GOVERNANCE AND THE EFFICIENCY OF ECONOMIC SYSTEMS
GESY

Discussion Paper No. 210

Efficient Inequity–Averse Teams

Jianpei Li*

May 2007

*Jianpei Li, Department of Economics, Humboldt University of Berlin

Spandauer Str. 1, 10099 Berlin, Germany

lijianpei@wiwi.hu-berlin.de

Tel: +49 30 2093 5652,

Fax: +49 30 2093 5619

Financial support from the Deutsche Forschungsgemeinschaft through SFB/TR 15 is gratefully acknowledged.

Efficient Inequity–Averse Teams*

JIANPEI LI

Department of Economics, Humboldt University of Berlin
Spandauer str. 1, 10099 Berlin, Germany
Email: lijianpei@wiwi.hu-berlin.de
Tel: +49 30 2093 5652, Fax: +49 30 2093 5619

May 2007

Abstract

This paper analyzes the efficiency of team production when agents exhibit other–regarding preferences. It is shown that full efficiency can be sustained as an equilibrium through a budget-balancing mechanism that punishes some randomly chosen agents if output falls short of efficient level but distributes the output equally otherwise, provided that the agents are sufficiently inequity averse. (JEL *C7, D7, D63, L2.* Keywords: *Moral hazard, Team production, Inequity aversion.*)

*Financial support from the German Science Foundation through SFB/TR 15 is gratefully acknowledged. I thank participants in the Brown Bag seminar at Humboldt University of Berlin for comments.

1 Introduction

Holmström (1982) showed in standard self–interest model that when agents are risk neutral, there exists no sharing rule that elicits first best efforts and balances the budget in team production. However, reality provides many examples indicating that people are more cooperative than assumed in the standard self–interest model. In many teams, agents work hard even when the pecuniary incentives go in the opposite direction. Many empirical and experimental results provide strong evidence that many people are not exclusively pursuing their own material self–interests; their behavior are instead significantly affected by fairness motives. (See, for example, Fehr and Schmidt (1999), Bolton and Ockenfels (2000).) Therefore, the preference assumption underlying the inefficiency result in Holmström (1982) needs to be reconsidered.

This paper looks at moral hazard problem in inequity–averse teams. Agents are envious when their coworkers receive higher monetary payoff than themselves, and are sympathetic when they receive higher monetary payoff than their co-workers. The psychologic feeling of envy or sympathy affects the agents' utility, and hence their behavior.

Adopting the utility function of Fehr and Schmidt (1999)[1], we show that when agents exhibit other–regarding preferences, a budget balancing, randomly punishing contract can elicit efficient efforts in equilibrium provided that the agents are sufficiently inequity averse. That contract distributes the output equally when the output is high and punishes some randomly chosen agents when the output is low.

When agents are inequity averse, given that everyone else exerts the efficient effort level, an agent's shirking leads to an output level below the efficient one. In that case, some randomly chosen agents get punished, and the associated unequal monetary payoffs among the agents reduce that shirking agent's utility, hence reducing the attractiveness of shirking. If every agent is sufficiently inequity averse, everyone chooses efficient action in equilibrium. That efficiency result does not depend on whether the agents are subject to limited liabilities. Large liability capacity alone can not achieve efficiency. However, provided that agents are inequity averse, full efficiency can be achieved if the liability capacity of each agent is sufficiently big.

The above randomly punishing contract is implicit in many team structures. Usually, if a team is successful, it continues and everyone stays with the team and enjoys its success. If it is unsuccessful, some or most members have to leave, except for a few remaining to keep the team going.

[1] That utility function is used for its simplicity. The result is qualitatively unaffected if other utility functions, for example, the one in Bolton and Ockenfels (2000), is adopted.

This paper is related to a growing literature that studies the efficiency of teams and partnerships. As examples, Rasmusen (1987) shows that when agents are risk averse, full efficiency can be achieved; Legros and Matthews (1993) show that full efficiency can be obtained for partners with discrete action space, and can be approximately achieved if agents can bear sufficiently large liabilities; Lazear and Kandel (1992) show that the existence of peer pressure can weaken the free rider problem; Gershkov, Li, and Schweinzer (2007) show that full efficiency can be achieved if the partners can base the allocation of shares on some noisy ranking of efforts. [2]

However, all above papers assume that agents pursue solely their own material interests and do not show other–regarding preferences. Bartling and von Siemens (2004) and Rey Biel (2003) are the first to analyze team production problem with inequity–averse agents. Nevertheless, their models have two important restrictions: efforts are binary and fully observable (contractible in the latter paper). The setup in this paper is general, with continuous action space and no observability of efforts are required.

The remaining part of the paper is organized as follows. In the next section, we describe the basic model, assuming that agents are homogeneous in their liability capacities. Section 3 presents the randomly punishing contract and proves the sustainability of full efficiency in equilibrium. In Section 4, we show that the efficiency result obtained in Section 3 does not depend on the homogeneity of liability capacities. Section 5 concludes.

2 The model

A team here consists of at least two agents, $N = \{1, \cdots, n\}$. Each agent, indexed by i, takes an unobservable action or effort level $e_i \in [0, +\infty)$. Write

$$e_{-i} = (e_1, \cdots, e_{i-1}, e_{i+1}, \cdots, e_n) \quad \text{and} \quad e = (e_i, e_{-i}) \tag{1}$$

Denote the production function as $y := y(e)$, which is strictly increasing, concave, and continuously differentiable. Output is deterministic, depending only on the effort levels, and is observable and verifiable.

A compensation rule specifies $s_i(y)$ as agent i's monetary payoff if the output is y. Agent i has limited liability, and his compensation cannot be less than the liability bound $-\omega$, with $\omega \geq 0$. That is, $s_i \geq -\omega$.[3] Agent i's utility is separable in his satisfaction from

[2] Further contributions to this literature are Miller (1997), Strausz (1999) and Battaglini (2006), etc..

[3] We assume that the agents are identical in their liability capacities to simplify notations and analysis. The result holds as well when agents have different ω. That discussion is relegated to Section 4.

monetary payoff and effort cost:

$$u_i(s,e) = m_i(s_i(y(e)), s_{-i}(y(e))) - C_i(e_i) \tag{2}$$

The major difference between this model and Holmström (1982) is that here an agent's utility depends not only on his own monetary payoff, but also on his co–workers' monetary payoffs.

Exerting effort e_i is costly to agent i, with cost function $C_i : [0,\infty) \to \mathbb{R}$ with $C_i(0) = 0$, $C_i'(\cdot) > 0$ and $C_i''(\cdot) > 0$. The first part of the agent's utility function, m_i, is defined according to Fehr and Schmidt (1999)[4]:

$$m_i(s_i, s_{-i}) = s_i - \left(\alpha_i \frac{1}{n-1} \sum_{j \neq i} \max\{s_j - s_i, 0\} + \beta_i \frac{1}{n-1} \sum_{j \neq i} \max\{s_i - s_j, 0\} \right) \tag{3}$$

The terms in the bracket capture the utility effects of disadvantageous and advantageous inequality respectively. We assume that $\alpha_i \geq 0$ and $\beta_i \geq 0$, for all i, with at least one inequality holding strict. $\alpha_i \geq 0$ implies that a worse off individual is willing to trade off some of his personal gain against a decrease in his co–workers' payoffs. This may denote envy or the disutility of being outdone. Positive β_i implies that a better off individual is fair-minded (or suffers from the envy of others) since he would trade off some decrease in his personal monetary gain against an increase in the co–workers' payoffs.

Since agents' utility loss from unequal payoffs can be removed through equal monetary allocation, *efficient* actions are those that maximize the total welfare of the team:

$$\max_e \; w(e) := y(e) - \sum_i C_i(e_i). \tag{4}$$

We assume the existence of unique equilibrium e^* and denote the associated output as $y(e^*)$. We concentrate on the sustainability of such efficient action profile as a Nash Equilibrium.

Definition 1. *Full efficiency is sustainable in equilibrium if $e_i = e_i^*$ (weakly) maximizes agent i's expected utility given $e_{-i} = e_{-i}^*$.*

In teams and partnerships, the agents usually can not credibly commit themselves to destroying some part of output ex post and there is no budget breaker available, as suggested by Holmström (1982). Hence, it is important to consider budget balancing mechanisms where the output is entirely distributed among the agents.

[4] Agents' inequity aversion can also be defined on relative utility levels. The result remains unchanged but the extra assumption of observable efforts is required.

Definition 2. *A mechanism is budget balancing if* $\sum_i s_i(y) = y$.

In the standard self-interest model with $\alpha_i = \beta_i = 0$, for all i , the agents do not care about other agents' monetary payoffs, utility function (2) becomes:

$$u_i(s_i, e) = s_i(y(e)) - C_i(e_i), \quad i = \{1, \cdots, n\}$$

As shown in Holmström (1982), there is no sharing rule that achieves full efficiency and balances the budget at the same time.

Proposition 1. *Full efficiency is not attainable with any budget–balancing mechanism if* $\alpha_i = \beta_i = 0$.

3 Efficient Mechanism

We claim that if the agents exhibit other–regarding preferences as captured by functions (2) and (3), full efficiency can be sustained in equilibrium through the following randomly punishing contract:

$$s_i(y) = \begin{cases} \frac{y}{n} & \text{if } y \geq y(e^*), \\ \frac{y+l\omega}{n-l} \text{ with probability } \frac{n-l}{n} & \text{if } y < y(e^*) \\ -\omega \text{ with probability } \frac{l}{n} & \text{if } y < y(e^*) \end{cases} \tag{5}$$

where l is some integer in the range of $[1, n-1]$. That contract stipulates that if the observed final output is not lower than the efficient level $y(e^*)$, the entire output is evenly distributed among all agents. If the final output is below the efficient level, l agents are chosen randomly, with each of them being charged a fine ω. The collected fine $l\omega$ and the output are equally distributed among the remaining $n-l$ agents.

Obviously allocation rule (5) is budget balancing. In the following, we show that if α_i, β_i or ω is sufficiently big, efficient action profile is sustained as a Nash equilibrium.

Given $e_{-i} = e^*_{-i}$, if agent i chooses the efficient effort, $e_i = e^*_i$, the final output is exactly $y(e^*)$, and is evenly distributed among the agents. Agent i's utility is

$$u_i(e^*_i, e^*_{-i}) = u_i(s(y(e^*))) = \frac{y(e^*)}{n} - C_i(e^*_i)$$

If agent i unilaterally deviates from e^*_i, he will not choose some effort $\hat{e}_i \geq e^*_i$. Suppose he does, then the output is no less than $y(e^*)$, which is equally distributed among all agents.

Evidently, that is not optimal as he shares his marginal contribution with $n-1$ others but bears the marginal cost alone. Hence, agent i chooses some $\hat{e}_i < e_i^*$.

Lemma 1. *Given contract (5) and action profile e_{-i}^*, agent i's optimal deviating effort $\hat{e}_i$ satisfies*

$$\left(\left(\frac{1}{n} - \frac{l\delta_i}{n(n-1)}\right)\frac{\partial y}{\partial e_i}(\hat{e}_i, e_{-i}^*) - C_i'(\hat{e}_i)\right)\frac{d\hat{e}_i}{d\delta_i} = 0 \tag{6}$$

where $\delta_i := \alpha_i + \beta_i$.

Proof. Since $\hat{e}_i < e_i^*$, $y(\hat{e}_i, e_{-i}^*) < y(e^*)$. According to contract (5), with probability $1/n$, agent i is punished and pays a fine equal to the amount ω. He then suffers from envy since $n-l$ among the other agents receive payoffs $\left(y(\hat{e}_i, e_{-i}^*) + l\omega\right)/(n-l) =: \lambda$, which is higher than his own monetary payoff $-\omega$. His utility in such a scenario is:

$$-\omega - \alpha_i \cdot \frac{1}{n-1} \cdot (n-l) \cdot (\lambda + \omega) - C_i(\hat{e}_i) =: A$$

With probability $(n-l)/n$, agent i is not punished, and receives the monetary payoff equal to λ. However, since l of the other team members receive a payoff equal to $-\omega$ and are worse off than him, he suffers from psychological loss due to sympathy. His utility in that scenario is:

$$\lambda - \beta_i \cdot \frac{1}{n-1} \cdot l \cdot (\lambda + \omega) - C_i(\hat{e}_i) =: B$$

Therefore, if agent i unilaterally deviates from efficient action profile, he chooses some effort e_i to maximize:

$$\begin{aligned} u_i(e_i, e_{-i}^*) &= u_i(s(y(e_i, e_{-i}^*))) = \frac{l}{n}A + \frac{n-l}{n}B \\ &= \left(\frac{1}{n} - \frac{l(\alpha_i+\beta_i)}{n(n-1)}\right) y(e_i, e_{-i}^*) - \frac{l(\alpha_i+\beta_i)}{n-1} \cdot \omega - C_i(e_i) \end{aligned}$$

The optimal deviating effort $\hat{e}_i$ is determined by the following Kuhn-Tucker Conditions:

$$\frac{\partial}{\partial e_i} u_i(\hat{e}_i, e_{-i}^*) = \left(\frac{1}{n} - \frac{l(\alpha_i+\beta_i)}{n(n-1)}\right)\frac{\partial y}{\partial e_i}(\hat{e}_i, e_{-i}^*) - C_i'(\hat{e}_i) \le 0, \tag{7}$$

$$\hat{e}_i \cdot \frac{\partial}{\partial e_i} u_i(\hat{e}_i, e_{-i}^*) = 0 \tag{8}$$

If $\alpha_i + \beta_i \le (n-1)/l$, the above maximization problem has a unique interior solution due to the concavity of y and convexity of C_i, and the unique $\hat{e}_i$ can be derived from:

$$\left(\frac{1}{n} - \frac{l(\alpha_i+\beta_i)}{n(n-1)}\right)\frac{\partial y}{\partial e_i}(\hat{e}_i, e_{-i}^*) - C_i'(\hat{e}_i) = 0 \tag{9}$$

The associated second order condition holds as well.

If $\alpha_i + \beta_i > (n-1)/l$, $\partial u_i/\partial e_i < 0$ for any positive e_i, the maximization problem has a corner solution, $\hat{e}_i = 0$, and $d\hat{e}_i/d\delta_i = 0$. This, together with equation (9), implies (6). $\square$

From the above lemma, we notice that α_i and β_i have symmetric impact on agent i's optimal deviating effort. This allows us to concentrate on the total effect of the two parameters, δ_i, which describes an agent's overall degree of inequity–aversion.[5]

Given allocation rule (5), agent i finds it not worthwhile to deviate from e_i^* if the following is nonnegative:

$$\begin{aligned}\Delta_i &= u_i(e_i^*, e_{-i}^*) - u_i(\hat{e}_i, e_{-i}^*)\\ &= \frac{y(e^*)}{n} - C_i(e_i^*) - \left(\frac{1}{n} - \frac{l\delta_i}{n(n-1)}\right) \cdot y(\hat{e}_i, e_{-i}^*) + \frac{l\delta_i}{n-1} \cdot \omega + C_i(\hat{e}_i)\end{aligned}$$

Obviously, if $\delta_i = 0$, the usual free–riding arguments apply and $\Delta_i < 0$.

Proposition 2. *For given ω, there exists a $\tilde{\delta}_i$ such that if $\delta_i \geq \tilde{\delta}_i$, efficient action profile is sustained in equilibrium. For given $\delta_i > 0$, there exists an $\tilde{\omega}$ such that if $\omega \geq \tilde{\omega}$, efficient action profile is sustained in equilibrium.*

Proof. For given ω, we have

$$\begin{aligned}\frac{\partial \Delta_i}{\partial\ \delta_i} &= \left(-\frac{1}{n}y' + \frac{l\delta_i}{n(n-1)}y' + C_i'\right)\frac{d\hat{e}_i}{d\delta_i} + \frac{l}{n(n-1)}(y(\hat{e}_i, e_{-i}^*) + n\omega)\\ &= \frac{l}{n(n-1)}(y(\hat{e}_i, e_{-i}^*) + n\omega) > 0\end{aligned}$$

The second line obtains because of (6). Δ_i is monotone increasing in δ_i implies that for given ω, there exists a threshold $\tilde{\delta}_i$ such that if $\delta_i \geq \tilde{\delta}_i$, $\Delta_i \geq 0$ and efficient actions are sustained in equilibrium.

Similar argument applies to ω as

$$\frac{\partial \Delta_i}{\partial \omega} = \frac{l\delta_i}{n-1} > 0.$$

$\square$

Proposition (2) indicates that if either δ_i or ω is sufficiently big, full efficiency is sustained in equilibrium for teams with smooth production function and continuous action space, in

[5] This is no longer true when the agents differ in their liability capacities.

contrast to the impossibility result in Holmström (1982) and Legros and Matthews (1993). Also note that inequity–aversion is the driving force of efficiency, and full efficiency can not be achieved if $\delta_i = 0$, independent of the magnitude of ω.

The intuition behind the above result is that when the agents exhibit other–regarding preferences, the randomly punishing contract can be used as a threat to create inequality among the agents. If an agent shirks, he suffers not only from less final output, but also psychological loss due to the associated inequality between him and his co–workers. The double losses reduce the attractiveness of shirking and offset the agent's incentive to free ride on others.

As a result, the agents are willing to work hard in order to avoid the probability of being unequal with their co–workers. Here, envy and sympathy for others have the same effect. In contrast, a negative β_i (satisfaction from overdoing co–workers) is detrimental to the implementation of full efficiency.

The working mechanism is similar to that with risk–averse agents as analyzed by Rasmusen (1987). When agents are risk averse, similar randomizing contract can be used to implement efficient actions because agents suffer from disutility when their payoffs fluctuate, their attitudes toward risk prevent them from shirking. The difference between risk aversion and inequity aversion is that risk attitude is concerning the fluctuation of one's own payoff, while inequity aversion is concerned with psychologic loss from comparison of one's own status with his reference group.

The working mechanism is also similar to peer pressure described by Lazear and Kandel (1992). In their setup, peer pressure comes mainly from shame and feeling of guilty, the cultivating of which usually require past investment of a corporation or the building of team norms. The psychologic effect modelled in this paper, envy and sympathy, comes mostly from internal feelings, and does not need others taking actions.

Corollary 1. *If l increases, the threshold values $\tilde{\delta}_i$ and $\tilde{\omega}$ required to sustain efficiency decrease.*

Proof. Because

$$\frac{\partial^2 \Delta_i}{\partial l\ \partial \delta_i} = \frac{1}{n(n-1)}(y(\hat{e}_i, e^*_{-i}) + n\omega) > 0; \quad \frac{\partial^2 \Delta_i}{\partial l\ \partial \omega} = \frac{\delta_i}{n-1} > 0, \tag{10}$$

if l increases, Δ_i increases faster with δ_i and ω, and the threshold values $\tilde{\delta}_i$ and $\tilde{\omega}$ required to turn Δ_i into positive decrease. □

The above corollary implies that the easiness of sustaining full efficiency is increasing with l, a massacre contract where $n-1$ agents get punished if total output falls below the efficient level is easiest to achieve efficiency.

<u>*Example:*</u> A team of two agents has production function $y(e) = e_i + e_j$ and cost function $C_i(e_i) = \frac{1}{2}e_i^2,\ i \in \{1,2\}$. The efficient action profile is $(e_1^*, e_2^*) = (1,1)$ and the associated output is $y(e_1^*, e_2^*) = 2$. Agent i's optimal unilateral deviating effort is $\hat{e}_i = \max\{\frac{1}{2}(1 - \alpha_i - \beta_i), 0\}$.

Suppose $\omega = 0$, $\alpha_i + \beta_i \geq 3 - 2\sqrt{2}$ is required to sustain full efficiency. If $\omega = 1$, $\alpha_i + \beta_i \geq 7 - \sqrt{48}$ is required to sustain full efficiency. If $\alpha_i + \beta_i = 0.1$, then full efficiency is achieved if $\omega \geq 0.5$. ◁

4 Heterogenous Liability Capacities

In this section, we relax the assumption of homogenous liability capacities. Now each agent is characterized by $(\alpha_i, \beta_i, \omega_i)$. When agent i unilaterally deviates from efficient action, his expected payoff is a random variable, depending on the average liability capacity of the others.

To illustrate in the simplest manner, we consider a contract with $l = 1$:

$$s_i(y) = \begin{cases} \frac{y}{n} & \text{if } y \geq y(e^*), \\ \frac{y+z_i}{n-1} \text{ with probability } \frac{n-1}{n} & \text{if } y < y(e^*) \\ -\omega_i \text{ with probability } \frac{1}{n} & \text{if } y < y(e^*) \end{cases} \tag{11}$$

where z_i is a random variable taking the value ω_j with probability $\frac{1}{n-1}$ for $j = 1, \cdots, n, j \neq i$, and $E[z_i] = \frac{1}{n-1}\sum_{j \neq i}\omega_j$.

Again if agent i unilaterally deviates from the efficient action profile, he chooses $\hat{e}_i < e_i^*$. Then with probability $1/n$ he pays a fine equal to $-\omega_i$, and each of the the other $n-1$ agents receives $\left(y(\hat{e}_i, e_{-i}^*) + \omega_i\right)/(n-1) =: \bar{\lambda}$. With probability $(n-1)/n$ he receives a monetary payoff equal to $(y(\hat{e}_i, e_{-i}^*) + z_i)/(n-1) =: \lambda_i$. Therefore, his expected utility is:

$$u_i(\hat{e}_i, e_{-i}^*) = \frac{1}{n}\left(-\omega_i - \alpha_i\left(\bar{\lambda} + \omega_i\right)\right) + \frac{n-1}{n}E\left[\lambda_i - \beta_i \cdot \frac{1}{n-1}\left(\lambda_i + z_i\right)\right] - C_i(\hat{e}_i)$$

with $\hat{e}_i$ determined by the associated Kuhn-Tucker conditions.

Agent i will not deviate if:

$$\Delta_i = u_i(e_i^*, e_{-i}^*) - u_i(\hat{e}_i, e_{-i}^*) \geq 0.$$

The following can be easily shown:

$$\frac{\partial \Delta_i}{\partial \alpha_i} = \frac{y(\hat{e}_i, e_{-i}^*) + n\omega_i}{n(n-1)} > 0; \quad \frac{\partial \Delta_i}{\partial \beta_i} = \frac{y(\hat{e}_i, e_{-i}^*)}{n(n-1)} + \frac{1}{(n-1)^2}\sum_{j \neq i}\omega_j > 0$$
$$\frac{\partial \Delta_i}{\partial \omega_i} = \frac{n-1+\alpha_i n}{n(n-1)} > 0; \quad \frac{\partial \Delta_i}{\partial \omega_j} = -\frac{n-1-\beta_i n}{n(n-1)^2}.$$

The sign of the last derivative depends on β_i. If $\beta_i \geq \frac{n-1}{n}$, Δ_i is increasing in ω_j, which implies that a large average liability capacity of the other agents prevents agent i from unilateral deviation. However, when β_i is small, agent i suffers little from advantageous inequalities. In that case, a large expected value of z_i increases agent i's incentive of deviation, as the expected fine from the other agents is big.

The above analysis is summarized in the following proposition.

Proposition 3. *If $\beta_i \geq \frac{n-1}{n}$, full efficiency is sustainable if either α_i or ω_i, $\forall i$, is sufficiently big. If $\beta_i < \frac{n-1}{n}$, given $\omega_i, \forall i$, full efficiency is sustainable if $\alpha_i, \forall i$ is sufficient big.*

If efficient action profile can be sustained as an equilibrium in a contract with $l = 1$, then it can be sustained in any contract with $l \geq 2$. The formal discussion is omitted as the notations become very messy and no new insight is obtained.

5 Conclusion

In this paper, we have shown that when agents exhibit other–regarding preferences, full efficiency can be sustained through a budget–balancing mechanism that punishes some agents randomly if output falls below efficient level, provided that the agents are sufficiently inequity averse or the liabilities they can bear are sufficiently big. The model provides an explanation why teams and partnerships are popular organization forms in spite of the free riding problem.

The sustainability of full efficiency crucially depends on the assumption that all agents are inequity averse. When some agents pursue purely self-interest, full efficiency is not attainable with the given contract, as those agents will surely deviate from the efficient action profile if their marginal contributions to the team output are not fully compensated.

In equilibrium the inequity–averse agents may find it to their benefits to overwork to make up the loss of output due to shirking agents, the overall equilibrium action profile is however suboptimal, even though the total effort obtained may be higher than that from standard self-interest model. Whether efficiency can be achieved through other mechanisms when agents have mixed preferences is left to future research.

References

Bartling, B., and F. von Siemens (2004): "Efficiency in Team Production with Inequity Averse Agents," *University of Munich*, Working Paper.

Battaglini, M. (2006): "Joint Production in Teams," *Journal of Economic Theory*, 130(1), 138–67.

Bolton, G., and A. Ockenfels (2000): "ERC–A Theory of Equity, Reciprocity and Competition," *American Economic Review*, 90(1), 166–193.

Fehr, E., and K. M. Schmidt (1999): "A Theory of Fairness, Competition, and Cooperation," *Quarterly Journal of Economics*, 114(3), 817–68.

Gershkov, A., J. Li, and P. Schweinzer (2007): "Efficient Tournaments in Teams," *Humboldt University of Berlin*, Working Paper.

Holmström, B. (1982): "Moral Hazard in Teams," *Bell Journal of Economics*, 13, 324–40.

Lazear, E., and E. Kandel (1992): "Peer Pressure and Partnerships," *Journal of Political Economy*, 100(4), 801–17.

Legros, P., and S. Matthews (1993): "Efficient and Nearly-Efficient Partnerships," *Review of Economic Studies*, 60(3), 599–611.

Miller, N. (1997): "Efficiency in Partnerships with Joint Monitoring," *Journal of Economic Theory*, 77(2), 285–99.

Rasmusen, E. (1987): "Moral Hazard in risk-averse teams," *RAND journal of economics*, 18(3), 428–35.

Rey Biel, P. (2003): "Inequity aversion and team incentives," *University College London*, mimeo.

Strausz, R. (1999): "Efficiency in Sequential Partnerships," *Journal of Economicy Theory*, 85, 140–56.