firm is only restricted by
the participation constraint of the selfish workers with low skills and the incentive constraint
that prevents selfish workers with high skills from accepting the contract of the selfish workers
with low skills. Optimal employment contracts are then as follows where superscript “na”
stands for the optimal second-best contracts to employ “not all” workers.
Proposition 2. (Excluding the Inequity-Averse Workers with Low Skills) Suppose workers’ types are private information. Consider a monopsonistic firm that wants to employ all but the inequity averse workers with low skills. The production quantities
\[
\ce'(q^{na}(hj)) = \frac{1}{\psi(hj)} \quad \text{and} \quad \ce'(q^{na}(\ell s)) = \left[\psi(\ell s) + \frac{\pi(\psi(\ell s) - \psi(hs))}{(1 - \pi)(1 - \gamma)}\right]^{-1}
\]
and income levels
\[
t^{na}(hj) = \psi(hj) c(q^{na}(hj)) + (\psi(\ell s) - \psi(hj)) c(q^{na}(\ell s))
\]
\[
t^{na}(\ell s) = \psi(\ell s) c(q^{na}(\ell s))
\]
then characterize optimal employment contracts for \(j \in \{i, s\}\).

Whereas inequity aversion has no additional direct impact on optimal contracts, excluding the inequity averse workers with low skills reduces the fraction of employed workers with low skills. This affects the trade-off between rent-extraction and efficiency so that \(\gamma\) affects the contracts in Proposition 2.

Alternative 2: Employing All Workers

Suppose next that the firm wants to employ all workers. Proposition 1 implies that selfish and inequity averse workers with equal skills get the same employment contracts. Because selfish workers with low skills never suffer from rent inequity but get the same contract as inequity averse workers with low skills, their participation constraint can be ignored. The firm is then only restricted by the participation constraint of the inequity averse workers with low skills and the incentive constraint that prevents selfish workers with high skills from accepting the employment contract of workers with low skills. Optimal employment contracts are as follows where superscript “a” stands for optimal second-best contracts to employ “all” workers.

Proposition 3. (Employing All Types of Workers) Suppose workers’ types are private information. Consider a monopsonistic firm that wants to employ all types of workers. The production quantities
\[
\ce'(q^{a}(hj)) = \frac{1}{\psi(hj)} \quad \text{and} \quad \ce'(q^{a}(\ell j)) = \left[\psi(\ell j) + \frac{\pi(\psi(\ell j) - \psi(hj))(1 + \alpha)}{1 - \pi}\right]^{-1}
\]
and income levels

\[ t^a(hj) = \psi(hj) c(q^a(hj)) + (1 + \pi \alpha) \left( \psi(\ell j) - \psi(hj) \right) c(q^a(\ell j)) \]

\[ t^a(\ell j) = \psi(\ell j) c(q^a(\ell j)) + \pi \alpha \left( \psi(\ell j) - \psi(hj) \right) c(q^a(\ell j)) \]

then characterize optimal employment contracts for \( j \in \{i, s\} \).

Inequity aversion now directly affects optimal employment contracts. As the participation constraint of the inequity averse workers with low skills is binding, they must be compensated for their suffering from unfavorable inequity. For contracts to remain incentive compatible all other workers receive this compensation for rent inequity as additional rents. Employing inequity averse workers with low skills thus causes the firm high costs. The firm responds to these costs by lowering the production quantity of the workers with low skills. This reduces rent inequity by reducing the information rent of the workers with high skills. Inequity aversion consequently aggravates the distortions caused by asymmetric information. Further, all workers with low skills get the same contract. Optimal contracts thus do not depend on \( \gamma_\ell \). They are also independent of the measure \( \beta \) of suffering from favorable rent inequity as all constraints concerning the inequity averse workers with high skills can be ignored by the arguments in Section 3.

**Optimal Second-Best Contracts**

Which of the firm’s alternatives is optimal depends on the fraction of the inequity averse worker with low skills. If many workers with low skills are inequity averse, their exclusion is very expensive. The firm then optimally offers employment contracts as in Proposition 3. These contracts look as if all workers were inequity averse although the firm knows that a considerable fraction of the workforce is selfish. This offers an explanation for how fairness can have a strong impact on employment contracts even if only some individuals exhibit social preferences. Yet if only few workers with low skills are inequity averse, then these are excluded and the firm offers employment contracts as in Proposition 2. This is summarized in the following proposition.
Proposition 4. (Second-Best Contracts) Suppose workers’ types are private information and there is a monopsonistic firm. Then there exists a cutoff $\tilde{\gamma}_l$ such that

1. for all $\gamma_l \leq \tilde{\gamma}_l$ it is optimal for the firm to exclude the inequity averse workers with low skills. Optimal contracts are then as characterized in Proposition 2.

2. for all $\gamma_l \geq \tilde{\gamma}_l$ it is optimal for the firm to employ all types of workers. Optimal contracts are then as characterized in Proposition 3.

In the present setting any exclusion of workers is exclusively driven by inequity aversion. If all workers are selfish, the workers’ outside option of zero implies that the firm can employ all types with a null contract. As initial marginal costs of production are zero, all employees optimally produce a strictly positive quantity. The monopsonist therefore optimally employs all workers. But inequity averse workers might need compensation for their suffering from rent inequity even if they produce nothing. The arising costs are similar to fixed costs, which can render the exclusion of inequity averse workers with low skills optimal. However, the costs caused by inequity aversion are endogenous as they depend on the rent inequity in the firm. The firm optimally reduces this rent inequity by lowering the information rent of the workers with high skills. Inequity aversion thus further distorts production of the workers with low skills.

Note that these additional distortions need not arise if workers do not differ in their propensity for inequity aversion but in some other unobservable characteristics that affects participation. Suppose some workers care more for leisure and thus have a higher outside option than other workers. If workers with low skills and high outside option are to be employed, they must get an income that exceeds their production costs. If the firm cannot observe outside options, it must adjust contracts to preserve incentives and all other workers receive additional rents. This indirect effect can render it optimal to exclude all workers with low skills and high outside option although their inclusion as such is profitable. But the income mark-up for workers with a high outside option is independent of production quantities. The additional distortions of production quantities as characterized above thus do arise with unobservable leisure preferences.
Continuum of Skill Levels

To investigate the robustness of the results suppose workers are still either inequity averse or selfish, but that there is a continuum of skill levels. If all workers are to be employed and types are private information, incentive compatibility requires that all but workers with the lowest skills must get information rents. As before asymmetric information generates rent inequity. Inequity averse workers with the lowest skills need compensation for their suffering from inequity, and all other types get this compensation as additional rents. Rent inequity thus causes the firm costs. The monopsonist then distorts production quantities to reduce information rents.

Yet with a continuum of skill levels the firm probably wants to exclude some of the inequity averse workers with low skills. Optimal contracts are then difficult to characterize. Inequity averse workers with medium skills get an information rent to prevent them from accepting the contract of the selfish workers with low skills. But they receive a lower rent than workers with high skills and thus suffer from unfavorable rent inequity; in addition they suffer from favorable rent inequity with respect to the workers with low skills. If the information rents of the inequity averse workers with medium skills do not cover their suffering from inequity aversion, their participation constraint binds and they require additional compensation. The firm must then give selfish workers with medium skills and workers with high skills additional rents to preserve incentives. In response it might further distort production quantities or even exclude selfish workers with low skills. An analysis of the resulting distortions is beyond the scope of this paper, but results are unlikely to change: production of workers with lower skills is reduced to decrease information rents and thereby rent inequity, and some workers with lower skills are excluded.

5 Competition

This section studies equilibrium employment decisions and contracts if firms compete for workers. Following Rothschild and Stiglitz (1976) a competitive equilibrium is defined by an equilibrium set $Y^*$ of offered contracts and workers’ acceptance decisions for all sets of
offered contracts. Workers’ decisions must form Bayesian equilibria, but competition is captured by a free entry condition whereas the strategic interaction of firms is not modeled explicitly. An equilibrium set $Y^*$ of offered contracts then satisfies the following conditions. First, no firm makes losses in equilibrium. Otherwise, the respective firm could increase its profits by leaving the market. Second, there exists no contract or menu of contracts outside the equilibrium set of offered contracts that, if offered, is optimally accepted by a strictly positive mass of workers and then makes no losses. Otherwise, there would be market entry as some profit opportunities are not exhausted.

Interestingly, competition need not work smoothly unless an equilibrium refinement restricts workers’ reactions to out-of-equilibrium contract offers. Inequity averse workers’ acceptance choices might depend on the composition of reference groups and thereby on the acceptance decisions of other workers. This can create multiple equilibria at the acceptance stage. Workers might then coordinate on different equilibria if new contracts are offered even if these new contracts are never accepted. This can render initially promising market entry unprofitable. Although discussed later, such complications are momentarily ruled out by the following refinement.

**Refinement (No Switch of Equilibrium).** Consider a competitive equilibrium with an equilibrium set $Y^*$ of offered contracts. Take any contract $y' \not\in Y^*$ and suppose that $y'$ cannot attract any workers if offered. Then $a^*(y, Y^* \cup y', \theta) = a^*(y, Y^*, \theta)$ for all $y \in Y^*$ and $\theta \in \Theta$.

If a new contract is offered but not accepted, then all workers are thus required to make the same contract choices as if no new contract had been offered at all. Employment contracts in a competitive equilibrium can now be characterized as follows where superscript “c” stands for “competitive” contracts.

**Proposition 5 (Competition and Contracts).** Suppose workers’ types are private information and firms compete for workers. Suppose further that workers of type $\theta \in \Theta$ accept employment in a competitive equilibrium, and that they are either selfish or that they are inequity averse and all employed workers form a reference groups. Then these workers’ contract

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8There can be cross-subsidization within firms so that some offered contracts might make losses.
If the proposition is violated, then in equilibrium some workers accept contracts that provide them with strictly less rent than their type’s contract in Proposition 5. Suppose a firm enters the market with such a contract. Since the contract never makes losses, it must not attract workers if the situation is to form an equilibrium. In the following consider only workers of the type who by accepting the new contract get a higher rent than in equilibrium. There are two cases. First, suppose that these workers are selfish or that they are inequity averse and all employed workers constitute a reference group. By the assumption on $\beta$ the workers’ utility is then strictly increasing in their rent when choosing among all contracts. Their initial contract choice can have been optimal only if it maximized rents given the original set of offered contracts. But the workers can get strictly more by accepting the new contract. Transitivity implies that they optimally accept the new contract. Second, suppose that the considered workers are inequity averse and firms define reference groups. The workers might now optimally stick to their old contract choice if they otherwise expects to suffer heavily from inequity. However, the new contract must not attract any workers if the situation is to form an equilibrium. A worker who unilaterally deviates and accepts employment at the new firm is thus alone in his reference group, cannot suffer from inequity aversion, and therefore gets a strictly higher utility than his equilibrium utility - as long as the other workers take the same acceptance decisions as if no new contract had been offered at all. The Refinement implies the latter. Summarizing, it can never be individually optimal for all workers to reject the new contract. Since production quantities are not distorted, employment contracts are thus efficient in any competitive equilibrium.

**Equilibrium Employment Decisions and Incentive Provision**

However, it is not yet clear whether in equilibrium workers do accept employment and, if yes, how they are allocated across firms. The employment decisions of selfish workers are efficient: they always accept employment as they get a strictly positive utility and thus more than their outside option of zero by accepting their type's contract in Proposition 5. However,
the same proposition implies that employed workers with different skills get different rents in equilibrium. Selfish workers with high and low skills always accept employment, thus competition generates some rent inequity in the labor market. This influences the contract choice of inequity averse workers. Results depend on the definition of reference groups.

Suppose first that all employed workers constitute a reference group. Inequity averse workers then inevitably suffer from the rent inequity in the labor market once they accept employment. This has the following consequences.

**Proposition 6 (All Employed Workers Form Reference Group).** Suppose workers’ types are private information, firms compete for workers, and all employed workers form a reference group. Then in any competitive equilibrium all selfish workers and all inequity averse workers with high skills are employed. Further, there exist two cutoffs

\[
\tilde{\alpha} = (\pi + (1 - \pi)(1 - \gamma_h)) \tilde{\alpha} \quad \text{and} \quad \tilde{\alpha} = \frac{1}{\pi} \frac{u(\gamma_c(\ell_i), \ell_i)}{u(\gamma_c(hs), hs) - u(\gamma_c(\ell_i), \ell_i)}
\]

such that all inequity averse workers with low skills are employed if \( \alpha \leq \tilde{\alpha} \), and not employed if \( \alpha > \tilde{\alpha} \). For \( \alpha \in [\tilde{\alpha}, \tilde{\tilde{\alpha}}] \) there exist equilibria in which either all or none of the inequity averse workers with low skills are employed. Finally, inequity averse workers might be hired by firms that employ workers with different skills.

The rent inequity in the industry is bounded and favorable to inequity averse workers with high skills so that these workers accept employment in equilibrium. Inequity averse workers with low skills suffer from unfavorable rent inequity. If their inequity aversion is sufficiently strong, they optimally reject employment. But an inequity averse worker’s suffering depends on the composition of the reference groups. If all inequity averse workers with low skills accept employment, then the fraction of workers with high skills among the employed workers is relatively small. In this case an employed inequity averse worker with low skills suffers less from rent inequity than if no other inequity averse workers with low skills are employed. If inequity aversion is very strong or very weak, then the acceptance decision of an inequity averse worker with low skills is independent of the composition of the reference groups. For intermediate levels of inequity aversion his decision depends on
the behavior of the other inequity averse workers with low skills: he optimally accepts employment if and only if all other inequity averse workers with low skills do the same. This generates multiple equilibria. Finally, an inequity averse worker’s reference group does not change when accepting different employment contracts. Firms hiring only identical workers therefore provide inequity averse workers with no extra utility as compared to firms with a heterogeneous workforce. Competition consequently does not promote the emergence of firms that specialize in workers with particular skills.

The results above are driven by the assumption that inequity averse workers can prevent exposure to rent inequity only by rejecting all offered contracts. If firms define reference group, workers do not suffer from inequity aversion in case they work in firms that employ only workers with identical skills. Since inequity averse workers have a taste for a homogeneous work environment, competition ensures that such specialized firms emerge. Inequity averse can then get a strictly positive utility by joining these firms. Because they have an outside option of zero, they accept employment in equilibrium. Selfish workers derive no additional utility from working in homogeneous firms. In equilibrium they might thus have colleagues with different skills. This is summarized in the following proposition.

**Proposition 7 (Firms Define Reference Groups).** Suppose workers’ types are private information, firms compete for workers, and firms define workers’ reference groups. Given the Refinement all workers are then employed in any competitive equilibrium. Further, inequity averse workers are hired by firms that employ only workers with identical skills.

Even more strikingly as in the monopsony case inequity aversion causes effects that do not arise if there are unobservable difference in workers’ leisure preferences. Competition allocates all rents to the workers. If production by workers with low skills and a high outside option is efficient, then these workers get a strictly positive rent when accepting an employment contract that implements their type’s efficient production quantity and pays out all proceeds. Therefore, all workers accept employment in any competitive equilibrium. Furthermore, these workers do not care about their colleagues’ rents so that competition never promotes the emergence of specialized firms.
Competition and the Impact of Inequity Aversion

Consider now the impact of competition. In a monopsony inequity aversion always causes distortions: either the firm reduces production quantities, or it excludes the inequity averse workers with low skills. If firms compete for workers and firm affiliation determines employed workers’ reference group, some firms specialize in workers with identical skills. The emerging sorting opportunities are efficient and render inequity aversion irrelevant. Yet if all employed workers form a reference group, competition can amplify the effect of inequity aversion.

Take the following example. Suppose \( c(q) = \frac{\delta}{2} q^2 \) with \( \delta > 0 \). Since the rent inequity in a monopsony equals the information rent of the workers with high skills, it is given by

\[
\Delta u^m = (\psi(\ell s) - \psi(hs)) c(q^m(\theta \ell s))
\]

where \( q^m(\ell s) \) is the optimal production by the selfish workers with low skills and superscript “m” indicates “monopsony”. As skill differences converge to zero, asymmetric information becomes irrelevant so that both information rents and rent inequity go to zero. In the limit a monopsonist employs all workers and production is efficient. If firms compete for workers, the rent inequity in the market is given by \( (\psi(\ell i) - \psi(hi))/(2\delta \psi(\ell i) \psi(hi)) \). By choosing a small \( \delta \) this inequity can be made arbitrarily large so that inequity averse workers with low skills optimally reject employment. By continuity there exist parameters \( \alpha \) and \( \delta \) for which efficiency is lower if firms compete for workers than in a monopsony.

A monopsonist has to compensate its inequity averse employees with low skills for their suffering from rent inequity. Inequity thus causes the firm costs. If the monopsonist wants to employ all workers, he thus distorts production to keep the rent inequity small. Competition precludes this internalization as it forces firms to offer workers their rent-maximizing contract. Rent inequity with all the associated consequences can then be extremely large.

Compensating Wage Differentials

All effects above - including the monopsony case - are driven by the assumption that inequity averse workers might be willing to forego rents to avoid rent inequity. This is most striking in the case of competing firms where all employed workers form a reference group and the
inequity averse workers with low skills reject employment in equilibrium. Empirical evidence validates this assumption. Following Rosen (1974) numerous papers have investigated why equally productive individuals often receive different wages. Yet in the present paper selfish and inequity averse workers with identical skills do not choose different jobs because of certain job characteristics. Instead, their behavior diverges since inequity averse workers care for the composition of their reference groups and are thus influenced by the contract choices of other workers.

**Equilibrium Existence**

Proposition 6 and 7 describe properties of any competitive equilibrium. In these situations workers receive their maximum utility for the case that they are not subsidized by either the firm or their colleagues. Suppose a firm enters the market and wants to attract workers by promising them a strictly higher utility. If the firm itself does not subsidize its employees and thereby makes losses, it must attract some workers who subsidize their colleagues. But workers who are not subsidized themselves cannot be attracted. Consequently, no firm can enter the market with one or several contracts, attract workers, and not make losses. This establishes equilibrium existence.

**Importance of the Refinement**

The Refinement is not necessary for the results concerning the selfish workers, neither is it needed for the results concerning the inequity averse workers as long as all employed workers form a reference group. Proposition 7 still describes some competitive equilibria even if firms determine reference groups and the Refinement is not imposed. But the following argument shows that there then exist other equilibria. Suppose two firms are active in the industry, where both firms employ workers with high and low skills. Suppose further that these firm use employment contracts as in Proposition 5 and that all workers accept their type’s employment contract. If the composition of the workforces is identical in both firms, workers’ contract choices form a Bayesian equilibrium in which inequity averse workers suffer from rent inequity as they have colleagues with different skills. Contrary to the argument for Proposition 5 cream-skimming these inequity averse workers need not be possible unless the
Refinement imposed. Otherwise, workers can coordinate on a different Bayesian equilibrium if a new firm enters the market. In this new equilibrium the firms employ only workers with identical skills. As there is no longer any rent inequity, inequity averse workers get their maximum utility and optimally reject employment at the new firm. Firms then have no incentives to enter the market as they cannot attract workers, and the original situation forms a competitive equilibrium. Without imposing the Refinement there can thus exist competitive equilibria in which some inequity averse workers reject employment or where they work in firms with heterogeneous workforces.

**Adverse Selection**

To focus on the problem of rent-extraction firms’ profits depend only on contracts and not on the attracted types of employees. As shown asymmetric information is then inconsequential once firms compete for workers. But suppose workers with high skills produce goods of exceptional quality, and goods with exceptional quality can be sold at a premium. Asymmetric information with respect to workers’ skills can then generate adverse selection. In this case firms cannot offer workers with high skills their rent-maximizing contracts without attracting workers with low skills and thereby making losses. In a competitive equilibrium workers with high skills thus receive a lower rent as compared to the case without adverse selection. However, competition still causes rent inequity. As inequity aversion has no impact on incentives once workers accept employment, the implications of inequity aversion remain qualitatively the same even in the presence of adverse selection.

**Fuzzy Reference Groups**

To illustrate the importance of reference group effects, reference groups are taken to depend on contract choices in an extreme way. In reality reference groups are likely to be more “fuzzy” in the following sense. Suppose that workers mostly compare themselves with their colleagues but that they also care - a little less - for the rents of workers who are unemployed or who work in other firms. Assume also that unemployed workers mostly compare themselves with unemployed workers, but that they also care - a little less - for the rents of employed.

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9This need not be as signals are productive; see Exercise 13.C.2 in Mas-Colell, Whinston, and Green (1995).
workers. Workers then cannot avoid rent inequity by rejecting all contracts or by working in firms with homogeneous employees. But they can reduce the resulting suffering. If inequity averse workers are to accept a contract, they must receive compensation for the increase in their suffering. Inequity aversion then generates all the effects analyzed above. As long as reference groups are influenced by contract choices, results remain unchanged. In the case of competition inequity aversion and fuzzy reference groups might even simultaneously generate the emergence of firms that specialize in workers with high skills and the absence of inequity averse workers with low skills from the market.

6 Summary and Discussion

This paper investigates how social preferences and sorting influence employment decisions and employment contracts if workers have private information on their skills and propensity for inequity aversion. Social preferences are shown to only have sorting implications if workers’ contract choices affect what they consider to be their reference group. Even then screening possibilities are limited, and a monopsonist either excludes the inequity averse workers with low skills or employs all types workers. If firms compete for workers, the impact of inequity aversion depends on the precise definition of reference groups. If all employed workers form a reference group, inequity averse workers with low skills might reject employment contracts in equilibrium. In consequence competition might worsen the distortions created by inequity aversion. Yet if firm affiliation determines employees’ reference groups, competition causes the emergence of firms that specialize in workers with identical skills and all workers accept employment in equilibrium. The following sections discuss important assumptions and further implications.

Endogenous Reference Groups

The analysis above shows that inequity aversion has no sorting effects when reference groups are independent of contract choices, but that it affects sorting behavior if workers determine their reference groups via their contract acceptance decisions. Equity theory in fact assumes that individuals have some control over their reference group. Goodman (1974) argues that
individuals compare themselves with others to evaluate their own performance so that “The availability of information about referents and their perceived relevance are the critical factors affecting the selection of referents.” (p.177) This is consistent with the assumptions in the present paper: the point is not that employed inequity averse workers are unaware of unemployed workers or workers in other firms, but that these workers cannot provide the former with relevant information concerning their performance. But individuals do not have complete control over the choice of their referents so that inequity averse workers cannot simply decide not to compare themselves with anybody.\footnote{Individuals might differ in their propensity for inequity aversion as some can better suppress unpleasant or unproductive emotions like envy if this is in their interest.} One reason is that many really want to assess their own performance and colleagues provide the most relevant information. Further, social comparisons are difficult to avoid if workers are constantly confronted with this information by frequent personal contact to their colleagues. Indeed, surveys like Gartrell (1982) and Shah (1998) confirm that proximity strongly affects the choice of referents.

**Competition, Organizational Change, and Inequality**

In the present setting competition might increase distortions caused by inequity aversion as firms can no longer compress rent inequity without loosing workers to competitors. While (10) describes the rent inequity in a monopsony, the rent inequity in case of competition is

\[
\Delta u^c = u(y(hs), hs) - u(y(\ell s), \ell s) \geq u(y(\ell s), hs) - u(y(\ell s), \ell s) = \left(\psi(\ell s) - \psi(hs)\right) c(q^c(\ell s))
\]

where the first inequality follows from incentive compatibility. Since a monopsonist distorts production, \(q^c(\ell s)\) strictly exceeds \(q^m(\ell s)\) so that competition unambiguously increases rent inequity in the market.

The model might thus offer an explanation for the recent rise in income and wealth inequality. Acemoglu (2002) concludes from the literature that this development is primarily driven by technical progress which affects relative demand for workers high and low skills. Moreover, technical change probably induces organizational change that can further aggravate inequality. Kremer and Maskin (1996) argue that technical change then generates
skill segregation, which can explain why "Economic activity has shifted from firms such as General Motors, which use both high- and low-skilled workers, to firms such as Microsoft and McDonald’s, whose workforces are much more homogeneous.” (p.1).

Contrary to the academic discourse, public debate blames “globalization” and thus intensified competition for all recent developments in the labor market. In this model competition causes organizational change and thereby increases rent inequity.\textsuperscript{11} Further, a monopsonist always employs selfish workers with low skills and all worker with high skills. If firm affiliation determines reference groups, competition induces some firms to specialize in workers with homogenous skills. The paper therefore generates a very direct link between competition and both rent inequity and skill segregation without requiring technical change.

\textbf{Heterogeneous Incentive Schemes and Corporate Cultures}

Casual empiricism suggests that similar firms often employ very different incentive schemes. Consider several identical firms that act as local monopsonists. The above analysis shows that optimal employment contracts depend on the mass of inequity averse workers with low skills. At the cutoff both regimes - employing all workers or excluding the inequity averse with low skills - generate the same profits although different masses of workers are employed. As optimal employment contracts are thus discontinuous in the fraction of inequity averse workers with low skills, identical firms facing slightly different pools of workers can choose very different remuneration schemes.

Whereas Hermalin (1994) links heterogeneity in incentive provision to asymmetric equilibria caused by product market competition, Okuno-Fujiwara (1994) and Morita (2001) argue that culture affects firms’ incentive structures since it affects equilibrium selection in the presence of strategic complementary. In the present paper cultural differences in the pools of workers can have a direct impact on monopsonists’ remuneration schemes: the higher the dissemination of social preferences, the more firms should employ heterogeneous workforces while distorting production to keep inequity small.

\textsuperscript{11}Effects are similar to Marin and Verdier (2004) who argue that globalization causes a war for talent.
Further, the economic literature views corporate culture as an instrument to affect workers’ behavior. But inequity averse and selfish workers are likely to differ in how they behave and interact with colleagues. This indicates that employment contracts could influence corporate culture by affecting workers’ sorting decisions, which relates to Besley and Ghatak (2005) and Prendergast (2003) who study how incentives affect the allocation of intrinsically motivated individuals across organizations.

Appendix

Proof of Proposition 1

Suppose that workers who accept either of the contracts \{y, \tilde{y}\} \subseteq Y share the same reference group. Consider workers of the types \{js, ji\} \subseteq \Theta with j \in \{h, \ell\}. Then \psi(js) = \psi(ji) such that \(u(y, js) \geq u(\tilde{y}, js)\) implies \(u(y, ji) \geq u(\tilde{y}, ji)\). By \(\beta < 1\) an inequity averse worker’s total utility is strictly increasing in his rent as long as his reference group is not changed. Then \(u(y, ji) \geq u(\tilde{y}, ji)\) yields \(u(y, ji) - S(y, ji) \geq u(\tilde{y}, ji) - S(\tilde{y}, ji)\). Q.E.D.

Proof of Proposition 2

By Proposition 1 all workers with high skills must get the same rent and thus

\[u(y(hs), hs) = u(y(hi), hi).\] (12)

Proposition 1 yields that \(u(y(hs), hs) \geq u(\tilde{y}, hs)\) for all \(\tilde{y} \in Y\) implies \(U(y(hs), hi) \geq U(\tilde{y}, hi)\) for all \(\tilde{y} \in Y\). Since (12) and \(\psi(hs) = \psi(hi)\) implicate \(U(y(hi), hi) = U(y(hs), hi)\), inequality \(U(y(hi), hi) \geq U(\tilde{y}, hi)\) holds for all \(\tilde{y} \in Y\). The incentive constraints of the selfish workers with high skills and (12) thus imply the incentive constraints of the inequity averse workers with high skills.

Assume the incentive constraints concerning the behavior of the workers with low skills to

\(^{12}\)Hermalin (2001) provides a nice survey. See also Rob and Zemsky (2002).
be non-binding. In addition to (12) the remaining constraints are then

\[
\begin{align*}
    u(y(hs), hs) &\geq u(y(\ell s), hs) \\
    u(y(hs), hs) &\geq 0 \\
    u(y(hi), hi) - S(y(hi), hi) &\geq 0 \\
    u(y(\ell s), \ell s) &\geq 0.
\end{align*}
\]

(13) is the incentive constraint that prevents selfish worker with high skills from accepting the employment contract of the selfish workers with low skills. (14) to (16) are the participation constraints of the employed workers.

\(\psi(hs) < \psi(\ell s)\) implies \(u(y(\ell s), hs) \geq u(y(\ell s), \ell s)\) and (13) and (16) render (14) non-binding. Constraints (12) and (13) imply that if employed inequity averse workers with high skills suffer at all, then they suffer from favorable rent inequity. By (16) the rent inequity in the firm is bounded. Given the maximum rent inequity and the worst possible composition of their reference group, (15) holds if \((1 - \beta) u(y(hi), hi) \geq 0\). Since \(\beta < 1\) by assumption, (14) and (12) render (15) non-binding.

The remaining constraints must be binding. (16) must be binding as the firm could otherwise increase profits by lowering \(t(\ell s)\) while improving incentives for the good workers. (12) must be binding as the firm could otherwise increase profit by lowering \(t(hi)\) without affecting any of the remaining constraints. (13) must be binding as the firm could otherwise increase profits by lowering \(t(hs)\) and \(t(hi)\) by the same amount. This leaves (12) unaffected and has no impact on (16). Maximizing the firm’s profit with only these constraints binding yields the contracts as characterized in Proposition 2.

Given the contracts in Proposition 2, consider the incentive constraints of the workers with low skills that were assumed to be non-binding at the beginning of this proof. These are

\[
\begin{align*}
    (\psi(\ell s) - \psi(hj))(c(q^{na}(hj)) - c(q^{na}(\ell s))) &\geq 0 \\
    u(y(\ell s), \ell i) - S(y(\ell s), \ell i) &< 0
\end{align*}
\]
for $j \in \{i, s\}$ where the binding constraint (13) was used to transform (17). (17) holds as $\psi(\ell s) > \psi(h s)$ and $q^na(\theta hj) > q^na(\ell s)$ for $j \in \{i, s\}$ and $q^na(\ell s) > 0$ as $c$ is strictly convex and satisfies the Inada conditions. (13) and $\psi(lj) > \psi(hs)$ then yield $u(y(\theta hj), \theta hj) \geq u(y(\ell s), \theta hj) > u(y(\ell s), \ell s)$ for $j \in \{\ell, h\}$. Workers with equal skills get the same rent when accepting the same contract, therefore $u(y(\ell s), \ell i) = u(y(\ell s), \ell s)$ and $S(y(\ell s), \ell i) > 0$. Then the binding participation constraint (16) renders (18) non-binding. Q.E.D.

**Proof of Proposition 3**

As in the proof of Proposition 2, Proposition 1 now implies that contracts must satisfy

$$u(y(\theta js), \theta js) = u(y(\theta ji), \theta ji)$$

(19)

for worker with equal skills $j \in \{\ell, h\}$. Further, the incentive constraints of the inequity averse workers can be ignored. Because selfish worker with low skills do not suffer from any rent inequity, (19) implies that their participation constraint is non-binding as long as the participation constraint of the inequity averse workers with low skills is satisfied. As in the previous proof, the participation constraints of the good workers can be ignored.

Assume that the incentive constraints concerning the behavior of the selfish workers with low skills are non-binding. In addition to (19) the remaining constraints are then

$$u(y(hs), hs) \geq u(y(\theta tj), \theta hj)$$

(20)

$$u(y(\ell i), \ell i) - \alpha S(y(\ell i), \ell i) \geq 0$$

(21)

for $j \in \{i, s\}$ where (21) is the participation constraint of the inequity averse workers with low skills and (20) is the incentive constraint that prevents selfish workers with high skills from accepting the employment contracts of the workers with low skills. (20) must be binding as the firm can otherwise increase profits by lowering $t(hs)$ and $t(hi)$ by the same amount. This has no effect on (19) and facilitates participation of the inequity averse workers with low skills. (21) must be binding as the firm can otherwise increase profits by lowering $t(\ell i)$ and $t(\ell s)$. This has no effect on (19) and improves incentives for the workers with high skills. Both the constraints (19) must be binding as the firm can otherwise increase profits
by lowering $t(hi)$ or $t(hs)$ without affecting any of the remaining constraints.

(20) and $\psi(hj) < \psi(\ell i)$ imply $u(y(\theta hj), \theta hj) > u(y(\ell i), \ell i)$ for all $j \in \{i, s\}$. As all workers of equal skills get the same rents, the suffering of the inequity averse workers with low skills from rent inequity is $S(y(\ell i), \ell i) = \pi\alpha [u(y(hs), hs) - u(\ell i, \ell i)]$. Maximization of the firm’s profit with the above constraints binding yields the contracts as characterized in Proposition 3. Analogously to the proof of Proposition 2 these contracts satisfy the incentive constraint of the selfish workers with low skills that was initially assumed to be non-binding. 

Q.E.D.

Proof of Proposition 4

Let $R^a(\alpha)$ and $R^{na}(\gamma \ell)$ denote the firm’s maximum profit when employing all and when excluding the inequity averse workers with low skills, respectively. Therefore,

$$R^{na}(\gamma \ell) = \pi [q^{na}(hj) - t^{na}(hj)] + (1 - \pi)(1 - \gamma \ell)[q^{na}(\ell i) - t^{na}(\ell i)]$$

(22)

$$R^a(\alpha) = \pi [q^a(hj) - t^a(hj)] + (1 - \pi)[q^a(\ell i) - t^a(\ell i)]$$

(23)

for $j \in \{i, s\}$ with quantities and income levels as characterized in Proposition 2 and 3. After substitution of the income levels the envelope theorem yields

$$\partial R^{na}(\gamma \ell)/\partial \gamma \ell = -(1 - \pi)[q^{na}(\ell i) - \ell s c(q^{na}(\ell s))]$$

(24)

$$\partial R^a(\alpha)/\partial \alpha = -(\psi(\ell i) - \psi(\ell j)) \pi c(q^a(\ell i))$$

(25)

for $j \in \{\ell, h\}$. $q^{na}(\ell s) < q^c(\ell s)$ and the properties of $c$ imply $q^{na}(\ell s) - \psi(\ell s) c(q^{na}(\ell s)) > 0$ for all $\gamma \ell$. The function $R^{na}$ is thus strictly decreasing in $\gamma \ell$. $q^a(\theta hj) > 0$ holds for finite $\alpha$. The function $R^a$ is thus strictly decreasing in $\alpha$.

Proposition 2 and 3 yield $\lim_{\gamma \ell \to 0} R^{na}(\gamma \ell) = \lim_{\alpha \to 0} R^a(\alpha)$. Then $\lim_{\gamma \ell \to 0} R^{na}(\gamma \ell) > R^a(\alpha)$ for all $\alpha > 0$ as $R^a$ is strictly decreasing in $\alpha$. Furthermore, $\lim_{\gamma \ell \to 1} q^{na}(\ell s) = 0$ and $\lim_{\gamma \ell \to 1} t^{na}(hj) = \psi(hj) c(q^{na}(hj))$ for $j \in \{i, s\}$. Then $\lim_{\gamma \ell \to 1} R^{na}(\gamma \ell)$ is equal to the firm’s profit if the firm employs all workers and the inequity averse workers with low skills get the contract $y(\ell i) = (0, 0)$. Inequity averse workers with low skills accept this contract as the workers with high skills also get no rent. Once employed, the firm’s profit is strictly
increasing in the production quantity of the inequity averse workers with low skills as
\[ \lim_{q \to 0} c'(q) = 0. \]
Thus, \[ R^a(\alpha) > \lim_{\gamma \to 1} R^{na}(\gamma \ell). \]

\[ R^a(\alpha) \text{ and } R^{na}(\gamma \ell) \text{ are continuous. } R^a(\alpha) \text{ is constant while } R^{na}(\gamma \ell) \text{ is strictly decreasing in } \gamma \ell. \]
The above limits and the intermediate value theorem complete the proof. \textit{Q.E.D.}

\textbf{Proof of Proposition 5}

Consider a competitive equilibrium with a set \( Y^* \) of offered contracts and suppose that
Proposition 5 does not hold. There are two cases. Either one can directly find workers of
some type \( \theta \) who accept a contract \( y(\theta) \) with \( q(\theta) \geq t(\theta) \) that is unequal to the contract \( y^c(\theta) \)
as in the proposition. Or workers of some type \( \theta' \) accept a contract \( y(\theta') \) with \( q(\theta') < t(\theta') \).
As otherwise their firm makes losses these workers must be cross-subsidized by workers of
another type \( \theta \) who accept a contract \( y(\theta) \) with \( q(\theta) > t(\theta) \).

In the following consider the workers of some type \( \theta \) who accept a contract \( y(\theta) \) that satisfies
\( q(\theta) \geq t(\theta) \) but is unequal to the contract \( y^c(\theta) \). Suppose that a firm enters the market and
offers \( y^c(\theta) \). As this contract cannot make losses by construction, it must not attract any
workers in order not to upset the considered competitive equilibrium. The proof proceeds to
show that this cannot be the case.

There are two cases. First, suppose that the workers of type \( \theta \) are inequity averse and firms
determine the employed workers’ reference groups. The Refinement then implies that the
workers of type \( \theta \) continue to accept \( y(\theta) \). It then remains optimal to reject \( y^c(\theta) \) only if

\[ u(y(\theta), \theta) - S(y(\theta), \theta) \geq u(y^c(\theta), \theta) - S(y^c(\theta), \theta). \]  \text{(26)}

Second, suppose that the workers of type \( \theta \) are either selfish, or that they are inequity averse
and the industry sectors determine the employed workers’ reference group. Workers of type
\( \theta \) then always prefer the employment contract that yields them the highest rent no matter
what the other workers do. As choosing the contract \( y(\theta) \) was optimal, they can thus get
a maximum utility \( u(y(\theta), \theta) - S(y(\theta), \theta) \) when choosing among the contracts \( y \in Y^* \). As
before it then remains optimal to reject $y_c^*(\theta)$ only if (26) holds.

$y_c^*(\theta)$ uniquely maximizes the rent of workers with type $\theta$ among all contract $y$ with $q \geq t$. This implies $u(y_c^*(\theta), \theta) > u(y(\theta), \theta)$. There are three cases. First, suppose that the workers of type $\theta$ are selfish. Then they never suffer from inequity aversion. Second, suppose that the workers of type $\theta$ are inequity averse and that firms determine their reference groups. Since $y_c^*(\theta)$ must not attract any workers, a worker who nevertheless accepts $y_c^*(\theta)$ forms his own reference group. Because there is nobody to compare with, $S(y_c^*(\theta), \theta)$ must be zero. Finally, suppose that the workers of type $\theta$ are inequity averse and the sectors form the employed workers’ reference group. Their utility is then strictly increasing in their own rent no matter what employment contract they accept. In all three cases $u(y_c^*(\theta), \theta) > u(y(\theta), \theta)$ contradicts (26) such that $Y^*$ cannot form an equilibrium set of offered contracts. 

Q.E.D.

Proof of Proposition 6

The simple formal proof for the selfish workers is omitted. Because of their low costs the inequity averse worker with high skills can get the highest rent by accepting employment. As no worker accepts employment if his resulting rent is less than zero, the rent inequity in the sector cannot exceed $u(y(hi), hi)$. Given the worst composition of his reference group, an inequity averse worker with high skills still gets at least utility $(1 - \beta) u(y(hi), hi)$ upon accepting employment. This utility exceeds zero as $\beta < 1$. Inequity-averse workers with high skills are thus employed in any competitive equilibrium.

Workers with different skills get different rents if they accept their respective contracts as in Proposition 5. By the above arguments all selfish and the inequity averse workers with high skills accept employment in any competitive equilibrium. If an inequity averse worker with low skills accepts employment, then he suffers from unfavorable rent inequity and gets utility $u(y(\ell_i), \ell_i) - \alpha \eta(u(y(h_j), h_j) - u(y(\ell_i), \ell_i))$ with $j \in \{s, i\}$. This utility depends on the fraction $\eta$ of workers with high skills in his reference group. Therefore, $\eta$ equals $\pi/(\pi + (1 - \pi)(1 - \gamma_\ell))$ if none of the latter accept employment, whereas it is $\pi$ if all of them accept employment. Comparing the corresponding utility levels to his outside option of zero
yields the cutoffs $\tilde{\alpha}$ and $\tilde{\tilde{\alpha}}$ as in Proposition 6. If $\alpha \leq \tilde{\alpha}$ then an inequity averse worker with low skills accepts employment even if all other inequity averse workers with low skills are not employed. If $\alpha > \tilde{\tilde{\alpha}}$ then he does accept employment not even if all the other inequity averse workers with low skills do accept employment. For intermediate values $\alpha \in [\tilde{\alpha}, \tilde{\tilde{\alpha}}]$ the inequity averse workers with low skills face a coordination problem: it then is individually optimal to match the acceptance decision of the other inequity averse workers with low skills. Q.E.D.

**Proof of Proposition 7**

Consider a competitive equilibrium with an equilibrium set $Y^*$ of offered contracts. Suppose that inequity averse workers of some type $\theta \in \{h_i, \ell_i\}$ work in a firm that employ workers with different skills. These workers get different rents if they accept their respective contracts as in Proposition 5. The inequity averse workers of type $\theta$ thus suffer from rent inequity. Suppose a firm enters the market and offers the contract $y^*(\theta)$ as characterized in Proposition 5. For the set $Y^*$ to form an equilibrium set of offered contracts, the contract $y^*(\theta)$ must not attract any workers. Yet a single worker of type $\theta$ who accepts the new contract $y^*(\theta)$ then forms his own reference group and thereby avoids the strictly positive utility loss $S(y(\theta), \theta)$. As he gets the same rent as before, it is optimal to accept the contract $y^*(\theta)$. Consequently, the set $Y^*$ cannot form an equilibrium set of offered contracts. Q.E.D.

**References**


