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Fairness in Bargaining and Markets

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*I dedicate this book to my beautiful wife,
Karolina. Thank you for your infinite
patience, understanding, support, and, most
importantly, unending love.*

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Symbols

\mathbb{N}	set of natural numbers
\mathbb{R}	set of real numbers
\mathbb{R}_+	set of non-negative real numbers
$x \geq y$	$(\forall i \in I): x_i \geq y_i$
$x \geq y$	$x \geq y$ and $(\exists i \in I): x_i > y_i$
$x > y$	$(\forall i \in I): x_i > y_i$
$(x)^+$	$\max\{0, x\}$
a, b	constants
a_i	strategy chosen by player i
b	share of buyers given by $B/(B+S)$
b_i	belief of player j about the strategy a_i chosen by player i
\tilde{b}	share of buyers for which $p^* = p_{\text{ref}}$
c	offer in the ultimatum or dictator game / a constant
$c(\cdot)$	offer in the ultimatum or dictator game
$c^*(\cdot)$	equilibrium offer in the ultimatum or dictator game
c_i	(second-order) belief of player i about b_i
$c(e)$	cost function of effort
e	effort decision
$f(\cdot)$	some (unspecified) function
$\tilde{f}_j(\cdot)$	kindness term: kindness player i experiences
$f_i(\cdot)$	reciprocation term: player i 's reaction to player j 's expected behavior
i, j	a player
k	role of player: proposer ($k = X$) or responder ($k = Y$)
k_i	exogenous sensitivity of player i to a relevant norm
n	number of players / a node in the game tree / a natural number
o	a deterministic bargaining outcome
p	price / units of a divisible good
p^*	equilibrium price / acceptance probability in equilibrium
p^{**}	equilibrium price in the limit of $\delta \rightarrow 1$
p^\dagger	equilibrium price for standard preferences without fairness concern

p°	equilibrium price for preferences without fairness concern for $\delta \rightarrow 1$
$p_B(t), p_S(t)$	price offered by a buyer/seller that is selected to make an offer
p_{ref}	exogenous reference price
\underline{p}, \bar{p}	lower/upper bound of intermediate case for p^* (see equation 5.6)
$p(c, \rho_R)$	acceptance probability for offer c in a ultimatum game by responder R
s_i	strategy of player i
\hat{s}	a strategy in the preference game $\hat{\Gamma}$ (a preference)
\mathbf{s}	a strategy profile
\mathbf{s}_{-i}	a strategy profile of players other than player i
$\hat{\mathbf{s}}$	a preference profile
t	time or period index / terminal node / test statistic of an OLS regression
$u(\cdot)$	(social) utility function
$u_i(x^i)$	immediate utility of player i of goods x^i
$u_i(x, t)$	immediate utility of player i of share x in period t
$u_i(\omega)$	utility of player i at end node ω of a game tree
$u_i^k(\cdot)$	utility of player i in the role k
x	price offer in an ultimatum game
x^i	player i 's amount of goods
\bar{x}^i	endowment of player i
x_i	amount of good i / market length of market number i
x_j^i	player i 's amount of good j
\bar{x}_j^i	endowment of player i of perfectly divisible good j
z	test statistic of a Probit regression
B	amount of buyers
F	bargaining solution
F^N	Nash bargaining solution
$F_X(t)$	distribution function of the exponential distribution
I	set of players
\mathbf{L}_{-i}	subset of strategy profiles \mathbf{S}_{-i} for which a social norm exists
M	pie size or maximum price
N_i	fair price the proposer ought to offer according to the norm of player i
P	a population
\bar{P}	an upper bound
R	a behavioral rule
R_i	a behavioral rule or norm for player i
$R_{i,j}$	player j 's belief about R_i
S	amount of sellers / set of strategy profiles
S_i	strategy set of player i
\hat{S}	set of feasible preference outcomes in Γ
\mathbf{S}_{-i}	set of strategy profiles of players other than player i
$\hat{\mathbf{T}}$	a set of stable preference strategies \hat{s} in $\hat{\Gamma}$
$V_B(t), V_S(t)$	utility of an unmatched buyer/seller at the beginning of period t
\mathcal{B}	set of bargaining problems
\mathcal{N}	set of nodes of the game tree
\mathcal{N}_i	set of nodes at which player i has to move

\mathcal{O}	set of bargaining outcomes
\mathcal{S}	set of situation types
\mathcal{T}	set of terminal nodes
\mathcal{U}	set of all feasible payoff combinations
α_i, β_i	exogenous (fairness) parameters of player i
β	a regression variable
$\hat{\beta}$	regression coefficient for regression variable β
δ_i	discount factor of player i
ε	tolerable gap between between p_{ref} and p^*
ε_i	pure outcome concern parameter of player i
ε_i^k	pure outcome concern parameter of player i in role k
ε_l	exogenous lower bound for parameter ε
λ	exogenous probability or share
μ	a mapping from preference profiles \hat{s} to equilibrium strategy profiles s
$v(n, t)$	successor of node $n \in \mathcal{N}$ on the path to a terminal node $t \in \mathcal{T}$
ω	end node of a game tree
$\pi_i(\cdot)$	expected material payoff to player i
$\hat{\pi}(\cdot)$	payoff function in higher-level preference game $\hat{\Gamma}$
ρ_i	reciprocity parameter of player i
ρ_i^k	reciprocity parameter of player i in role k
σ_β	standard errors of individual regression coefficients for β
$\tau(v)$	strictly increasing affine transformation of payoffs
ϑ	probability that a potential match is formed
$\vartheta_j(n)$	intention factor for player j in a node $n \in \mathcal{N}_i$
v	payoff combination selected from \mathcal{U} by outcome o
v^D	disagreement point or status quo point
$\Delta_j(n)$	outcome term for player j in a node $n \in \mathcal{N}_i$
Γ	a game / the “game of life”
$\hat{\Gamma}$	a higher-level preference game
$\Omega(\cdot)$	degree of attributed intention
$\Pi_i(n)$	set of payoff combinations at node $n \in \mathcal{N}_i$

Introduction

This book focuses on economic bargaining theory. Economic bargaining theory seeks to predict the outcomes of *bargaining situations*. In such situations, governments, firms, or individuals share a mutual interest in cooperation; however, they also have conflicting interests regarding the terms of an agreement. A classic example of such a situation is wage bargaining between unions and employers. More commonplace examples also exist. For instance, a discussion between partners on how to spend an evening can be understood as a bargaining situation.

Economic bargaining theory explores the relationship between bargaining situations and the outcomes of the bargaining. Economists have two primary reasons to show interest in this relationship. The first reason is that many important human interactions, including economic interactions, are bargaining situations. The second reason is that the understanding of these situations may inform the economic theory of markets.

The tool utilized in this study is the mathematical theory of games. Predictions for bargaining outcomes are developed by modeling the bargaining situation as a strategic game and using game-theoretic equilibrium concepts in order to solve the game. In this approach, the specific identified bargaining outcome depends on the *assumptions* underlying the model. The neoclassical and fundamental assumption is that of rational agents—called *economic men*—who strive to maximize their utility based on stable preferences.

Over the last few decades, a new branch of economics has emerged: experimental economics. Experimental economics investigates human economic behavior in laboratory studies. In these studies, subjects are incentivized with real monetary payoffs. For many decision situations, including bargaining situations, human behavior observed in the laboratory contradicted predictions of neoclassical economic models which were based on purely self-concerned and materialistic preferences. This led some behavioral economists to develop behavioral models which seek to integrate insights from psychology, sociology, and anthropology into neoclassical economics.

This book is a contribution to this kind of behavioral economic research. It develops new insights into the implications of *social fairness norms*. It is based on

game-theoretic analysis and supports the view that a *preference for reciprocity* is evolutionarily stable in a “game of life” that consists of bilateral bargaining situations. Such a preference depends on a fairness benchmark or reference. This dependence is addressed by a classroom experiment in which the following hypothesis is investigated: that the fairness reference depends in a predictable way on the framing of the specific bargaining situation, and therefore, the framing affects behavior. Afterwards, this book explores the implications of fairness concern for price formation in *matching markets*, which involve temporary bilateral bargaining. This is examined by the theoretical analysis of a market model, and by an experimental laboratory study of such a market. The more detailed structure of this book is as follows.

Chapter 1 provides a brief introduction to the classic bargaining theories which are used as foundations in the subsequent chapters. Chapter 1 begins with Edgeworth’s (1881) early formalization of the bargaining problem; it explains the necessity of further assumptions to narrow down the set of potential solutions to a unique equilibrium prediction. The chapter then introduces the cooperative game-theoretical approach of Nash (1950) as well as the non-cooperative approach. The chapter uses some exemplary applications to ultimatum and alternating offers bargaining for clarification. Finally, the matching market model of Rubinstein and Wolinsky (1985) is explained, and relevant ties to the literature are pointed out.

Chapter 2 begins with some of the empirical evidence that initiated the economic research on social utility. The chapter presents a comparison of recent approaches to the definition of *preferences* that result in *fair* behavior. These approaches can be grouped into two categories: equity-based and intention-based (psychological) approaches. Intention-based approaches explain more stylized facts from experiments but, in terms of tractability, come at a cost. Nevertheless, their explanatory power justifies their complexity. Specifically, the model of Falk and Fischbacher (2006) is identified as a very versatile approach because it unifies equity-based and pure intention-based models into one framework.

Chapter 3 combines the methods of evolutionary and behavioral game theory. The chapter addresses the questions of under what circumstances is behavior closer to the standard *homo economicus*-type, i.e., maximizing monetary payoffs, and which environments induce human beings to act more like *homo reciprocans*, with a preference for reciprocity. The chapter is based on the *indirect evolutionary approach* which was derived from the classic evolutionary approach in connection with social preferences. To account for human abilities, classical game theory is used to predict strategic behavior. However, the *preferences* of the players are based on evolutionary stability. Therefore individual preferences are seen in a new way: not as exogenously given, but as evolving over time. The chapter investigates agents who face a stylized, pecuniary “game of life” which comprises the ultimatum game and the dictator game. Utility may, but need not, be attached to equity and reciprocity as formalized by Falk and Fischbacher (2006). However, critically, this social component of preferences cannot be conditioned on whether an ultimatum or a dictator game is played. The evolutionary fitness of agents is determined solely by material success. While a strong preference for reciprocity evolves under these conditions,

little interest in equity evolves. It is shown, in line with experimental observations, that a preference for reciprocity plays a significant role in games with punishment opportunities. Possible exogenous constraints that link reciprocity and equity concerns imply long-run levels of both that depend on the relative frequency of ultimatum vs. dictator interaction in agents' multi-game environment. Chapter 3 was a joint project with Siegfried K. Berninghaus and Stefan Napel. It was published 2007 in the *Journal of Evolutionary Economics*.

A preference for reciprocity is a social fairness norm. Chapter 4 addresses the reference dependence of such fairness norms. What is perceived as fair, may depend on the context. Therefore, context may affect behavior. This hypothesis was tested in a classroom experiment that involved more than 1000 students. All subjects made a decision in the same strategic environment, but the framing that described the bargaining situation varied across treatments. The observation made was that behavior varies significantly depending on the framing and that behavior varies in a predictable manner. One possible explanation is the potential reference dependence of social norms. Subjects may derive utility, not only from the material payoff, but also from a norm-related payoff. The norm-related payoff may depend on the relation of the pecuniary payoff and a reference point. This reference point may be a belief about what one "ought to share" or a similar reference dependent social norm. The chapter was a joint project with Philipp Reiss who not only subjected his students to the experiment, but also contributed to parts of the chapter at hand.

Fair behavior in bilateral bargaining is one of the most discussed topics in microeconomics today. However, its implications for markets are not yet completely clear. Double-auction markets appear to have a strong built-in tendency toward the competitive equilibrium. This tendency, however, does not necessarily translate to all other market forms. To address this shortfall, chapter 5 extends the scope to a market setting that involves temporary one-on-one interactions: it investigates price formation in a decentralized market with random matching à la Rubinstein and Wolinsky (1985). In contrast to the original model, agents are assumed to have subdued social preferences. Buyers, for example, prefer a lower price to a higher one, but experience smaller utility increases below a reference price that serves as a common fairness benchmark. The strategic equilibrium reflects market fundamentals. However, it is markedly affected by the fairness concern of agents, and less sensitive to the buyer–seller ratio near the fair-price benchmark. If the fairness benchmark is influenced by the market experience of traders, for example, in a manner consistent with the theory of cognitive dissonance, prices may be sticky around very different reference levels in markets with otherwise identical fundamentals. The implied history dependence turns out to be mitigated rather than exacerbated by friction. These results have important practical implications. For example, they can explain a potential mechanism behind soft policy measures like the publication of the rent indices common in several German municipalities: Such measures may affect the fairness benchmark of market participants. This may, in turn, affect behavior. Chapter 5 is based on collaboration with Stefan Napel. It is forthcoming as a joint paper in the *Journal of Economic Behavior & Organization*.

The model described in chapter 5 is built on several limitative assumptions. One of these limitative assumptions is perfect homogeneity of agents on each side of the market. All agents are assumed to hold a common reference price and discount factor. Chapter 6 relaxes these and other assumptions of the model. Heterogeneity with respect to reference prices, discount factors, and the degree of fairness concern does not render the results of the original model invalid. For example, it is *not* necessary that all agents have a preference for fairness, or that they agree on the same reference price. As long as *some* participating agents hold a sharp notion of the reference price, the effects of fairness on equilibrium market prices are sustained. Corresponding to intuition, the larger the share of agents in the market with fairness concern, the more pronounced the effect. Interestingly, the share of gains from trade that an agent can capture is increasing in fairness concern. This fact is analogous to the findings regarding reciprocity in the “game of life” (see chapter 3). In contrast to the finding for heterogeneity under the premise of perfect information, assuming imperfect information may eliminate the uniqueness of the equilibrium. Overall, the model proves to be very robust, and the major findings translate into more generalized settings.

The final chapter provides a robustness check of a different kind. Chapter 7 investigates price formation in an *experimental* market that involves random matching. Specifically, it investigates whether market prices are in line with the predictions of standard theory based on material payoff maximization, or if, instead, market prices exhibit inflexibility with respect to market conditions in a way that is consistent with the fairness preferences discussed in chapters 5 and 6. In the chapter, a proposed laboratory study is described in detail, and the study’s feasibility is demonstrated by a trial session which was conducted with 20 paid subjects at the BonnEcon-Lab. Preliminary results of this trial session indicate that market prices are indeed sticky and that the behavioral model is a better predictor of outcomes than standard theory based on material payoff maximization. This result is contrary to the result typically obtained through experimental studies of markets. Most such studies find that fairness has either limited or no effects on market prices. However, typically double-auction or similar setups are investigated. These are distinct from the setup investigated here because they have an inherent tendency to converge to the competitive equilibrium. By contrast, markets involving a matching and bargaining process allow the fairness concerns of the subjects to affect market prices. Given that such markets are typically utilized in the analysis of labor and monetary markets, these findings may have far-reaching consequences.

Because they are designed to be self-contained, the first five chapters and chapter 7 can be read in any sequence. However, chapter 6 is closely tied to chapter 5.

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