

Chlaß, Nadine

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The Impact of Procedural Asymmetry in Games of Imperfect Information

Nadine Chlaß[‡]

August 28, 2010

Abstract

Games of imperfect information distribute information unevenly among parties. Often, this procedural asymmetry provokes a winner's curse. Recently, parties have been found to hold preferences purely over such procedural (a)symmetries. Here, I explore the impact preferences for purely procedural symmetry exert if agents cannot exit or modify a procedure at odds with such preferences. To that end, I design a game which exhibits extreme procedural asymmetry. In an experimental test, parties are found to compensate the procedural asymmetry monetarily such that essentially no winner's curse results. Here, we see how preferences over outcome-invariant aspects of a procedure turn outcome-varying.

JEL Classification: C78, D63, D82

Key words: procedural preferences, asymmetric information, winner's curse

[‡]Friedrich Schiller University of Jena, Germany. Main parts of this research were carried out while the author was working at the Max Planck Institute of Economics Jena, Germany.

1 Introduction

Recently, individuals have been suggested to hold preferences purely over procedural aspects (Chlaß et al. 2009). Such aspects describe the *rules of the game* which generates the outcome. Individuals who hold preferences purely over procedural aspects distinguish between procedures which are identical in terms of expected outcomes (Bolton et al. 2005), or intentions (Sebald 2007). Thereby, individuals seem to prefer symmetric procedures which do, for instance, grant each player the same freedom of choice, the same freedom to harm others, or the same information. Such purely procedural concerns link to individuals' moral judgment (Kohlberg 1984), (Lind 2008).

Here, I explore how purely procedural concerns affect parties' behavior if parties are subject to strongly asymmetric procedures which they cannot exit or modify. To that end, I design a very asymmetric bargaining procedure¹ which consistently advantages one party over another in several procedural aspects. Therein, an acquirer who is privately informed about the value of the target firm makes an offer to acquire that target firm. The procedure is designed such that per path of play, the acquirer chooses her offer from a continuous set of options, whereas the target may only choose whether to accept or reject the offer. Hence, parties' freedom of choice differs substantially. Moreover, acquirers choose from a continuum of unkind options² whereas targets only have one unkind option per path of play. Hence, parties freedom to harm the other also differs substantially. Finally, acquirers are advantaged by information over targets since acquirers hold private information on the target value.

If parties in this asymmetric game prefer procedural symmetry, I expect procedurally advantaged acquirers to compensate targets for the asymmetry of the game. Similarly, I expect procedurally disadvantaged targets to require such a compensation if they are to accept an offer. Note that such a mechanism would countervail a potential winner's curse³ on the target side.

¹The procedure is a modification of the acquiring-a-company game (Bazerman and Samuelson 1983).

²An offer is 'unkind' (Dufwenberg and Kirchsteiger 2004) if the target payoff is smaller than a social reference, for instance smaller than an equal split.

³For results on the winner's curse in sequential common-value auctions see (Grosskopf et al. 2007), (Charness and Levin 2009).

Thereby, I do not directly elicit whether or not individuals hold purely procedural preferences. Instead, I use individuals' moral preferences as an instrument for purely procedural preferences (Chlaß et al. 2009). Indeed, this instrument shows a strong link to above-equilibrium offers on the acquirer side. Similarly, the instrument explains targets' acceptance thresholds. Targets incur only a very small winner's curse. These are cases where the instrument does not predict any purely procedural preference, or only a very weak one. I discuss why the instrument is valid and has no direct effect on individual responses.

Let me finally point out where such asymmetric bargaining procedures arise in practice. The situation arises when acquirers by some sort of expertise hold information which is not revealed to the target owner by mere ownership. A venture financier for example, who buys into a start-up⁴ often holds market and management expertise which exclusively inform her on the prospect of that young company. A similar situation arises on markets of real estate when acquirers hold private information on natural resources (Hendricks and Kovenock 1989). Finally, on informal antiquity markets an acquirer's expertise in art may advantage her informationally over owners of scarce art objects (Coffman 1991)⁵. Each of these markets fosters the exchange of commodities whose qualities exhibit extreme skewness⁶, a phenomenon which perhaps, draws on expertise instead of ownership to reveal quality.

The following section presents the game, its Bayesian Nash and its Cursed Equilibria (Eyster and Rabin 2005). Section 3 reviews theory on the instruments I use to explain equilibrium deviations. I review how subjects' moral preferences are related to *purely procedural preferences* (Chlaß et al. 2009) and review how personality traits (Ruch 1999) might capture parties' sensitivity to incur a winner's curse (Chlaß 2010). Section 4 describes the experimental design. Result section 5 starts out with overall behavior, defines equilibrium deviations, and regresses these deviations on the instruments in question. Section 6 concludes.

⁴Empirically, active venture financiers (the 'external management' who buys in) take over targets' management prior to or after the acquisition (Denis 2004)

⁵As a last example, government's expertise on the purpose of a technology may advantage her informationally over bidders in public procurement. Strategic expertise for instance may motivate public defence spending on innovative activities (Schnee 1978).

⁶New ventures show high failure rates (Agarwal and Gort 2002), natural resources are scarcely allocated (Gorelov 1982) as are high quality art items (Baumol 1986). If high qualities are scarce, the distribution assigns less probability mass to high than to low qualities which results in skewness. Qualities may bend to either extreme which is why mere variance is inappropriate to capture scarcity.

2 The Game

2.1 Structure

The game involves two players, an acquirer a and the owner of a target company t . Target company qualities v are i.i.d. triangularly distributed with lower bound 0, upper bound 1 and mode c , i.e. $v \sim s(0, 1, c)$. Acquirers hold private information on a target's actual quality \bar{v} whilst targets merely know the overall distribution of qualities $f(v) = s(0, 1, c)$. Acquirer a moves first and makes an acquisition offer $p \in [0, 1]$ based on her private information \bar{v} . Target t moves second and decides whether to accept or to reject the offer, i.e. $\delta_t \in \{0, 1\}$. Note the information hidden in any acquisition offer p that \bar{v} cannot exceed p . If target t accepts an offer p , she obtains p and cedes ownership. An acquirer in turn obtains targets ownership and pays offer p . If a target vetoes an offer, neither party earns anything.

Thereby, parties differ in their valuation of the target. Acquirers value target ownership at the actual target quality \bar{v} . Targets in turn value ownership only at a fraction $q, q \in [0, 1]$ of this very quality. Hence, we have payoffs: $\Pi_a = (\bar{v} - p) \cdot \delta_t$, and $\Pi_t = (p - q \cdot \bar{v}) \cdot \delta_t$. Thereby, q interlinks parties' valuation of target ownership and denotes a common-value parameter. Since acquirers value ownership more than targets, acquisitions promote market efficiency by devolving ownership to the party who values it most. Thereby, q rules the degree to which acquisitions foster market efficiency.

2.2 Bayesian Nash Equilibrium

In round $T=2$ target t expects a nonnegative payoff $E(\Pi_t) \geq 0$ iff $p \geq q \cdot E(v|v \geq p)$. Her best response writes:

$$\delta_t^{BNE} = \begin{cases} 1 & : \quad p \geq q \cdot E(v|v \geq p) \\ 0 & : \quad otherwise \end{cases}$$

In round $T=1$, acquirer a rules out dominated strategies by stating the smallest offer a target accepts, namely $p = q \cdot E(v|v \geq p)$. She rules out losses iff $p \leq \bar{v}$. Her best response writes⁷:

$$p_a^{BNE} = \begin{cases} q \cdot E(v|v \geq p) & : \quad q \cdot E(v|v \geq p) \leq \bar{v} \\ d & : \quad otherwise \end{cases}$$

⁷For $q \cdot E(v|v \geq p) > \bar{v}$ acquirers might wish to exploit target trembles and instead of $p = 0$, offer $p \in [0, \bar{v}]$. If targets trembled by ϵ we would have $\delta_t^{TBE} = 1 \cdot (1 - \epsilon) | p \geq q \cdot E(v|v \geq p)$ and $\delta_t^{TBE} = 1 \cdot \epsilon | p < q \cdot E(v|v \geq p)$.

where $d \in [0, \bar{v}]$. Assume now $f(v) = s(0, 1, c)$ where mode c rules market efficiency, scope and distribution of market welfare. For $f(v) = s(0, 1, c)$ one may distinguish three cases. Which one applies would depend on parties' break-even points and on whether p truncates $f(v)$ below or above mode c :⁸

$$p_{a,s(0,1,c)}^{BNE}(\bar{v}) = \begin{cases} \frac{1}{2} \cdot \frac{4^{1/3} \cdot \Xi^{1/3}}{-3+2q} - \frac{1}{2} \frac{c \cdot 4^{2/3}}{\Xi^{1/3}} : & p < c, q \cdot E(v|v \geq p) \leq \bar{v} \\ -\frac{q}{-3+2 \cdot q} : & p > c, q \cdot E(v|v \geq p) \leq \bar{v} \\ d : & \text{otherwise.} \end{cases}$$

However, only in case 2 do we observe acquisitions, that is, would perfectly rational self-interested parties agree to exchange ownership: Since I assumed $v \in [0, 1]$, offers in the first case would always fall outside the definition range of p . Fig. 1 illustrates throughout negative p ⁹ which will always fall short of targets' break-even.

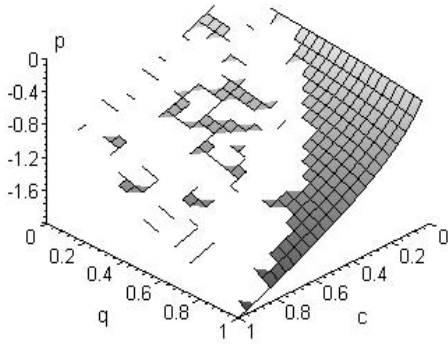


Fig. 1: Equilibrium prices for $p < c$.

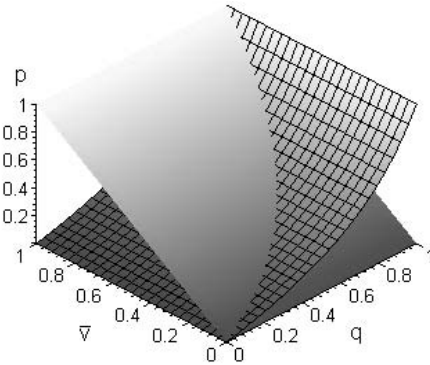


Fig. 2: Equilibrium prices for $p > c$.

The third case subsumes all residual offers where acquirers break even, but targets do not. An acquirer may make such offers to exploit target trembles. In case two finally, acquisitions may be mutually beneficial depending on c, \bar{v} , and q . Fig. 2 illustrates the area of mutually beneficial acquisitions in case 2. The checked plane displays equilibrium offers (which respect targets' break even),

⁸ $\Xi := c \left(qc + q + \sqrt{(4c + 2q^3c^2 - 3q^2c^2 + 4q^3c - 6q^2c + 2q^3 - 3q^2)(-3 + 2q)^{-1}} \right) (-3 + 2q)^2$, result derived in Appendices A and B.

⁹This case becomes more interesting if we vary b . The experiment covers $b = 10$ where the case predicts (mutually beneficial) acquisitions. For details on this case and the equilibrium solution here see Appendix B.

and the shaded plane depicts acquirers' break even \bar{v} . Above the shaded plane, i.e. $p > \bar{v}$, acquisitions are mutually beneficial. Below the shaded plane we have case 3 with $p_{a,s(0,1,c)}^{BNE} = d$. Here, we have all offers an acquirer may make if she cannot make a mutually beneficial offer, for instance to exploit target trembles.

In summary, if we have qualities $v \in [0, 1]$, skewness parameter c affects condition $qE(v \gtrsim p) \leq \bar{v}$ which guarantees that mutually beneficial equilibrium prices exist. In particular, c may reinforce or countervail the impact of common value parameter q which, in the original acquiring-a-company game (Bazerman and Samuelson 1983), was the only parameter to rule scope and distribution of market welfare. Negative Skewness in qualities may hence soften social dilemma under information asymmetry. However, equilibrium offers themselves are no direct function of c for $v \sim (0, 1)$ ¹⁰.

2.3 Cursed Equilibria

The cursed equilibrium involves players who *"...wrongly assume that with some positive probability the other players do not play their type-specific action profile, but the same mixed action profile corresponding to their average distribution of actions."* (Eyster and Rabin 2005, p.1624). If a target assigns probability zero to the event that an acquirer may condition her offer on \bar{v} , she is said fully cursed, i.e. $\chi_t = 1$. An offer would convey no information to her.

In round $T=2$, a *fully* cursed target does not account for the information in p that $\bar{v} \geq p$. She supposes to rule out nonnegativity in expected profits by ensuring $p - q \cdot E(v) \geq 0$ where $E(v \sim s(0, 1, c)) = \frac{1+c}{3}$. The range of all χ -cursed best responses denotes:

$$\delta_{\chi_t,t} = \begin{cases} 1 : & p \geq \chi_t \cdot q \cdot E(v) + (1 - \chi_t) \cdot q \cdot E(v|v \geq p) \\ 0 : & \textit{otherwise} \end{cases}$$

If an acquirer in round $T=1$ wrongly expects a target to comply with rational self-interest, she offers $p_{\chi_a \neq \chi_t}^{CE} = p^{BNE}$. Here, target cursedness would merely affect the condition under which acquisitions occur in equilibrium. If instead,

¹⁰This can become be the case if we choose other quality ranges a, b for $v \sim s(a, b, c)$.

an acquirer for some reason knew a target's degree of cursedness¹¹, she would set a different p , i.e. p_{χ_t} . Thereby, we may either assume her to hold correct beliefs on χ_t , or both parties to ignore the information in p by the same χ . The range of χ - cursed equilibria denotes:

$$p_{\chi_a=\chi_t} = \begin{cases} \chi_t \cdot q \cdot \frac{1+c}{3} + (1 - \chi_t) \cdot p_{a,s(0,1,c)}^{BNE} : & p_{\chi_t} \leq \bar{v} \\ d : & otherwise \end{cases}$$

Fig. 3 and 4 compare the ranges of constellations q, c, \bar{v} for which acquisitions occur in Bayesian Nash (black), and in a fully Cursed Equilibrium (grey). For $p < c$, a price in Bayesian Nash equilibrium falls outside the definition range of p and for any definition range, falls short of targets' break-even. Hence, Fig. 3 depicts only one grey boundary plane if $p < c$ for the Cursed Equilibrium. All \bar{v} above that plane are acquired in a fully Cursed equilibrium.

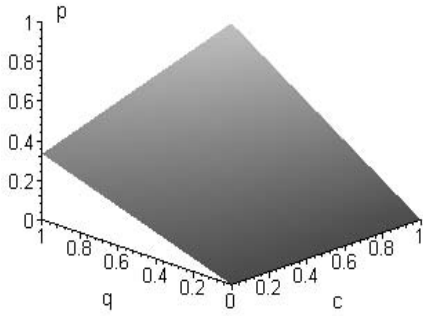


Fig. 3: Acquisitions thresholds in BNE and CE, $p < c$.

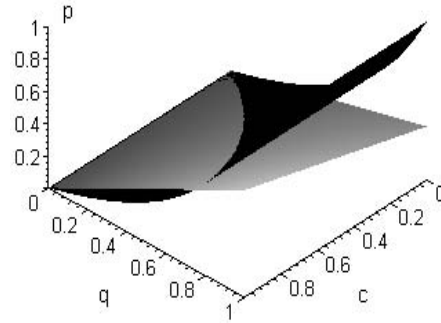


Fig. 4: Acquisition thresholds in BNE and CE, $p > c$.

The area of equilibrium acquisitions shrinks in q and c but more pronouncedly so in c . In extremum, $2/3$ of overall target qualities remain unacquired. Fig. 4 depicts two boundary planes for $p > c$, a black one in Bayesian Nash, a grey one

¹¹The cursed equilibrium requires both players be cursed to the same degree, i.e. $\chi_a = \chi_t$. Here, the potentially cursed party moves *last* - an instance uncovered in (Eyster and Rabin 2005) who merely require the uncursed party to best respond. The concept is not immediately applicable. Either cursedness affects only targets and then acquirers would need to hold a correct belief on targets' χ_t which may be acquired in a repeated setting. Or, both parties are cursed whereas cursedness impacts acquirers' second order beliefs. Cursed acquirers might fail to detect the information they emit via p and hence, fail to detect the information sent to the other party just as the other party ignores it herself. Cursedness was found to be linked with *Neuroticism* and *Extraversion* (Chlaß 2010). If acquirer and target choices can similarly be linked to those traits, this would bespeak that both parties can be cursed.

in Cursed Equilibrium. Curiously, c and q would span a small area for which the black plane lies below the grey one. In a small area, cursedness would hence imply a 'social dilemma' under information asymmetry while perfectly rational self interest does not (Eyster and Rabin 2005).

3 Procedural Aspects of the Game

3.1 Purely Procedural Preferences

Above, I have argued that information asymmetry may cause involuntary¹² deviations from rational self-interest. However, information asymmetry might also cause voluntary deviations from rational self-interest if agents exhibit preferences purely over the fact how a procedure distributes information¹³. Thereby, one can compare the situation of one party to another party with respect to a procedural criterion and express parties' procedural positions relative to one another. The difference in parties' purely procedural positions may be termed as *procedural (a)symmetry*. Thereby, Chlaß et al. (2009) find evidence that individuals care for procedural symmetry.

How does a management buy-in distribute information? Information symmetry as expressed by perfectness in information requires that in each node, each party knows all previous moves. In each of her decision nodes, an acquirer knows all previous moves. Specifically in $T=1$, she knows nature's move \bar{v} from $T=0$. Targets in turn know the acquirer's move in $T=2$, but ignore how nature moved in $T=0$. By informational asymmetry, a management buy-in advantages acquirers relative to targets.

How does a management buy-in define parties' freedom of choice, or moves along each path of play? In a management buy-in, acquirers choose from a continuous set of moves, or offers $p \in [0, 1]$ along each path of play. Targets can only accept or reject, and have only two moves along each path of play, i.e. $\delta \in \{0, 1\}$. Hence, a management buy-in advantages acquirers over targets by granting acquirers more freedom of choice.

¹²If one assumes that no cursed party would intentionally incur a loss.

¹³Such preferences over procedural aspects are purely procedural if they persist even when the procedural aspect does *not* affect the outcome.

How does a management buy-in define parties' freedom of unkind¹⁴ choice, or unkind moves along each path of play? In a management buy-in, acquirers choose from a continuous set of unkind options. Here, acquirers' generic kind actions cover an interval with a lower boundary which shares the expected¹⁵ surplus evenly, and an upper bound of 1. A target in comparison disposes of exactly one unkind action which is to exert her veto. In unkind opportunities, a management buy-out advantages acquirers over targets as in all other procedural criteria. In sum, the game exhibits extreme procedural asymmetry.

Procedural asymmetry may violate *purely procedural preferences* and excite deviations from perfectly rational play. Chlaß et al. (2009) experimentally link players' desire to design symmetric¹⁶ procedures to their moral preferences. These capture individual concepts of what is morally desirable. Kohlberg (1967, 1984) distinguishes three types of moral argumentation, a *preconventional*, a *conventional*, and a *postconventional* concept.

Preconventionally, individuals define what is morally desirable by means of the benefit an outcome yields for the self. Preconventionally, an outcome is the more desirable, the better it is for the self. Conventionally, individuals rely on social expectations or assess intentions behind outcomes to define whether or not an outcome is morally desirable. Conventionally, an outcome is the more desirable, the more it satisfies others' expectations, or the kinder the intentions behind the outcome. Purely procedural preferences were positively linked to only one, the postconventional moral concept. Thereby, individuals would not refer to outcomes but instead, define moral desirability of an outcome by aspects of the outcome generating procedure. A postconventional argumentation would then assess whether these aspects are respect values like freedom, or the respect for other individuals' agreement which postconventionally, are considered to be universally valid. The postconventional concept can be measured in two ways. First, one may elicit the average importance of postconventional arguments to an individual. Second, one may elicit the relative frequency at which postconventional arguments are ranked highly important which is the *P-Score* by Rest

¹⁴Kindness here is defined as in (Dufwenberg and Kirchsteiger 2004).

¹⁵kindness is defined with respect to a social reference. The only means a target can judge an acquirer's kindness by, is an expected equal split

¹⁶No party is advantaged over another in terms of a procedural aspect.

(Rest 1974).

Suppose now, a party holds purely procedural preferences but has no vote to design a procedure such as to even out purely procedural asymmetry. Such a party might start to compensate procedural asymmetry monetarily. How might such a monetary compensation affect behavior in the underlying game? Procedurally advantaged acquirers might add a premium λ to their offers in order to compensate targets for their purely procedural disadvantage. Procedurally disadvantaged targets might accept only acquisition offers which include that very premium.

3.2 Instrumenting Purely Procedural Preferences

In order to see whether individuals who hold purely procedural preferences compensate procedural asymmetry monetarily and thereby countervail a winner's curse, one can either directly elicit purely procedural preferences, or instrument them. A direct elicitation of individuals' purely procedural preferences results in a lengthy experimental task which affects data quality and will always invoke some carry-over effect between the two experimental tasks. Hence, I will exploit the link¹⁷ between moral preferences and purely procedural preferences pointed out in (Chlaß et al. 2009) to *instrument* the former.

A proper instrument must be correlated with the unobserved independent variable of interest, and second, must not otherwise be linked to the observed dependent variable, i.e. acquirers' and targets' *positive* deviations from Bayesian Nash equilibrium¹⁸. Let me first show that there is a correlation between moral and purely procedural preferences. Tables 1 and 2 show how purely procedural preferences correlate with moral preferences¹⁹.

¹⁷which is predicted by evolutionary psychology (Kohlberg 1984) and experimentally found in (Chlaß et al. 2009).

¹⁸These result from higher-than-Nash equilibrium offers and higher-than-Nash equilibrium acceptance thresholds.

¹⁹The dependent variable is whether subjects indeed preferred to even out their own, or another individual's purely procedural disadvantage ($l=1$). Reported are marginal effects of significant determinants from a first experiment where only purely procedural preferences were elicited (Chlaß et al. 2009).

Evening out an own purely procedural disadvantage, n=67, Count $R^2=0.67$

x_i	l	$\partial y/\partial x_i$	σ	z	p
$a1$	1	0.15	0.08	1.75	0.08
$a2 \cdot a3$	1	-0.22	0.08	-2.63	0.01
$Psc.$	1	0.17	0.07	2.44	0.02

Table 1. Moral determinants of evening out an own procedural disadvantage.

Evening out others' purely procedural disadvantage, n=52, Count $R^2=0.71$

x_i	l^*	$\partial y^*/\partial x_i$	σ	z	p
$a2 \cdot a3$	1	-0.23	0.07	-3.44	0.01
$Psc.$	1	0.32	0.06	5.47	0.00

Table 2. Moral determinants of evening out others' procedural disadvantage

Two moral determinants are associated with purely procedural preferences. First, individuals are *less* likely to hold purely procedural preferences if they apply postconventional arguments conditional on conventional arguments, as expressed by the interaction effect $a2 \cdot a3$, instead of considering them separately. Second, individuals were *more* likely to hold purely procedural preferences if they frequently ranked postconventional arguments highly important as captured by a high *P-score*.

Can $a2 \cdot a3$ affect *positive* acquirer and target deviations by a negative link other than the nonexistence of purely procedural preferences? The interaction $a2 \cdot a3$ very nicely illustrates the idea of inequity aversion (Bolton and Ockenfels 2000) or reciprocity (Falk and Fischbacher 2006). These clearly require individuals to assess others' expectations, or others' intentions which are arguments of a conventional type. At the same time, they also involve a comparison of an outcome to a universal principle - the principle of equality - which is of a post-conventional nature²⁰. Now, take an inequity averse acquirer (she scores high on $a2 \cdot a3$). If she wished to fully equalize payoffs, she would offer $p_{ia} = \frac{\bar{v}}{2}(1+q)$. As long as $p_{ia} \leq p^{BNE}$, inequity averse acquirers of any parameter a, b and in particular of smaller b will *decrease* their offers with respect to p^{BNE} since the target value enters an acquirer's payoff via $\bar{v} - p$ while it enters targets' payoffs via $p - q \cdot \bar{v}$. Hence, given $p_{ai} \leq p^{BNE}$, there exists no direct link between $a2 \cdot a3$ and *above-equilibrium offers* other than via purely procedural preferences. The

²⁰If one has linear inequity aversion preferences $x - \text{amax}\{(y-x), 0\} - \text{bmax}\{(x-y), 0\}$ where a and b denote non-negative individual parameters (Fehr and Schmidt 1999), the last two terms capture the player's preferences for equal payoffs. Similarly, reciprocal preferences involve a comparison of what a player believes the other intended to give, and what she believes the other might/should have given

same argument holds for reciprocal preferences: if acquirers' above equilibrium offers could be explained by reciprocal motives, a direct link should be positive²¹. Hence, there is no other *negative* link between above-equilibrium-offers and $a_2 \cdot a_3$ apart from the negative link via the nonexistence of procedural preferences.

For targets, higher than equilibrium thresholds should, if at all, be *positively* linked to inequity-averse and reciprocal motives. As long as $a_2 \cdot a_3$ is *negatively* linked to above-equilibrium thresholds, the link can only be via the *nonexistence* of purely procedural preferences.

Postconventional arguments such as whether or not universal principles like participation and freedom are respected, are unlikely to be linked to outcomes at all other than via the existence of purely procedural preferences. First, postconventional arguments are explicitly defined by aspects of the procedure behind an outcome. Second, all outcome-based opportunistic and social preferences are captured by pre-conventional and conventional arguments, or, an interdependency between conventional and postconventional arguments. Therefore, to analyse deviations from equilibrium, one can instrument purely procedural preferences by the relevance of postconventional arguments.

In summary, moral preferences yield *two* instruments for purely procedural preferences: First, one has $a_2 \cdot a_3$ which links to the nonexistence of purely procedural preferences, and should negatively correlate with above equilibrium behavior of either party. Second, one has the relative frequency at which postconventional arguments are applied, *P-score*, or possibly the overall average importance of postconventional arguments a_3 . These should be positively linked to above-equilibrium behavior on either side. I will use both instruments to check the consistency of my results.

²¹If I believe a target will accept my offer, I believe she will be kind. I reciprocate by making a higher than equal-split offer. Hence $a_2 \cdot a_3$ should be positively linked to above equilibrium offers

4 Experimental Design

I conducted a computerized experiment with altogether 286 undergraduates from the Friedrich-Schiller-University of Jena, randomly drawn from different fields of study. Participants were recruited using ORSEE (Greiner 2004), the experiment was programmed in z-Tree (Fischbacher 2007). At the beginning of each session, participants were randomly seated at visually isolated computer terminals where they received a hardcopy of the German instructions²². Subsequently, participants would answer a control questionnaire to ensure their understanding. The experiment started after all participants had successfully completed the questionnaire.

Each of nine sessions relied on a 3×2 factorial $f(v)$ -between and q -within subjects design with

$$f(v) \in \{u(0, 10), s(0, 10, 0), s(0, 10, 10)\} \quad \text{and}$$

$$q \in \{0.2, 0.6\},$$

varying distributions $f(v)$, skewness c , and common-value parameter q . First, subjects' risk preferences were elicited using trade-offs between lotteries (Wakker and Deneffe 1996). Second, subjects would answer a control questionnaire on the game. Each subject was then randomly assigned acquirer or target for the entire experiment. Subsequently, subjects underwent one cycle of 10 rounds per q constellation. In each round, subjects were randomly matched with another subject of their group. Subjects received feedback on the respective round, but not on their cumulative overall earnings which were revealed only at the very end. A session was partitioned into two matching groups resulting in six matching groups per treatment. Each matching group consisted of 16^{23} subjects. To reveal a potential ordering effect, three of overall six matching groups per treatment experienced the $q = 0.2$ cycle first while three started out with $q = 0.6$.

Finally, subjects would answer two questionnaires, the moral judgment test (MJT) by Lind (1987, 2008), and the Eysenck personality questionnaire (EPQ-R) by Ruch (1999). The first elicits moral conceptions by which I shall proxy

²²Instructions are available from the author upon request.

²³Except for one with only 14 due to no-show-ups.

the importance subjects attribute to purely procedural aspects. Details on the MJT and its analysis can be found in (Lind 2008) and (Chlaß et al. 2009). The EPQ-R in turn shall proxy cursedness. It consists of negatively or positively coded German questions, each related to one Eysenckian personality trait. Subjects received a fixed compensation of €5 for answering both questionnaires.

I simplify²⁴ the game by setting mode c at the lower or upper boundary of an intuitive interval $[a, b] = [0, 10]$. Thus, $s(a, b, c)$ simplifies to $s(0, 10, 0) = 0.2 - 0.02 \cdot v$ and $s(0, 10, 10) = 0.02 \cdot v$, respectively. The impact of information asymmetry is separated from the effect skewness produces by adding a scenario $f(v) = u(0, 10)$ where each quality arises equally likely. Let me review the predictions for each treatment:²⁵

PREDICTION 1. For $f(v) = u(0, 10)$, acquisitions occur in Bayesian Nash equilibrium at $p_{u(0,10)}^{BNE} = \frac{10q}{2-q}$ iff $p_{u(0,10)}^{BNE} \leq \bar{v}$. Acquisitions occur in Cursed equilibrium at $p_{u(0,10)}^{CE} = \chi \cdot 5q + (1 - \chi) \cdot \frac{10q}{2-q}$ iff $p_{u(0,10)}^{CE} \leq \bar{v}$.

PREDICTION 2. For $f(v) = s(0, 10, 0)$, acquisitions occur in Bayesian Nash equilibrium at $p_{s(0,10,0)}^{BNE} = \frac{-10 \cdot q}{-3+2q}$ iff $p_{s(0,10,0)}^{BNE} \leq \bar{v}$, acquisitions in a Cursed equilibrium at $p_{s(0,10,0)}^{CE} = \chi \cdot q \frac{10}{3} + (1 - \chi) \cdot \frac{-10 \cdot q}{-3+2q}$ iff $p_{s(0,10,0)}^{CE} \leq \bar{v}$.

PREDICTION 3. For $f(v) = s(0, 10, 10)$, acquisitions occur in Bayesian Nash equilibrium at $p_{s(0,10,10)}^{BNE} = \frac{1}{2} \frac{30-20q-10\sqrt{9+12q-12q^2}}{-3+2q}$ iff $p_{s(0,10,10)}^{BNE} \leq \bar{v}$. Acquisitions occur in Cursed equilibrium at $p_{s(0,10,10)}^{CE} = \chi \cdot \frac{20q}{3} + (1 - \chi) \cdot \frac{1}{2} \frac{30-20q-10\sqrt{9+12q-12q^2}}{-3+2q}$ iff $p_{s(0,10,10)}^{CE} \leq \bar{v}$.

5 Results

5.1 Descriptives

Fig. 5 and 6 depict offer densities²⁶ p for all $f(v)$ and q . There are two equally marked densities for each $\{f(v), q\}$ constellation. A first displays overall offers,

²⁴Any discrete formulation (Charness and Levin 2009) of a triangular distribution would make a pooled equilibrium exist for certain \bar{v} which cannot be distinguished from actual equilibrium deviations. The pooled equilibrium varies with random draw \bar{v} . Hence, I do not simplify by discretizing qualities.

²⁵Appendix B derives solutions for $f(v) \sim u(0, 10)$, $f(v) \sim s(0, 10, 0)$ and $f(v) \sim s(0, 10, 10)$.

²⁶Bandwidth is obtained using Silverman's rule of thumb (Silverman 1986, p.48)

a second depicts offers conditional on $q \cdot E(v) \leq \bar{v}$ which states that acquisitions be of mutual benefit and in parties' rational self-interest. Two vertical lines depict the acquisition offers targets accept in fully Cursed and in Bayesian Nash equilibrium. In between, we find all partially cursed equilibria with $\chi \in]0, 1[$.

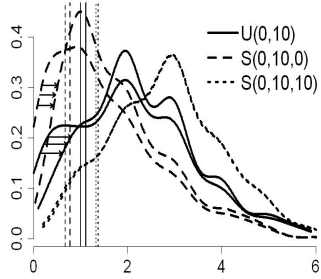


Fig. 5: Offer densities $q = 0.2$.

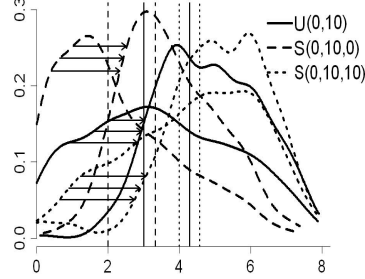


Fig. 6: Offer densities $q = 0.6$.

Offer densities peak in the same order as Bayesian Nash offers which imply acquisitions (case 2) predict. If acquirers break even in Bayesian Nash equilibrium, offers are higher and densities shift rightward. Offers distinctly exceed the Bayesian Nash offer where acquisitions yield a large surplus which holds for low q and negatively skewed qualities, i.e. large c . Here, if mutually beneficial acquisitions are possible, offers shift even further beyond the equilibrium.

In contrast, offers fall close to a cursed equilibrium when acquisitions yield little surplus as for high q and positively skewed qualities, i.e. low c . Here, if mutually beneficial acquisitions are possible, offers shift toward a Bayesian Nash offer which yields acquisitions. In sum, acquirers deviate the more from rational self-interest, the more surplus an acquisitions implies²⁷. Hence, offers may depend on target quality \bar{v} , as if acquirers intended to share the surplus.

Fig. 7 and 8 depict overall offers as compared to accepted offers. Of two equally marked densities, the first depicts overall, the second accepted offers. If acquisitions imply a large surplus as for low q and high c , targets successfully discipline offers below their expected break-even (the Bayesian Nash offer in case 2).

²⁷The surplus is determined by q, c , and \bar{v} .

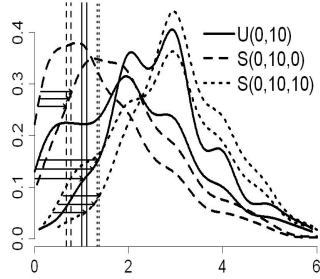


Fig. 7: Accepted offer densities
 $q = 0.2$.

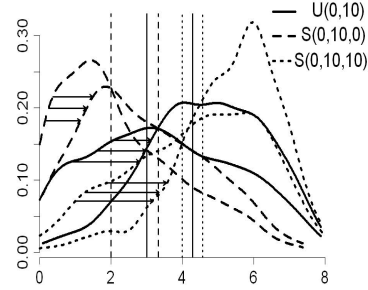


Fig. 8: Accepted offer densities
 $q = 0.6$

However, target veto shifts offers far beyond targets' break-even which hints at market inefficiencies. If acquisitions imply little surplus as denoted by high q , targets fail to fully discipline offers below their break-even. On markets of positively skewed qualities $c = 0$ which yield least surplus, targets merely veto offers into a fully Cursed equilibrium. Note that even acceptances of offers below a fully Cursed Equilibrium occur. In absence of skewness, targets shift offers near their break-even. For negatively skewed qualities $c = 10$, most targets veto offers beyond their break-even while some still incur losses. In sum, targets may drive the efficiency loss far beyond the efficiency loss rational self interest predicts. At the same time, veto does not fully preclude a winner's curse when acquisitions yield little surplus.

Table 3 displays average offers, average profits, and market efficiency for all q and $f(v)$. Thereby, *impass* denotes the share of unsuccessful acquisitions, *wc* the number of acquisitions where targets incur a loss, and *mbt* the share of mutually beneficial acquisitions.

$f(v)$	q	\bar{p}	$\bar{\pi}_a$	$\bar{\pi}_t$	<i>impass</i>	<i>wc</i>	<i>mbt</i>
$v \sim U(0, 10)$	q=0.2	2.08 (1.70)	3.90 (3.32)	1.41 (0.71)	0.40	0.01	0.59
	q=0.6	3.45 (4.09)	2.11 (1.05)	0.59 (0.45)	0.44	0.07	0.49
$v \sim S(0, 10, 0)$	q=0.2	1.51 (1.35)	2.48 (2.65)	1.04 (0.66)	0.34	0.01	0.65
	q=0.6	2.24 (2.83)	1.39 (1.07)	0.33 (0.40)	0.44	0.08	0.48
$v \sim S(0, 10, 10)$	q=0.2	2.79 (1.42)	4.04 (2.54)	1.69 (0.74)	0.24	0.01	0.75
	q=0.6	4.32 (3.27)	2.41 (1.37)	0.64 (0.76)	0.41	0.08	0.51

Table 3: Market efficiency and distribution of welfare per treatment in ECU.

Average offers react to q as derived in equilibrium. They react least under positive skewness $c = 0$, intermediately in absence of skewness, and most under negative skewness $c = 10$. Acquirers' information advantage goes along with a payoff advantage over targets. Contrary to the *management buy-out* where some 24% to 27% of interactions imply a winner's curse and some 41% are vetoed ²⁸ (Valley et al. 1998) we do not observe much of a winner's curse. *Management buy-ins* show invariably high veto rates for all q and hence, overall strong inefficiency. Despite, we find rational self interest an overall powerful benchmark whose conjectures hold ordinally. But let us see whether this is indeed out of rational self-interest, or for some other reason.

5.2 Acquirer Deviations from Rational Self-Interest

Ordinally, overall behavior seems in line with rational self-interest. At the same time, cardinal deviations arise which vary systematically. Here, I will try to shed light on the logic of these deviations. Thereby, dynamics unfold which support the same ordinal pattern as rational self-interest.

Let me define how an acquirer may deviate from rational self-interest. She deviates iff under equilibrium condition $q \cdot E(v|v \geq p) < \bar{v}$, she states $p \neq q \cdot E(v|v > p)$. If an acquirer wished to compensate purely procedural asymmetry by adding a premium to the equilibrium offer, she would deviate by $p > q \cdot E(v|v > p)$ iff $q \cdot E(v|v \geq p) < \bar{v}$. If an acquirer was cursed and ignored the information emitted by her offer²⁹, she would deviate by $p < q \cdot E(v|v > p)$ iff $q \cdot E(v|v \geq p) < \bar{v}$.

Deviations were clustered based on Euclidian distance³⁰ by Ward's minimum variance technique such as to obtain both similarly sized and homogeneous classes (Ward 1963). Subsequently, classes of deviations were modelled via an ordered mixed effects logit model. Here, I present a version of three classes³¹

²⁸In acquiring-a-company, $q = 0.5$ delimits mutually beneficial trade. Veto and winner's curse rates should furthermore increase for $q = 0.6$ as implemented here.

²⁹This amounts to the case in cursed equilibrium where $\chi_a = \chi_t$. Thereby, cursedness would not only affect the range of acquisitions, but also the price.

³⁰Deviations cannot be modelled continuously since within an interval around zero, deviations are merely noise as confirmed by classification performance.

³¹For any number of classes, predictors show the same impact in sign and significance given sufficient class size. Naturally, classification performance varies.

$l_a = (0, 1, 2)$ where $l_a = 0$ has mean deviation -0.68, $l_a = 1$ mean deviation 0.55, and $l_a = 2$ mean deviation 2.13. Within each class, all predictors x_d listed in table 4 could exhibit fixed effects $\hat{\beta}_d$. A random effect was specified on the individual level (*ID*). The model produces an overall Count R^2 of 47% which varies throughout l_a . For $l_a = 0$ the model classifies 39% of $n_{l_a=0} = 488$ observations correctly, for $l_a = 1$, 29% of $n_{l_a=1} = 630$ observations, respectively. For $l_a = 2$, a class of strong excess equilibrium offers with $n_{l_a=2} = 946$, 62% of all deviations are classified correctly. Table 4 provides obtained fixed effects, their standard errors, z-statistics, and p-values. All random variables were z-standardized to even out differences in scaling³². Individuals switch classes at highly significant thresholds $\tau_{01} = -1.74$ and $\tau_{12} = 0.28$.

x_d	$\hat{\beta}_d$	Std. Error	z-Value	p-Value
$a1 \cdot \bar{v}$	1.36	0.15	9.18	0.00
$a2 \cdot a3 \cdot \bar{v}$	-1.25	0.13	-9.77	0.00
$a3 \cdot Psc. \cdot \bar{v}$	1.71	0.23	7.51	0.00
N	-0.24	0.08	-2.93	0.01
<i>Period</i>	0.03	0.01	3.59	0.00

Table 4. Acquirer deviations

The complete proxy for purely procedural preferences of evening out others' disadvantage in (Chlaß et al. 2009) had two components, $a2 \cdot a3$, and *P-score*. The first rendered a subject less likely to hold purely procedural preferences, the second rendered purely procedural preferences likelier. Thereby, decisions were one-shot and pie size was fixed.

Here, interaction $a2 \cdot a3$ has a negative sign. The higher an acquirer scores in $a2 \cdot a3$, the more likely she will show a deviation from a class with a smaller mean. Classes were ordered from negative to positive, and hence, we would expect such an individual to offer less than the mutually beneficial equilibrium offer. Interaction $a2 \cdot a3$ was negatively associated with purely procedural preferences. Hence, individuals for whom the instrument indicates procedural indifference make offers short of equilibrium.

Postconventional moral preferences $a3$ show a positive impact. The higher

³²Hence, *Period* is the only predictor that needs to be multiplied by its range within [1, 20].

an acquirer scores here, the more likely she shows a deviation from a class with a higher mean. That is, she would more likely make an offer which is higher than the equilibrium offer. Postconventional preferences $a3$ were positively linked to purely procedural preferences. Hence, individuals with purely procedural preferences tend to make offers above the equilibrium offer. The impact of either moral preference depends on the level of \bar{v} which rules the implied surplus, or 'pie size'. The larger \bar{v} , the larger the resulting deviation. Finally, outcome-based pre-conventional moral preferences $a1$ shift probability mass toward positive deviations, i.e. larger excess equilibrium offers. Hence, a concern about the own payoff seems to result in higher offers³³.

RESULT 1. Acquirers whose moral preferences imply *purely* procedural preferences tend to make significantly higher offers than procedurally indifferent acquirers.

The only predictor which has a positive correlation with the winner's curse is N , personality trait *Neuroticism* first linked to the curse in (Chlaß 2010). Load on Neuroticism makes an acquirer more likely to show a deviation from a class of a lower mean. Hence, she is more likely to make an offer smaller than the equilibrium offer. If I could tie targets' cursedness to the same trait below, acquirers might indeed be cursed via their second order beliefs in that they do not perceive the information emitted by an offer. Finally, higher than equilibrium offers become even more likely in time since *Period* has a positive sign. Risk preferences do not affect deviations³⁴.

RESULT 2. Load on personality trait *Neuroticism* which links to cursedness, significantly decreases offers.

In sum, we find *postconventional preferences* to noticeably increase offers beyond an equilibrium offer of rational self-interest. The increase would depend on target quality \bar{v} or the 'pie size' which parties negotiate. Since postconventional moral preferences imply the existence of preferences over purely procedural aspects, the result is in line with a desire to compensate *purely procedural asymmetries*. Let us now try to see why, given these empirical motivations,

³³Preconventional moral preferences did not proxy purely procedural preferences.

³⁴Risk preferences were expressed by individuals' elicited certainty equivalents.

offer behaviour was so close to rational self-interest. On average, or better, on expectation, target quality or 'pie size' \bar{v} increases from $f(v) = s(0, 10, 0)$ over $f(v) = u(0, 10)$ to $f(v) = s(0, 10, 10)$ since v increases in expectation. For the same reason, Bayesian Nash equilibria increased through these treatments. If compensation increases in \bar{v} as my results indicate, one would observe the same pattern as rational self-interest predicts. Such instances provoke many a vivid debate on behavioral economics (Smith 1994). Here, we might have some insight in the dynamics behind such a phenomenon.

RESULT 3. The empirical motivations behind acquirer offers support the same ordinal empirical pattern as rational self interest does.

5.3 Target Deviations from Rational Self-Interest

Let us see how purely procedural preferences and personality traits determine target deviations. A target deviates iff she accepts mutually nonbeneficial offers, i.e. $\delta_t = 1$ for $p < q \cdot E(v|v > p)$. She also deviates iff she vetos mutually beneficial offers, i.e. $\delta_t = 0$ for $p \geq q \cdot E(v|v > p)$.

If a target preferred procedural symmetry and required compensation λ for her procedural disadvantage, her acceptance threshold is $\underline{p}_{asymm.} = \underline{p}_{symm.} + \lambda$. Thereby, individual acceptance thresholds will fall less likelier below the equilibrium threshold $\underline{p}_{BNE} = q \cdot E(v|v > p)$. Hence, acceptances of nonprofitable offers become less likelier by the extent to which procedural asymmetry matters individually. If personality traits in turn were indeed to proxy cursedness, the likelihood of accepting nonbeneficial offers, i.e. $\delta_t = 1$ for $p < q \cdot E(v|v > p)$, should increase in an individual's load on this trait.

Thereby, acquisition offers naturally censor target deviations. A target can only deviate to the extent an offer allows her to. To sidestep this, I only compare targets who were given a similar chance to deviate³⁵. Acquisition offers who differ similarly from equilibrium are merged into clusters. Hence, each cluster includes similarly censored (non)-deviations. In cluster j , a target who deviates is assigned class $l_t^j = 1 \leftrightarrow y_{ij} = 1$, a target who does not deviate is assigned class $l_t^j = 0 \leftrightarrow y_{ij} = 0$, respectively. Thus obtained class-affiliation is modeled

³⁵In short, I balance treatment assignment 'can deviate by amount x ' by a degenerate propensity score (Rosenbaum and Rubin 1983).

via a mixed effects logit model. Since for deviations $\delta_t = 0$ for $p \geq q \cdot E(v|v > p)$ it turns very difficult to get similarly sized classes, I only present deviations of the cursed type $\delta_t = 1$ for $p < q \cdot E(v|v > p)$ which fully serves my main purpose. All listed predictors could exhibit fixed effects. An additional random effect $\hat{\psi}_{id}$ was specified on the individual level (*ID*).

<i>j</i>	<i>n</i>	x_d	$\hat{\beta}_d$	σ	t	$ p > z$	$\hat{\psi}_{id}$	Count	R^2
1	367	<i>Intercept</i>	-2.71	0.51	-5.33	0.00	5.98		
		<i>a3 · Psc. · Period</i>	-0.82	0.33	-2.48	0.02	(-)		
		<i>a2 · a3</i>	0.57	0.21	2.69	0.01	(-)		0.71
		<i>Ex</i>	0.52	0.24	2.18	0.03	(-)		
2	333	<i>Intercept</i>	-0.96	0.29	-3.37	0.01	4.43		
		<i>a3 · Psc. · Period, f(v)=S(0,10,0)</i>	-0.73	0.26	-2.78	0.01	(-)		
		<i>a3 · Psc. · Period, f(v)=S(0,10,10)</i>	-0.64	0.25	-2.59	0.01	(-)		0.54
		<i>a2 · a3</i>	0.30	0.23	1.29	0.20	(-)		
		<i>Ex</i>	0.59	0.26	2.25	0.03	(-)		
3	525	<i>Intercept</i>	-0.36	0.13	-2.86	0.01	0.77		
		<i>a3 · Psc. · Period</i>	-0.30	0.12	-2.52	0.02	(-)		0.53
		<i>a2 · a3</i>	0.32	0.15	2.19	0.03	(-)		

Table 5. Negative target deviations

Group $j=1$ has mean potential deviation -3.03 ($\sigma = 0.59$), group $j=2$ mean potential deviation -1.54 ($\sigma = 0.35$), group $j=2$ mean potential deviation -0.45 ($\sigma = 0.25$). Table 5 displays marginal effects, their standard-errors, z-statistics, p-values, variances of random components, and the fraction of correctly classified deviations.

Again, I start with the interaction of postconventional and conventional preferences $a2 \cdot a3$ which was negatively linked to purely procedural preferences (Chlaß et al. 2009). In line therewith, targets who score high in $a2 \cdot a3$ are more likely to accept nonbeneficial offers. Hence, targets who are less likely to hold purely procedural preferences, incur a strong winner’s curse. Let me turn to the second instrument. For all groups j , interactions between postconventional moral preferences $a3$ and the *P-score* make the acceptance of nonbeneficial offers less likely. In all groups, the impact of this interaction depends on *Period*. That is, acquirer offers much smaller than equilibrium are considered increasingly unacceptable with time. In sum, if the instrument implies that targets hold purely procedural preferences, targets are less likely to experience a winner’s curse.

RESULT 4. Targets whose moral preferences imply *purely* procedural preferences are less likely to accept nonbeneficial offers than are other targets.

Again, personality traits are the only variables which are positively linked to the winner’s curse which is in line with (Chlaß 2010). One is *Extraversion*, the other *Neuroticism*, which also explained curse-like behavior on the acquirer side. Neuroticism only shows if we split $j = 1$ into two subclusters. The degree to which accepted offers are nonbeneficial translates into a target’s cursedness (Eyster and Rabin 2005). *Extraversion* would then support severest and small degrees of cursedness. *Neuroticism* in turn only explains intermediate degrees of cursedness. Neither personality trait would apply to group $j=3$ where targets are given a chance to deviate negligibly from perfectly rational self-interest. Slight deviations may hence simply reflect target mistakes. Once more, risk attitudes would not exert a significant impact.

RESULT 5. Target cursedness and acquirer offers short of equilibrium both link to *Neuroticism*. Since these deviations arise from the same source, acquirers might be ‘cursed’ as well and offers in Cursed equilibrium may depend on acquirers’ degree of cursedness.

6 Conclusion

In this paper, I set the acquiring-a-company game (Bazerman and Samuelson 1983) for the case of a so-called *management-buy-in*. In a *management-buy-in*, ownership of a target company typically devolves from its owner to a more experienced external management. Thereby, the acquirer holds private information on the target quality. Mostly, *management-buy-ins* occur on markets where qualities are skewedly distributed. In the game, skewness parameter c and parties’ difference in target valuation rule the extent of the social dilemma under information asymmetry (Akerlof 1970).

The resulting game exhibits extreme procedural asymmetry. It grants acquirers a procedural advantage over targets in several *purely procedural criteria* (Chlaß et al. 2009). First, acquirers can choose from a larger set of moves than targets, and therefore, acquirers have more freedom of choice. Second, acquirers can choose from a larger set of kind actions and have a greater freedom of kind

choices. Third, acquirers hold an information advantage over targets. Recently, individuals have been found to prefer procedures who treat parties symmetrically. Here, I test how such purely procedural concerns affect behavior when parties are subject to a very asymmetric procedure which they cannot exit or modify. Thereby, I use *moral preferences* to instrument purely procedural preferences (Chlaß et al. 2009).

If the instrument implies an *acquirer* to hold purely procedural concerns, the acquirer offers significantly more than the equilibrium offer. If the instrument implies a *target* to hold purely procedural preferences, the target is significantly more reluctant to accept nonprofitable offers. Consequently, we observe only a small share of winner's curse interactions.

The residual winner's curse is tied to *personality traits* (Eysenck 1967, 1990) as found in (Chlaß 2010). Severest and light degrees of target cursedness link to *Extraversion*, intermediate degrees to *Neuroticism*. Thereby, *Neuroticism* also explains acquirer offers short of equilibrium. Could the informationally advantaged party display symptoms of cursedness? I argue that if a cursed party ignores information in players' actions (Eyster and Rabin 2005), a cursed acquirer may be as ignorant of the signal her offer emits as a cursed target is. Consequently, she would expect a cursed target to accept nonbeneficial offers.

In sum, I present a game of a very asymmetric structure and perform a detailed analysis of deviations from equilibrium. I tie deviations from rational self-interest to *individual moral judgment*, and *personality traits*. The first serve as an instrument for *purely procedural preferences* from (Chlaß et al. 2009). The second correlate with winner's curse phenomena. Thereby, I find that the mere rules of a game take an effect on individual behavior. Here, the effect is such that essentially no winner's curse arises under information asymmetry.

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Appendix

A. Bayesian Nash Equilibrium - $f(v) = s(0, 1, c)$.

Establishing $q \cdot E(v|v \geq p)$ requires to establish $E(v|v \geq p)$ for distribution $f(v) = s(0, 1, c)$. A triangular distribution with lower bound a , upper bound b and mode c writes

$$f(v|a, b, c) = \begin{cases} f_1 := \frac{2(v-a)}{(b-a)(c-a)} : & a \leq v \leq c \\ f_2 := \frac{2(b-v)}{(b-a)(b-c)} : & c \leq v \leq b \\ 0 : & \text{otherwise.} \end{cases}$$

Conditioning the distribution on $v > p$ yields $f(v|v > p) = I_{v \in [p, b]} \frac{f(v)}{P(v > p)}$ where P denotes probability and I an indicator function taking on a value of one if the subscripted condition holds, and zero otherwise. Thereby:

$$P(v > p) = \begin{cases} \int_p^c f_1(v)dv + \int_c^b f_2(v)dv : & p < c \\ \int_p^b f_2(v)dv : & p > c. \end{cases}$$

The conditional expected value hence writes:

$$E(v|v > p) = \begin{cases} \frac{\int_p^c v f_1(v)dv + \int_c^b v f_2(v)dv}{\int_p^c f_1(v)dv + \int_c^b f_2(v)dv} : & p < c \\ \frac{\int_p^b v f_2(v)dv}{\int_p^b f_2(v)dv} : & p > c. \end{cases}$$

Setting $a = 0$, $b = 1$, $c = c$, we find $\int_p^c f_1(v)dv = c - p^2 c^{-1}$, $\int_c^b f_2(v)dv = 1 - c$, $\int_p^c v f_1(v)dv = -2(3c)^{-1}p^3 + 2/3c^2$, $\int_c^b v f_2(v)dv = (3 - 3c)^{-1} - (c^2 - 2/3c^3)(1 - c)^{-1}$, $\int_p^b v f_2(v)dv = (3 - 3c)^{-1} - p^2(1 - c)^{-1} + 2p^3(3 - 3c)^{-1}$, $\int_p^b f_2(v)dv = (1 - p)^2(1 - c)^{-1}$. Hence,

$$E(v|v > p) = \begin{cases} \frac{\frac{2}{3}p^3 - p^2 + \frac{1}{3}}{(1-p)^2} : & p > c \\ \frac{-\frac{2}{3c}p^3 + \frac{2}{3}c^2 + \frac{\frac{2}{3}c^3 - c^2 + \frac{1}{3}}{1-c}}{1 - \frac{p^2}{c}} : & p < c. \end{cases}$$

A rational self-interested acquirer will make the minimal offer a rational self-interested target accepts, i.e. $\Pi_t^0 = p - q \cdot E(v|v > p) = 0$. This holds for:³⁶

$$p_{\Pi_t^0} = \begin{cases} \frac{1}{2} \cdot \frac{4^{1/3} \cdot \Xi^{1/3}}{-3+2q} - \frac{1}{2} \frac{c \cdot 4^{2/3}}{\Xi^{1/3}} : & p < c \\ -\frac{q}{-3+2 \cdot q} : & p > c. \end{cases}$$

A rational self interested acquirer would only offer $p_{\Pi_t^0}$ given nonnegativity in her own profits, i.e. iff $p_{\Pi_t^0} < \bar{v}$.

B. Bayesian Nash Equilibria - Experimental Conditions.

f(v)=s(0,10,0). For $f(v) = s(0, 10, 0)$, $f(v) = 0.2 - 0.02v$ for $v \in [0, 10]$ since p will always exceed or equal c . Hence:

$$E(v|v > p) = \frac{\int_p^{10} v(0.2 - 0.02v)dv}{\int_p^{10} (0.2 - 0.02v)dv} = \frac{\frac{2}{300}p^3 - \frac{1}{10}p^2 + \frac{10}{3}}{\frac{1}{100}p^2 - \frac{1}{5}p + 1}.$$

In this case, $\Pi_t^0 = p - q \cdot E(v|v > p) = 0$ implies $p_{\Pi_t^0} \in \{10, -10\frac{q}{-3+2q}\}$ iff $p_{\Pi_t^0} \leq \bar{v}$.

f(v)=s(0,10,10). For $f(v) = s(0, 10, 10)$, $f(v) = 0.02v$ for $v \in [0, 10]$. Here,

$$E(v|v > p) = \frac{\int_p^{10} 0.02v^2 dv}{\int_p^{10} 0.02v dv} = \frac{\frac{20}{3} - \frac{2}{300}p^3}{1 - \frac{1}{100}p^2}$$

In this case, $\Pi_t^0 = p - q \cdot E(v|v > p) = 0$ implies $p_{1,2,\Pi_t^0} = \frac{1}{2} \frac{30-20q \pm 10\sqrt{9+12q-12q^2}}{-3+2q}$ iff $p_{1,2,\Pi_t^0} \leq \bar{v}$.

f(v)=u(0,10). For $f(v) = u(0, 10)$, $E(v|v > p) = \frac{p+10}{2}$. In this case, $\Pi_t^0 = p - q \cdot E(v|v > p) = 0$ is satisfied by $p_{\Pi_t^0} = \frac{10q}{2-q}$ iff $p_{\Pi_t^0} \leq \bar{v}$.

³⁶ $\Xi := c \left(qc + q + \sqrt{(4c + 2q^3c^2 - 3q^2c^2 + 4q^3c - 6q^2c + 2q^3 - 3q^2)(-3 + 2q)^{-1}} \right) (-3 + 2q)^2$