

Kragl, Jenny; Schmid, Julia

Working Paper

Relational contracts and inequity aversion

SFB 649 Discussion Paper, No. 2006,085

Provided in Cooperation with:

Collaborative Research Center 649: Economic Risk, Humboldt University Berlin

Suggested Citation: Kragl, Jenny; Schmid, Julia (2006) : Relational contracts and inequity aversion, SFB 649 Discussion Paper, No. 2006,085, Humboldt University of Berlin, Collaborative Research Center 649 - Economic Risk, Berlin

This Version is available at:

<https://hdl.handle.net/10419/25168>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

SFB 649 Discussion Paper 2006-085

Relational Contracts and Inequity Aversion

Jenny Kragl*
Julia Schmid**



* School of Business and Economics,
Humboldt-Universität zu Berlin, Germany

** Department of Economics and Management,
Technical University Berlin, Germany

This research was supported by the Deutsche
Forschungsgemeinschaft through the SFB 649 "Economic Risk".

<http://sfb649.wiwi.hu-berlin.de>
ISSN 1860-5664

SFB 649, Humboldt-Universität zu Berlin
Spandauer Straße 1, D-10178 Berlin



SFB 649 ECONOMIC RISK BERLIN

Relational Contracts and Inequity Aversion*

Jenny Kragl[†]

Humboldt University at Berlin

Julia Schmid[‡]

Technical University Berlin

December 6, 2006

Abstract

We study the effects of envy on the feasibility of relational contracts in a standard moral hazard setup with two agents. Performance is evaluated via an observable, but non-contractible signal which reflects the agent's individual contribution to firm value. Both agents exhibit disadvantageous inequity aversion. In contrast to the literature, we find that inequity aversion may be beneficial: In the presence of envy, for a certain range of interest rates relational contracts may be more profitable. Furthermore, for some interest rates reputational equilibria exist only with inequity averse agents.

Keywords: principal-agent, relational contract, inequity aversion, envy

JEL classification: D63 , D82, M52, M54

*We would like to thank Dominique Demougin, Oliver Fabel, Carsten Helm, Dorothea Kübler, and Anja Schöttner for helpful comments and discussions. Financial support by the Deutsche Forschungsgemeinschaft through the SFB 649 "Economic Risk" is gratefully acknowledged.

[†]School of Business and Economics, Spandauer Str. 1, D-10178 Berlin, Germany, phone: +49 30 2093-1344, fax: +49 30 2093-1343, e-mail: kragl@wiwi.hu-berlin.de

[‡]Department of Economics and Management, Straße des 17. Juni 135, D-10623 Berlin, Germany, phone: +49 30 314-76665, fax: +49 30 314-24268, e-mail: j.schmid@ww.tu-berlin.de

"Implicit contracts can be effective only in a social atmosphere that incorporates a sense of mutual respect and a consensus on principles of fair play and good faith."

ARTHUR M. OKUN¹

1 Introduction

The present paper investigates how concerns for fairness among agents affect the optimal provision of incentives in a one-task framework with only subjective performance measures. In particular, we analyze the impact of horizontal inequity aversion on the principal's credibility in a relational contract. We find that there are cases where the principal prefers to employ inequity averse rather than inequity neutral agents.

Frequently, if not typically, the agent's true contribution to firm value cannot be objectively assessed. In this case, the use of contractible but imperfect performance measures creates distortions with respect to the agent's effort decision.² In many cases, the agent's true contribution to firm value can, nonetheless, be observed by both contracting parties. The observed subjective performance may be used in implicit agreements (relational contracts). As subjective assessments are not verifiable by third parties, contracts are not court-enforceable and, thus, have to be self-enforcing. They may be implemented in long-term relationships as reputational equilibria.³

Furthermore, agents' contributions are not necessarily perfectly correlated to their efforts. Thus, agents undertaking the same effort could receive different rewards. This might provoke envy, empathy or spiteful behavior

¹Okun (1980), p. 8.

²There is a vast literature on pay for performance. See e.g. Kerr (1975), Baker (1992), Milgrom and Roberts (1992), and Holmström and Milgrom (1994). For congruency problems see e.g. Holmström and Milgrom (1991) and Baker (2002).

³Reputational equilibria may exist if one party cares about her reputation in future relationships. See e.g. Holmström (1981), Bull (1987), and Baker, Gibbons, and Murphy (1994).

among agents, especially if they work on similar tasks.⁴ Taking into account the presence of inequity averse preferences, we investigate the feasibility of relational contracts.

We consider a relationship between one principal and two risk-neutral, not financially constrained agents who exhibit disadvantageous inequity aversion. We have in mind employees working on similar tasks in small or medium-size firms. Since workers tend to compare their payoffs with those of their colleagues, we believe the assumption of inequity aversion to be reasonable. Specifically, we model preferences as "self-centered inequity aversion", as proposed by Fehr and Schmidt (1999), abstracting from empathy.⁵ Neither agent's effort is directly observable by the principal, albeit imperfectly correlated with individual performance. The principal seeks to mitigate the resulting moral hazard problem by offering each agent an incentive contract contingent on their respective performances.⁶ As observed performance is not verifiable, the contract has to be self-enforcing. In modeling the game structure, we follow Bull (1987).

We replicate some results established in the literature. Grund and Sliwka (2005) and Demougin and Fluet (2006) show that more envious agents exert more effort than less envious ones, when being offered identical incentive contracts. However, to ensure participation, the principal has to pay the inequity averse agents a premium to compensate them for the faced risk of unequal payoffs (inequity premium). In this kind of framework, agency costs increase in the presence of inequity aversion, as reported by e.g. Bartling and Siemens (2005) and Grund and Sliwka (2005).⁷ Hence, the principal would rather employ inequity neutral than inequity averse agents.

⁴See for experimental evidence of other-regarding preferences e.g. Goranson and Berkowitz (1966), Fehr, Gächter, and Kirchsteiger (1997), Fehr, Kirchsteiger, and Riedl (1995), and Berg, Dickhaut, and McCabe (1995). For the importance of reference groups, see Loewenstein, Thompson, and Bazerman (1989), Falk and Fischbacher (2006), Bolton and Ockenfels (2000), and Bartling and Siemens (2006).

⁵For alternative approaches regarding the formalization of fairness concerns see e.g. Rabin (1993), Bolton and Ockenfels (2000), and Falk and Fischbacher (2006).

⁶We consider agents' tasks to be independent such that there is no inherent advantage in team production. Therefore we focus on individual bonus payments as a natural compensation scheme.

⁷This holds under unlimited liability what is the case we consider. Under limited liability, this might not be true; efficiency may increase under inequity aversion as long as agents receive rents. See e.g. Demougin and Fluet (2003) and Demougin and Fluet (2006).

The present paper analyzes how this conclusion is affected under a relational contract. The principal's credibility constraint requires that her gains from renegeing fall short of the discounted gains from continuing the relational contract.⁸ We find that this constraint is ambiguously affected by the presence of envy: On the one hand, the incentive for the principal to deviate from the relational contract in order to save bonus expenses decreases in the propensity for inequity aversion. Intuitively, this is due to the fact that envious agents work harder given the same incentive in order to avoid ending up with a lower payoff than their colleagues. This facilitates credible commitment on the principal's side. On the other hand, as agents have to be compensated for their disutility incurred by envy, the principal's long-run profits out of the contract decrease as agents become more envious. Consequently, commitment to paying the offered bonus is more difficult.

The sum of these two counteracting effects determines whether credibility is either more or less easily obtained by the principal as agents become more envious. Whenever the savings due to lower bonus payments exceed the loss of profits via the inequity premium payments, the principal prefers to employ more envious agents.

We identify a necessary and sufficient condition under which, for a certain range of the principal's discount rate, relational contracts are less profitable or even infeasible when agents do not exhibit inequity aversion. In that case, inequity aversion becomes an advantageous factor in principal-agent relationships in the sense that more reputational equilibria can be sustained with envious agents.

Before proceeding with the analysis a few caveats are in order. First, we limit attention to individual bonus schemes. Other contracts would be possible. For example, to align incentives the principal could use tournaments. Here, the principal would not face any credibility problem. However, this reward scheme would exacerbate problems related to inequity aversion. The principal could also use a team bonus structure solely for the purpose of avoiding inequity. This would introduce an alternative trade-off. Specifically, a team bonus implies a weaker relationship between individual effort

⁸We derive this rationality (credibility) constraint analogously to Baker, Gibbons, and Murphy (1994).

and the marginal likelihood of obtaining the bonus. This requires raising the bonus level, making the relational contract less likely.

Second, one has to be aware of the fact that for an individual's perception of fairness and equity many determinants beside the colleague's payoff may play a role; e.g. effort, ability, education, gender, status etc. Cognition of inequity is presumably affected by mutual comparisons regarding all the mentioned characteristics. In our model, due to the agents' homogeneity in both preferences and characteristics, differences in payoffs are the sole source of inequity. Hence, payoff inequality accords with inequity.

The next section describes our basic framework. Subsection 2.1 addresses the agency problem in the single-period game. Subsection 2.2 develops the reputation game and thereby the relational contract. In section 3, we examine the impact of the agent's propensity for envy on the feasibility of the relational contract and derive our main result concerning the principal's credibility problem. Section 4 discusses the implications and concludes.

2 The Model

We consider a repeated game between a principal (the firm) and two agents homogeneous in preferences and characteristics. In each period, each agent chooses an unobservable effort level e_i that stochastically determines the agent's contribution to firm value Y_i . That contribution is either high or low; for simplicity $Y_i \in \{0, 1\}$. It is observable by all three contracting parties, but not verifiable, and can therefore only be used as a performance measure in a self-enforcing relational contract.

By exerting effort agent i ($i = 1, 2$) affects the probability of $Y_i = 1$:

$$\Pr[Y_i = 1|e_i] = p(e_i), \tag{1}$$

where $p(e_i) \in [0, 1]$, $p(0) = 0$, $p'(e_i) > 0$, and $p''(e_i) < 0$. Agents' outputs are independent.

The principal offers each agent an explicit compensation contract specifying a guaranteed fixed wage w . In addition, the principal announces to pay each agent a bonus b according to his respective contribution to firm value. As the principal's profit is assumed to be additive in the considered task, the principal prefers employing more agents over less. However, taking into account that there are other tasks that are not explicitly captured by the contract investigated, overall she employs just two agents.⁹ The principal offers identical compensation contracts.

Provided that the principal keeps her promise, the bonus is paid whenever she observes $Y_i = 1$. Thus, the agent's net monetary payoff $\pi_i - c(e_i)$ is:

$$\pi_i - c(e_i) = w + bY_i - c(e_i), \quad (2)$$

where $c(e_i)$ denotes each agent's costs of effort with $c(0) = 0$, $c'(0) = 0$, $c'(e_i) > 0$, and $c''(e_i) \geq 0$.

Following Fehr and Schmidt (1999), both agents exhibit inequity aversion. In particular, we assume them only to suffer from disadvantageous inequity, i.e. they dislike outcomes where they are worse off than the respective other agent. Each agent observes the other agent's gross monetary payoff. All parties are risk neutral and not financially constrained. For simplicity, the agents' utilities are assumed to be linear in money.

Agent i 's utility is given by

$$U_i(\pi_i, \pi_j) = \pi_i - c(e_i) - \alpha \max\{\pi_j - \pi_i, 0\}, \quad \alpha > 0 \quad (3)$$

where α denotes his propensity for envy. The third term thus captures the disutility derived from being worse off than agent j .¹⁰

⁹Alternatively, we could assume the principal to employ many agents and approach the problem from the perspective of one agent, whereas all the others form his reference group.

¹⁰Abstracting from costs, Fehr and Schmidt (1999) propose the following utility function: $U_i = \pi_i - \alpha \max\{\pi_j - \pi_i, 0\} - \beta \max\{\pi_i - \pi_j, 0\}$. Incorporating empathy via the parameter β would not significantly affect our results, as it is established to assume $\alpha > \beta$. Moreover, Demougin and Fluet (2006) take costs into account when investigating inequity: $U_i = \pi_i - c(e_i) - \alpha \max\{\pi_j - c(e_j) - \pi_i + c(e_i), 0\}$. This would not change our results. However, an inconvenient discontinuity at the symmetric Nash-equilibrium would be introduced.

The timing of events within each period is as follows. At the beginning of the period, the principal offers each agent the above specified compensation contract. Second, the agents either accept the contract or reject it in favor of an alternative employment opportunity that provides utility U_0 . Third, if the agents accept the contract, agents choose simultaneously respective effort levels e_i . Fourth, Y_i is realized and observed by all parties. Finally, the agents receive the explicit fixed wage, and if $Y_i = 1$ the principal decides whether to pay the implicit bonus or not.

2.1 The Single-Period Game

To derive the relational contract, we initially consider the single-period game where we assume performance to be objectively assessable, i.e. there is no credibility problem on the principal's side.

Agent i suffers from disadvantageous inequity amounting to the difference in payoffs, whenever agent j receives the bonus, but agent i does not. Thus, given that agent j exerts effort e_j agent i 's expected utility is

$$E[U_i|e_i, e_j] = w + p(e_i)b - c(e_i) - \alpha(1 - p(e_i))p(e_j)b, \quad i = 1, 2 \wedge i \neq j \quad (4)$$

We focus on the symmetric Nash-equilibrium, where agents exert identical effort levels; $e_i = e_j = e$. The equilibrium is characterized by

$$e = \arg \max_{\hat{e}} E[U_i|\hat{e}, e]. \quad (5)$$

The first-order condition yields

$$bp'(e) - c'(e) + \alpha p'(e)p(e)b = 0. \quad (\text{IC})$$

Thus, given that the agents exhibit inequity aversion and are faced with a contract with bonus b , they will undertake effort e , implicitly defined by

$$\frac{c'(e)}{(1 + \alpha p(e))p'(e)}. \quad (6)$$

To put it differently, when agents are characterized by inequity aversion α and the principal wants to induce effort e , she has to offer a bonus

$b(e; \alpha)$ defined by (6). Holding e constant and implicitly differentiating (6) with respect to α yields the effect of a variation of the degree of inequity aversion on the workers' willingness to undertake effort for a given bonus level.

Proposition 1 *With an increasing propensity for envy, the agents exert more effort for any given bonus.*

Proof. $\frac{\partial b(e; \alpha)}{\partial \alpha} = -\frac{p(e)}{p'(e)} \frac{c'(e)}{(p(e)\alpha+1)^2} < 0$ ■

Intuitively, as envious agents suffer from being worse off than their co-workers to a larger extent than standard agents, they exert relatively higher levels of effort in order to decrease the probability of not getting the bonus. This incentive-strengthening effect is in line with Demougin and Fluet (2006).¹¹ In the remainder of the paper, we will refer to it as the *bonus effect*.

The principal's profit per agent i is $V(e_i; \alpha) = (1 - b(e_i; \alpha))Y_i - w$. Hence, she solves

$$\max_e (1 - b(e; \alpha))p(e) - w \tag{7}$$

$$s.t. \quad E[U_i|e, e] \geq U_0, \tag{PC}$$

$$bp'(e) - c'(e) + \alpha p'(e)p(e)b = 0, \tag{IC}$$

where (PC) ensures participation. Since we assume unlimited liability, the participation constraint binds, leading to zero rent for the agents in the optimal contract. In equilibrium, for each agent holds

$$w + p(e)b = c(e) + \alpha(1 - p(e))p(e)b + U_0. \tag{8}$$

The second term on the right-hand side in equation (8) is the inequity premium. Hence, expected wage costs per agent are equal to the sum of his costs of effort, his reservation utility, and the inequity premium.

¹¹In the context of tournaments, Grund and Sliwka (2005) and Demougin and Fluet (2003) report the same result.

Substituting w and b in the principal's objective function by using (8) and (6), her problem simplifies to

$$\max_e p(e) - c(e) - \alpha p(e) (1 - p(e)) \frac{c'(e)}{(1 + \alpha p(e)) p'(e)} - U_0. \quad (9)$$

Let the effort level that maximizes the principal's profit (9) be denoted e^* . In the subsequent sections, e^* will serve as a benchmark.

Proposition 2 *For any given e , with verifiable performance, total agency costs increase in the propensity for envy, α .*

Proof. The derivative of (9) w.r.t. α is negative, as $-\frac{c'(e) p(e)(1-p(e))}{p'(e) (p(e)\alpha+1)^2} < 0$.

■

Despite the bonus effect the principal faces higher costs when agents are inequity averse. This result is due to the fact that the principal needs to compensate the agent for his expected disutility from inequity in order to ensure participation. We refer to this wage cost-augmenting effect as *inequity premium effect*. This result is in line with the agency literature, see e.g. Bartling and Siemens (2005) and Grund and Sliwka (2005).

2.2 The Repeated Game

To model the relational contract, we embed the foregoing stage game into an infinitely repeated game, considering trigger strategy equilibria. Following Bull (1987), we assume that each agent has a finite working life, whereas the firm is assumed to be infinitely-long lived. If the principal reneges on the promised bonus once, no agent will ever again believe the firm to fulfill the contract, as the information on the principal's deviation from the relational contract is rapidly transmitted to the labor market.

As effort is not contractible, agents will exert zero effort if relational contracts are infeasible, corresponding to a closure of the firm and resulting in a fallback profit of zero: $V^F = 0$. If relational contracts are feasible, the principal realizes a continuation profit from the long-term relationship, denoted $V^C(e; \alpha)$, corresponding to expected profit defined in (9).

For the relational contract to be self-enforcing, the gains from renegeing must fall short of the gains from continuing the relational contract. This is required to hold for all realizations of performance. If both agents perform successfully, $Y_i = Y_j = 1$, the principal's incentive to renege on the relational contract is strongest, as her resulting one-time benefit from deviation amounts to twice the bonus. Concerning her reputation, it does not make any difference whether she refuses to pay just one or both bonuses. Thus,

$$b(e; \alpha) \leq \frac{V^C(e; \alpha)}{r} \quad (\text{RC})$$

constitutes the renegeing constraint of the principal (RC). Whether condition (RC) can be satisfied or not, depends on the firm's interest rate r .

3 The Optimal Relational Contract

In the following, we investigate whether an increase in the propensity for envy facilitates the feasibility of relational contracts, i.e. whether the principal may commit herself for higher levels of r , provided that agents are envious, compared to the case of non-envious agents.

The different effects of envy on the feasibility of relational contracts can be understood by closer examination of condition (RC). The impact of α is twofold. On the one hand, as shown in Proposition 1, we observe the *bonus effect*; $\frac{\partial b}{\partial \alpha} < 0$. Consequently, the incentive of a one-time-deviation from the relational contract in order to save bonus expenses decreases. On the other hand, the *inequity premium effect* lowers the principal's profit from contract continuation; $\frac{\partial V^C}{\partial \alpha} < 0$, as shown in Proposition 2. Thus, fulfilling the relational contract is less attractive to the principal.

Hence, depending on the overall effect of α on (RC) commitment power of the principal may either become stronger or weaker as agents become more envious. In the former case, more reputational equilibria can be sustained with envious agents. In the following, we analyze condition (RC) and the relative impact of the described effects in greater detail.

To illustrate the issue we use an example represented in Figure 1. Specifically, we assume $\alpha = 0.2$, $p(e) = 1 - \exp(-e)$, $c(e) = \frac{1}{8}e^2$, and $U_0 = 0.1$.

The figure plots the principal's expected profit $V^C(e; \alpha)$. The convex curves depict $rb(e; \alpha)$ for various discount rates.

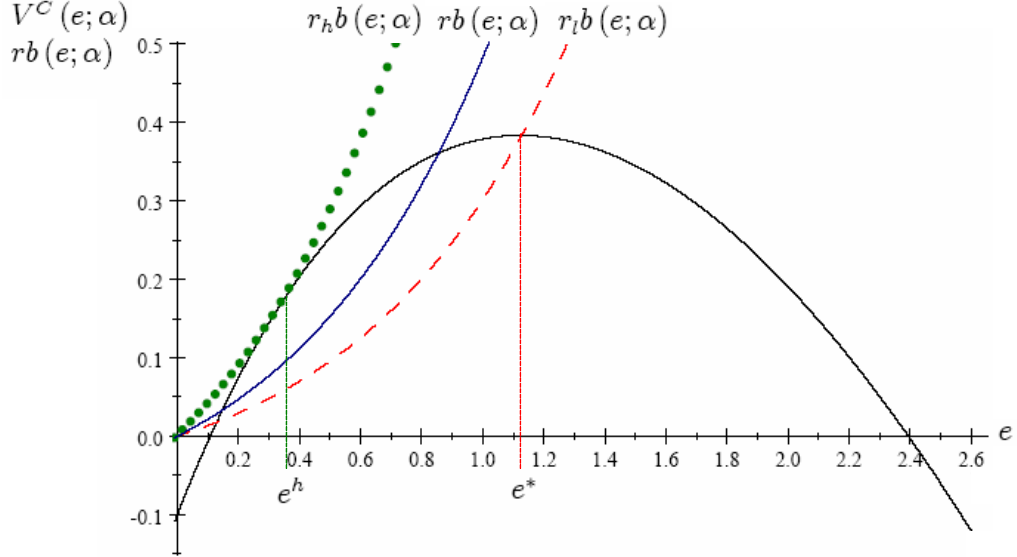


Figure 1: Reneging Constraint for $p(e) = 1 - \exp(-e)$, $\alpha = 0.2$, $c(e) = \frac{1}{8}e^2$, and $U_0 = 0.1$.

For a sufficiently *low interest rate* the (RC) does not bind. The principal implements the profit-maximizing benchmark effort level e^* (equivalent to the case of verifiable performance). We denote the threshold interest rate where the (RC) just becomes binding for any higher interest rate r_l . The dashed line illustrates $r_l b(e; \alpha)$.

The solid curve depicts $rb(e; \alpha)$ for a *medium interest rate* where the (RC) binds. To ensure credibility on the one hand and to maximize profits on the other hand, the principal will always choose to implement the maximum effort that just satisfies the (RC), i.e. the effort where $V^C(e; \alpha)$ and $rb(e; \alpha)$ intersect at the highest possible e . The figure illustrates that the optimal effort declines as the principal's discount rate or the agents' alternative utilities increase.¹²

¹²This result has also been shown by Baker, Gibbons, and Murphy (1994).

For a sufficiently *high interest rate* condition (RC) cannot be satisfied. The interest rate r_h where the (RC) can just be fulfilled via adjustment of e , is characterized by $r_h b(e; \alpha)$ being tangent to $V^C(e; \alpha)$. The effort level implemented at this threshold is denoted e^h . Relational contracts are infeasible for any interest rate higher than the threshold interest rate r_h . The dotted line, $r_h b(e; \alpha)$, represents this marginal case.

r_h and e^h are implicitly defined as the solution of the following 2×2 - system consisting of the binding reneging constraint and the tangency condition:

$$\begin{aligned} r &= \frac{V^C(e; \alpha)}{b(e; \alpha)} \\ r \frac{\partial b(e; \alpha)}{\partial e} &= \frac{\partial V^C(e; \alpha)}{\partial e} \end{aligned} \tag{10}$$

The higher the marginal interest rate r_h is, the greater is the range of interest rates the principal may credibly commit for. The value of r_h is determined by the agents' propensity for envy. By investigating the impact of α on r_h we derive the following result.

Proposition 3 *An increasing propensity for envy enhances the feasibility of the relational contract, iff the following condition holds:*

$$p(e^h) > \frac{(c(e^h) + U_0) p'(e^h) + c'(e^h)}{p'(e^h) + c'(e^h)} \tag{11}$$

Proof. See Appendix. ■

The necessary and sufficient condition (11) assures that the bonus effect outweighs the inequity premium effect. The principal's incentive to renege on the bonus payments is sufficiently low such that the negative impact of envy on the continuation profit is overcompensated. Whether condition (11) holds, depends on the particular way the performance measure is affected by effort in relation to the costs of effort and the alternative utility. The condition can only be fulfilled, if the sum of effort costs and alternative utility is smaller than unity. Further, if the marginal probability of generating a favorable outcome is high relative to the marginal costs of effort, the condition is more easily fulfilled.

Thus, we find that in the reputation game a high propensity for envy may be advantageous for the principal regarding her commitment power. There exist cases, where the principal can build up a long-term contractual relationship with inequity averse agents, whereas with inequity neutral agents she cannot. Hence, under the above condition (11) reputational equilibria can be sustained for a greater range of interest rates with inequity averse agents.

Figure 2 illustrates our result for the example functions introduced on page 11. It plots the principal's profit under the optimal contract for any level of r ; $V^*(r, \alpha) = \max V^C(e; \alpha)$, s.t. $b \leq V^C/r$. The solid curve depicts her profit under the relational contract, if α takes a high value ($\alpha = 0.8$). The dashed curve depicts her profit, if agents do not exhibit any propensity for envy ($\alpha = 0$). The example function satisfies condition (11), i.e. $r_h(0.8) > r_h(0)$.

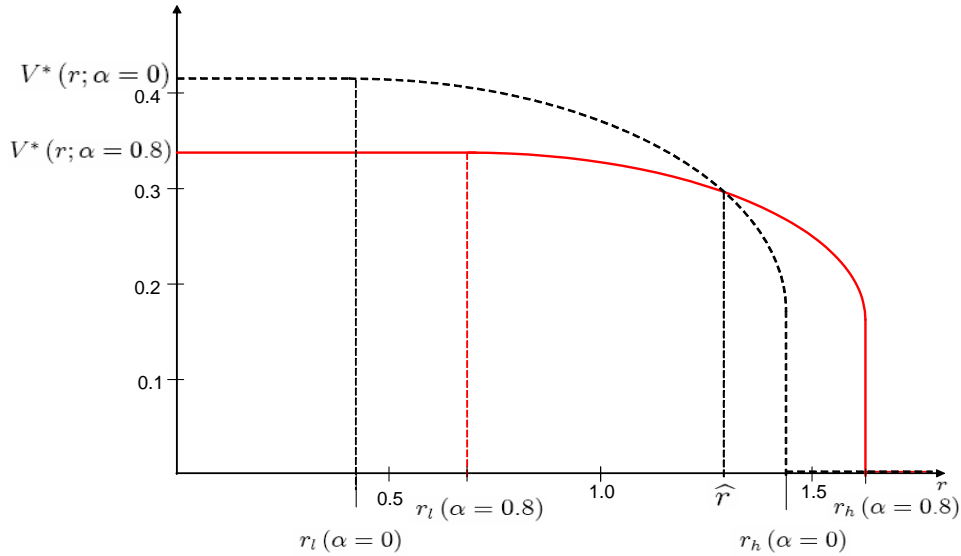


Figure 2: Profits with inequity neutral and inequity averse agents for $p(e) = 1 - \exp(-e)$, $c(e) = \frac{1}{8}e^2$, and $U_0 = 0.1$.

For any functions satisfying condition (11), the following considerations hold. For sufficiently low interest rates r , i.e. interest rates below the respective lower interest thresholds, $r \leq r_l(\alpha)$, a relational contract is feasible and the optimal effort level e^* can be induced by the principal. $V^*(e^*; \alpha)$ is

realized.

For any interest rate r inbetween the respective lower and upper threshold levels, i.e. $r_l(\alpha) < r \leq r_h(\alpha)$, effort e has to be adapted such that (RC) is fulfilled. Profits, $V^*(e; \alpha)$, decrease in this range as interest rates increase. However, depending on the value of α , profits decrease at different rates.

When r takes a value higher than the critical value \hat{r} , continuation profits from employing envious agents exceed those from employing non-envious ones. Even more importantly, there exist some r inbetween the upper thresholds, i.e. $r_h(\alpha_{low}) < r \leq r_h(\alpha_{high})$, for which relational contracts are feasible with more inequity averse agents, whereas the principal cannot credibly commit herself when dealing with less inequity averse agents. Reputational equilibria can be sustained for a greater range of interest rates in the presence of inequity aversion on the agents' sides.

4 Concluding Remarks

We consider optimal individual incentive schemes in a principal-agent relationship with two identical agents who exhibit horizontal disadvantageous inequity aversion. As there are only subjective performance measures available to evaluate the agents' performances, the bonus contracts are enforced in a reputational equilibrium.

The analysis focuses on the impact of the agents' propensity for envy on the principal's commitment power that determines the feasibility of the relational contract. There are two countervailing effects at work: As agency costs increase due to inequity aversion, the principal's profits from the contract decrease as agents become more envious. Thus, continuation of the relational contract becomes less attractive. On the other hand, inequity aversion serves as an incentive-strengthening device. This implies that the principal has to pay a lower bonus to implement the same effort given that agents are envious, thereby reducing her benefit from a one-time deviation. We identify a necessary and sufficient condition assuring that the principal's ability to commit increases as agents become more envious.

This result has several implications. The implementation of a relational contract might not be possible with inequity neutral agents, when the return on the principal's alternative investment possibilities is relatively high. Thus, this could lead her to displace production to countries, where people generally exhibit a greater degree of inequity aversion due to cultural differences.¹³

Further, one could expect a more frequent implementation of relational contracts in countries whose populations are more sensitive to inequity aversion. This hypothesis is in line with the findings of Moriguchi (2003), who explains differences in institutional arrangements in the U.S. and Japan, pointing out that the U.S. was hit harder by the Great Depression compared to Japan. This goes along with lower continuation profits and, thus results in the less frequent use of relational contracts in the U.S. According to our analysis, a depreciation of future profits has a less severe impact on the feasibility of relational contracts if employees are inequity averse. Hence, these countries' differences in the propensity for inequity aversion could also play a role for the explanation of differences in institutional arrangements in this context.¹⁴

Appendix

Proof of Proposition 3. Differentiation of r^h yields

$$\frac{\partial r^h}{\partial \alpha} = \frac{\left(\frac{\partial V^C}{\partial e} \Big|_{e=e^h} b - V^C \frac{\partial b}{\partial e} \Big|_{e=e^h} \right) \frac{\partial e}{\partial \alpha} + \frac{\partial V^C}{\partial \alpha} \Big|_{e=e^h} b - V^C \frac{\partial b}{\partial \alpha} \Big|_{e=e^h}}{b^2}. \quad (12)$$

The system (10) implies

$$\frac{\partial V^C}{\partial e} \Big|_{e=e^h} b(e^h; \alpha) - V^C(e^h; \alpha) \frac{\partial b}{\partial e} \Big|_{e=e^h} = 0. \quad (13)$$

With (13), (12) simplifies to

¹³Alesina, Di Tella, and MacCulloch (2004) and Corneo (2001) find Europeans to exhibit a higher propensity for inequity aversion in comparison to U.S. Americans.

¹⁴Empirical evidence suggests that the Japanese exhibit stronger inequity aversion than e.g. U.S. Americans.

$$\frac{\partial r_h}{\partial \alpha} = \frac{\left. \frac{\partial V^C}{\partial \alpha} \right|_{e=e^h} b - V^C \left. \frac{\partial b}{\partial \alpha} \right|_{e=e^h}}{b^2}. \quad (14)$$

To decide upon the effect of α on r_h the sign of equation (14) is crucial:

$$\text{sign} \left(\frac{\partial r_h}{\partial \alpha} \right) = \text{sign} \left(\left. \frac{\partial V^C}{\partial \alpha} \right|_{e=e^h} b - V^C \left. \frac{\partial b}{\partial \alpha} \right|_{e=e^h} \right) \quad (15)$$

Substituting V^C as given in (9) and with

$$\frac{\partial V^C(e^h; \alpha)}{\partial \alpha} = -b \left(1 - p(e^h) \right) p(e^h) - \alpha \left(1 - p(e^h) \right) p(e^h) \left. \frac{\partial b}{\partial \alpha} \right|_{e=e^h}$$

equation (15) further simplifies to

$$\text{sign} \left(\frac{\partial r_h}{\partial \alpha} \right) = \text{sign} \left(-b^2 \left(1 - p(e^h) \right) p(e^h) - \left(p(e^h) - c(e^h) - U_0 \right) \left. \frac{\partial b}{\partial \alpha} \right|_{e=e^h} \right). \quad (16)$$

With $b(e^h; \alpha) = \frac{c'(e^h)}{(1+\alpha p(e^h))p'(e^h)}$ as given in (6) and

$$\left. \frac{\partial b}{\partial \alpha} \right|_{e=e^h} = - \frac{c'(e^h) p(e^h) p'(e^h)}{\left((1 + \alpha p(e^h)) p'(e^h) \right)^2}$$

equation (16) results in

$$\text{sign} \left(\frac{\partial r_h}{\partial \alpha} \right) = \text{sign} \left(-c'(e^h) \left(1 - p(e^h) \right) + \left(p(e^h) - c(e^h) - U_0 \right) p'(e^h) \right). \quad (17)$$

Thus,

$$\frac{\partial r_h}{\partial \alpha} > 0 \quad \text{iff} \quad p(e^h) > \frac{(c(e^h)+U_0)p'(e^h)+c'(e^h)}{p'(e^h)+c'(e^h)}.$$

■

References

- Alesina, A., R. Di Tella, and R. MacCulloch (2004). Inequality and happiness: are europeans and americans different? *Journal of Public Economics* 88(9-10), 2009–2042.
- Baker, G. (2002). Distortion and risk in optimal incentive contracts. *Jour-*

- nal of Human Resources* 37(4), 748–751.
- Baker, G., R. Gibbons, and K. J. Murphy (1994). Subjective performance measures in optimal incentive contracts. *The Quarterly Journal of Economics* 109(4), 1125–56.
- Baker, G. P. (1992). Incentive contracts and performance measurement. *Journal of Political Economy* 100(3), 598–614.
- Bartling, B. and F. v. Siemens (2005). Inequity aversion and moral hazard with multiple agents. Discussion paper, University of Munich, Department of Economics.
- Bartling, B. and F. v. Siemens (2006). The intensity of incentives in firms and markets: Moral hazard with envious agents. Discussion Papers in Economics 913, University of Munich, Department of Economics.
- Berg, J., J. Dickhaut, and K. McCabe (1995). Trust, reciprocity, and social history. *Games and Economic Behavior* 10(1), 122–142.
- Bolton, G. E. and A. Ockenfels (2000). ERC: A theory of equity, reciprocity, and competition. *American Economic Review* 90(1), 166–193.
- Bull, C. (1987). The existence of self-enforcing implicit contracts. *The Quarterly Journal of Economics* 102(1), 147–59.
- Corneo, G. (2001). Inequality and the state: Comparing u.s. and german preferences. *Annales d' Economie et de Statistique* 63-64, 283–296.
- Demougin, D. and C. Fluet (2003). Inequity aversion in tournaments. Cahier de recherche 03-22, CIRPÉE.
- Demougin, D. and C. Fluet (2006). Group vs. individual performance pay when workers are envious. In D. Demougin and C. Schade (Eds.), *Contributions to Entrepreneurship and Economics - First Haniel-Kreis Meeting on Entrepreneurial Research*, pp. 39–47. Duncker & Humblot Verlag.
- Falk, A. and U. Fischbacher (2006). A theory of reciprocity. *Games and Economic Behavior* 54(2), 293–315.
- Fehr, E., S. Gächter, and G. Kirchsteiger (1997). Reciprocity as a contract enforcement device: Experimental evidence. *Econometrica* 65(4), 833–860.

- Fehr, E., G. Kirchsteiger, and A. Riedl (1995). Gift exchange and reciprocity in competitive experimental markets. Economics Series 14, Institute for Advanced Studies.
- Fehr, E. and K. M. Schmidt (1999). A theory of fairness, competition and cooperation. *Quarterly Journal of Economics* 114(3), 817–868.
- Goranson, R. E. and L. Berkowitz (1966). Reciprocity and responsibility reactions to prior help. *Journal of Personality and Social Psychology* 3(2), 227–232.
- Grund, C. and D. Sliwka (2005). Envy and compassion in tournaments. *Journal of Economics & Management Strategy* 14(1), 187–207.
- Holmström, B. (1981). Contractual models of the labor market. *American Economic Review* 71(2), 308–13.
- Holmström, B. and P. Milgrom (1991). Multitask principal-agent analyses: Incentive contracts, asset ownership, and job design. *Journal of Law, Economics and Organization* 7(0), 24–52.
- Holmström, B. and P. Milgrom (1994). The firm as an incentive system. *American Economic Review* 84(4), 972–91.
- Kerr, S. (1975). On the folly of rewarding a, while hoping for b. *The Academy of Management Journal* 18(4), 769–783.
- Loewenstein, G. F., L. Thompson, and M. H. Bazerman (1989). Social utility and decision making in interpersonal contexts. *Journal of Personality and Social Psychology* 57, 426–41.
- Milgrom, P. R. and J. Roberts (1992). *Economics, Organization, and Management*. Englewood Cliffs, NJ: Prentice-Hall.
- Moriguchi, C. (2003). Implicit contracts, the great depression, and institutional change: A comparative analysis of u.s. and japanese employment relations, 1920-1940. NBER Working Papers 9559, National Bureau of Economic Research, Inc.
- Okun, A. M. (1980). The invisible handshake and inflationary process. *Challenge* 27, 5–12.
- Rabin, M. (1993). Incorporating fairness into game theory and economics. *American Economic Review* 83(5), 1281–1302.

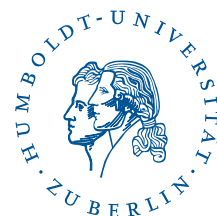
SFB 649 Discussion Paper Series 2006

For a complete list of Discussion Papers published by the SFB 649, please visit <http://sfb649.wiwi.hu-berlin.de>.

- 001 "Calibration Risk for Exotic Options" by Kai Detlefsen and Wolfgang K. Härdle, January 2006.
- 002 "Calibration Design of Implied Volatility Surfaces" by Kai Detlefsen and Wolfgang K. Härdle, January 2006.
- 003 "On the Appropriateness of Inappropriate VaR Models" by Wolfgang Härdle, Zdeněk Hlávka and Gerhard Stahl, January 2006.
- 004 "Regional Labor Markets, Network Externalities and Migration: The Case of German Reunification" by Harald Uhlig, January/February 2006.
- 005 "British Interest Rate Convergence between the US and Europe: A Recursive Cointegration Analysis" by Enzo Weber, January 2006.
- 006 "A Combined Approach for Segment-Specific Analysis of Market Basket Data" by Yasemin Boztuğ and Thomas Reutterer, January 2006.
- 007 "Robust utility maximization in a stochastic factor model" by Daniel Hernández-Hernández and Alexander Schied, January 2006.
- 008 "Economic Growth of Agglomerations and Geographic Concentration of Industries - Evidence for Germany" by Kurt Geppert, Martin Gornig and Axel Werwatz, January 2006.
- 009 "Institutions, Bargaining Power and Labor Shares" by Benjamin Bental and Dominique Demougin, January 2006.
- 010 "Common Functional Principal Components" by Michal Benko, Wolfgang Härdle and Alois Kneip, January 2006.
- 011 "VAR Modeling for Dynamic Semiparametric Factors of Volatility Strings" by Ralf Brüggemann, Wolfgang Härdle, Julius Mungo and Carsten Trenkler, February 2006.
- 012 "Bootstrapping Systems Cointegration Tests with a Prior Adjustment for Deterministic Terms" by Carsten Trenkler, February 2006.
- 013 "Penalties and Optimality in Financial Contracts: Taking Stock" by Michel A. Robe, Eva-Maria Steiger and Pierre-Armand Michel, February 2006.
- 014 "Core Labour Standards and FDI: Friends or Foes? The Case of Child Labour" by Sebastian Braun, February 2006.
- 015 "Graphical Data Representation in Bankruptcy Analysis" by Wolfgang Härdle, Rouslan Moro and Dorothea Schäfer, February 2006.
- 016 "Fiscal Policy Effects in the European Union" by Andreas Thams, February 2006.
- 017 "Estimation with the Nested Logit Model: Specifications and Software Particularities" by Nadja Silberhorn, Yasemin Boztuğ and Lutz Hildebrandt, March 2006.
- 018 "The Bologna Process: How student mobility affects multi-cultural skills and educational quality" by Lydia Mechtenberg and Roland Strausz, March 2006.
- 019 "Cheap Talk in the Classroom" by Lydia Mechtenberg, March 2006.
- 020 "Time Dependent Relative Risk Aversion" by Enzo Giacomini, Michael Handel and Wolfgang Härdle, March 2006.
- 021 "Finite Sample Properties of Impulse Response Intervals in SVECMs with Long-Run Identifying Restrictions" by Ralf Brüggemann, March 2006.
- 022 "Barrier Option Hedging under Constraints: A Viscosity Approach" by Imen Bentahar and Bruno Bouchard, March 2006.

SFB 649, Spandauer Straße 1, D-10178 Berlin
<http://sfb649.wiwi.hu-berlin.de>

This research was supported by the Deutsche
Forschungsgemeinschaft through the SFB 649 "Economic Risk".



- 023 "How Far Are We From The Slippery Slope? The Laffer Curve Revisited" by Mathias Trabandt and Harald Uhlig, April 2006.
- 024 "e-Learning Statistics – A Selective Review" by Wolfgang Härdle, Sigbert Klinke and Uwe Ziegenhagen, April 2006.
- 025 "Macroeconomic Regime Switches and Speculative Attacks" by Bartosz Maćkowiak, April 2006.
- 026 "External Shocks, U.S. Monetary Policy and Macroeconomic Fluctuations in Emerging Markets" by Bartosz Maćkowiak, April 2006.
- 027 "Institutional Competition, Political Process and Holdup" by Bruno Deffains and Dominique Demougin, April 2006.
- 028 "Technological Choice under Organizational Diseconomies of Scale" by Dominique Demougin and Anja Schöttner, April 2006.
- 029 "Tail Conditional Expectation for vector-valued Risks" by Imen Bentahar, April 2006.
- 030 "Approximate Solutions to Dynamic Models – Linear Methods" by Harald Uhlig, April 2006.
- 031 "Exploratory Graphics of a Financial Dataset" by Antony Unwin, Martin Theus and Wolfgang Härdle, April 2006.
- 032 "When did the 2001 recession *really* start?" by Jörg Polzehl, Vladimir Spokoiny and Cătălin Stărică, April 2006.
- 033 "Varying coefficient GARCH versus local constant volatility modeling. Comparison of the predictive power" by Jörg Polzehl and Vladimir Spokoiny, April 2006.
- 034 "Spectral calibration of exponential Lévy Models [1]" by Denis Belomestny and Markus Reiß, April 2006.
- 035 "Spectral calibration of exponential Lévy Models [2]" by Denis Belomestny and Markus Reiß, April 2006.
- 036 "Spatial aggregation of local likelihood estimates with applications to classification" by Denis Belomestny and Vladimir Spokoiny, April 2006.
- 037 "A jump-diffusion Libor model and its robust calibration" by Denis Belomestny and John Schoenmakers, April 2006.
- 038 "Adaptive Simulation Algorithms for Pricing American and Bermudan Options by Local Analysis of Financial Market" by Denis Belomestny and Grigori N. Milstein, April 2006.
- 039 "Macroeconomic Integration in Asia Pacific: Common Stochastic Trends and Business Cycle Coherence" by Enzo Weber, May 2006.
- 040 "In Search of Non-Gaussian Components of a High-Dimensional Distribution" by Gilles Blanchard, Motoaki Kawanabe, Masashi Sugiyama, Vladimir Spokoiny and Klaus-Robert Müller, May 2006.
- 041 "Forward and reverse representations for Markov chains" by Grigori N. Milstein, John G. M. Schoenmakers and Vladimir Spokoiny, May 2006.
- 042 "Discussion of 'The Source of Historical Economic Fluctuations: An Analysis using Long-Run Restrictions' by Neville Francis and Valerie A. Ramey" by Harald Uhlig, May 2006.
- 043 "An Iteration Procedure for Solving Integral Equations Related to Optimal Stopping Problems" by Denis Belomestny and Pavel V. Gapeev, May 2006.
- 044 "East Germany's Wage Gap: A non-parametric decomposition based on establishment characteristics" by Bernd Görzig, Martin Gornig and Axel Werwatz, May 2006.
- 045 "Firm Specific Wage Spread in Germany - Decomposition of regional differences in inter firm wage dispersion" by Bernd Görzig, Martin Gornig and Axel Werwatz, May 2006.

SFB 649, Spandauer Straße 1, D-10178 Berlin
<http://sfb649.wiwi.hu-berlin.de>

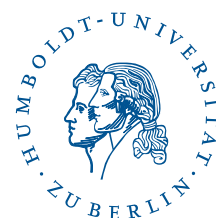
This research was supported by the Deutsche
 Forschungsgemeinschaft through the SFB 649 "Economic Risk".



- 046 "Produktdiversifizierung: Haben die ostdeutschen Unternehmen den Anschluss an den Westen geschafft? – Eine vergleichende Analyse mit Mikrodaten der amtlichen Statistik" by Bernd Görzig, Martin Gornig and Axel Werwatz, May 2006.
- 047 "The Division of Ownership in New Ventures" by Dominique Demougin and Oliver Fabel, June 2006.
- 048 "The Anglo-German Industrial Productivity Paradox, 1895-1938: A Restatement and a Possible Resolution" by Albrecht Ritschl, May 2006.
- 049 "The Influence of Information Costs on the Integration of Financial Markets: Northern Europe, 1350-1560" by Oliver Volckart, May 2006.
- 050 "Robust Econometrics" by Pavel Čížek and Wolfgang Härdle, June 2006.
- 051 "Regression methods in pricing American and Bermudan options using consumption processes" by Denis Belomestny, Grigori N. Milstein and Vladimir Spokoiny, July 2006.
- 052 "Forecasting the Term Structure of Variance Swaps" by Kai Detlefsen and Wolfgang Härdle, July 2006.
- 053 "Governance: Who Controls Matters" by Bruno Deffains and Dominique Demougin, July 2006.
- 054 "On the Coexistence of Banks and Markets" by Hans Gersbach and Harald Uhlig, August 2006.
- 055 "Reassessing Intergenerational Mobility in Germany and the United States: The Impact of Differences in Lifecycle Earnings Patterns" by Thorsten Vogel, September 2006.
- 056 "The Euro and the Transatlantic Capital Market Leadership: A Recursive Cointegration Analysis" by Enzo Weber, September 2006.
- 057 "Discounted Optimal Stopping for Maxima in Diffusion Models with Finite Horizon" by Pavel V. Gapeev, September 2006.
- 058 "Perpetual Barrier Options in Jump-Diffusion Models" by Pavel V. Gapeev, September 2006.
- 059 "Discounted Optimal Stopping for Maxima of some Jump-Diffusion Processes" by Pavel V. Gapeev, September 2006.
- 060 "On Maximal Inequalities for some Jump Processes" by Pavel V. Gapeev, September 2006.
- 061 "A Control Approach to Robust Utility Maximization with Logarithmic Utility and Time-Consistent Penalties" by Daniel Hernández-Hernández and Alexander Schied, September 2006.
- 062 "On the Difficulty to Design Arabic E-learning System in Statistics" by Taleb Ahmad, Wolfgang Härdle and Julius Mungo, September 2006.
- 063 "Robust Optimization of Consumption with Random Endowment" by Wiebke Wittmüß, September 2006.
- 064 "Common and Uncommon Sources of Growth in Asia Pacific" by Enzo Weber, September 2006.
- 065 "Forecasting Euro-Area Variables with German Pre-EMU Data" by Ralf Brüggemann, Helmut Lütkepohl and Massimiliano Marcellino, September 2006.
- 066 "Pension Systems and the Allocation of Macroeconomic Risk" by Lans Bovenberg and Harald Uhlig, September 2006.
- 067 "Testing for the Cointegrating Rank of a VAR Process with Level Shift and Trend Break" by Carsten Trenkler, Pentti Saikkonen and Helmut Lütkepohl, September 2006.
- 068 "Integral Options in Models with Jumps" by Pavel V. Gapeev, September 2006.
- 069 "Constrained General Regression in Pseudo-Sobolev Spaces with Application to Option Pricing" by Zdeněk Hlávka and Michal Pešta, September 2006.

SFB 649, Spandauer Straße 1, D-10178 Berlin
<http://sfb649.wiwi.hu-berlin.de>

This research was supported by the Deutsche
 Forschungsgemeinschaft through the SFB 649 "Economic Risk".



- 070 "The Welfare Enhancing Effects of a Selfish Government in the Presence of Uninsurable, Idiosyncratic Risk" by R. Anton Braun and Harald Uhlig, September 2006.
- 071 "Color Harmonization in Car Manufacturing Process" by Anton Andriyashin, Michal Benko, Wolfgang Härdle, Roman Timofeev and Uwe Ziegenhagen, October 2006.
- 072 "Optimal Interest Rate Stabilization in a Basic Sticky-Price Model" by Matthias Paustian and Christian Stoltenberg, October 2006.
- 073 "Real Balance Effects, Timing and Equilibrium Determination" by Christian Stoltenberg, October 2006.
- 074 "Multiple Disorder Problems for Wiener and Compound Poisson Processes With Exponential Jumps" by Pavel V. Gapeev, October 2006.
- 075 "Inhomogeneous Dependency Modelling with Time Varying Copulae" by Enzo Giacomini, Wolfgang K. Härdle, Ekaterina Ignatieva and Vladimir Spokoiny, November 2006.
- 076 "Convenience Yields for CO₂ Emission Allowance Futures Contracts" by Szymon Borak, Wolfgang Härdle, Stefan Trück and Rafal Weron, November 2006.
- 077 "Estimation of Default Probabilities with Support Vector Machines" by Shiyi Chen, Wolfgang Härdle and Rouslan Moro, November 2006.
- 078 "GHICA - Risk Analysis with GH Distributions and Independent Components" by Ying Chen, Wolfgang Härdle and Vladimir Spokoiny, November 2006.
- 079 "Do Individuals Recognize Cascade Behavior of Others? - An Experimental Study -" by Tim Grebe, Julia Schmid and Andreas Stiehler, November 2006.
- 080 "The Uniqueness of Extremum Estimation" by Volker Krätschmer, December 2006.
- 081 "Compactness in Spaces of Inner Regular Measures and a General Portmanteau Lemma" by Volker Krätschmer, December 2006.
- 082 "Probleme der Validierung mit Strukturgleichungsmodellen" by Lutz Hildebrandt and Dirk Temme, December 2006.
- 083 "Formative Measurement Models in Covariance Structure Analysis: Specification and Identification" by Dirk Temme and Lutz Hildebrandt, December 2006.
- 084 "PLS Path Modeling – A Software Review" by Dirk Temme, Henning Kreis and Lutz Hildebrandt, December 2006.
- 085 "Relational Contracts and Inequity Aversion" by Jenny Kragl and Julia Schmid, December 2006.

SFB 649, Spandauer Straße 1, D-10178 Berlin
<http://sfb649.wiwi.hu-berlin.de>

This research was supported by the Deutsche
Forschungsgemeinschaft through the SFB 649 "Economic Risk".

