SONDERFORSCHUNGSBEREICH 504

Rationalitätskonzepte,
Entscheidungsverhalten und
ökonomische Modellierung

No. 03-26

A Simple Axiomatization and Constructive Representation Proof for Choquet Expected Utility

Alain Chateauneuf*
and J¨urgen Eichberger**
and Simon Grant***

October 2003

*CERMSEM Université Paris I, email: chateaun@univ-paris1.fr

**Sonderforschungsbereich 504, email: juergen.eichberger@awi.uni-heidelberg.de

***Department of Economics Rice University, email: sgrant@rice.edu

Universität Mannheim
L 13,15
68131 Mannheim

A Simple Axiomatization and Constructive Representation Proof for Choquet Expected Utility

Abstract

We provide a set of simple and intuitive set of axioms that allow for a direct and constructive proof of the Choquet Expected Utility representation for decision making under uncertainty.

Alain Chateauneuf
CERSEM
Université Paris I

Jürgen Eichberger
Wirtschaftstheorie I
Universität Heidelberg

Simon Grant
Department of Economics
Rice University

1 Introduction

In subjective expected utility theory choice under uncertainty is perceived as the maximization of the mathematical expectation of a utility function with respect to the subjective probabilities that represent the individual's subjective assessment of the relative likelihood of events (see Savage [1954] for the definitive statement and Anscombe and Aumann [1963] for an alternative, simpler, treatment.) Motivated by examples such as the well-known Ellsberg paradoxes and an increasing body of experimental and empirical evidence, decision theorists have developed and analyzed models for decision making under uncertainty that entail the mathematical expectation of a utility function with respect to 'non-additive probabilities' or capacities. This generalization of subjective expected utility has been dubbed Choquet Expected Utility as it utilizes the Choquet integral for non-additive measures (see Gilboa [1989] for an axiomatization in the Savage purely subjective uncertainty setting and Schmeidler [1989] for an alternative and simpler treatment in the Anscombe and Aumann setting.)

In this note we adopt the Anscombe and Aumann setting of the horse/roulette lotteries representation of alternative courses of action. That is, courses of action, or acts, are functions from a set of states of nature to the set of simple lotteries defined over an arbitrary set of outcomes. Our aim is to exploit this rich structure to provide a set of simple and intuitive axioms that allow us to provide a direct and constructive proof of the Choquet Expected Utility representation. Nothing that we do constitutes a technical advance on Schmeidler's (1989) pioneering work but we submit that our constructive proof allows a more direct and intuitive comparison with the standard Expected Utility model. Indeed to quote Anscombe and Aumann (1963)

> "The novelty of our presentation, if any, lies in the double use of [expected] utility theory, permitting the very simple and plausible assumptions and the simple construction and proof." (p. 203)

2 The Set-up and the Axioms

We set our analysis in the context of the well-known Anscombe-Aumann framework (Anscombe & Aumann (1962)). We assume that the uncertainty a decision maker faces can be described by a non-empty set of *states*, denoted by $\mathcal{S}$. This set may be finite or infinite. Associated with the set of states is the set of events, taken to be a sigma-algebra of subsets of $\mathcal{S}$, denoted by $\mathcal{E}$. We assume that for each s in $\mathcal{S}$, $\{s\}$ is in $\mathcal{E}$. Let $\mathcal{X}$ be an arbitrary non-empty set of *outcomes* (finite or infinite) and denote by $\mathcal{L}$ the set of lotteries (simple probability measures) on $\mathcal{X}$. An *act*, or *horse-race lottery*, is a function (measurable with respect to $\mathcal{E}$)

$f : \mathcal{S} \to \mathcal{L}$ with *finite* range, $\mathcal{F}$ denotes the set of such acts. We shall identify each $L \in \mathcal{L}$ with the constant horse-race lottery $[L \text{ on } \mathcal{S}]$ (that is, $f(s) = L$ for all $s \in \mathcal{S}$) and so with slight abuse of notation, we shall let $\mathcal{L}$ also denote the set of constant acts. For each x in $\mathcal{X}$, let δ_x denote the (degenerate) lottery that yields the outcome x with probability one.

Let $\succsim$ denote the individual's preference relation on $\mathcal{F}$. For ease of exposition and clarity we impose without essential loss of generality a structural assumption that there exists a maximally preferred outcome and a minimally preferred outcome.

Axiom 0 Their exist two outcomes M and 0, such that $\delta_M \succ \delta_0$, and $\delta_M \succsim \delta_x \succsim \delta_0$, for all $x \in \mathcal{X}$

Both the sets $\mathcal{L}$ and $\mathcal{F}$ are *mixture spaces*. In particular, for any pair of lotteries L' and L'' in $\mathcal{L}$, and any α in $(0, 1)$, $\alpha L' + (1 - \alpha) L''$ is the lottery L in $\mathcal{L}$ for which $L(x) = \alpha L'(x) + (1 - \alpha) L''(x)$, for each x in $\mathcal{X}$. Similarly, for any pair of horse-race lotteries f' and f'' in $\mathcal{F}$, and any α in $(0, 1)$, we define $\alpha f' + (1 - \alpha) f''$ to be the horse-race lottery $f \in \mathcal{F}$, for which $f(s) = \alpha f'(s) + (1 - \alpha) f''(s)$, for each s in $\mathcal{S}$. A utility function $U : \mathcal{L} \to \mathbb{R}$ defined on the lottery space is said to be affine if for any pair of lotteries L' and L'' in $\mathcal{L}$, and any α in $(0, 1)$, $U(\alpha L' + (1 - \alpha) L'') = \alpha U(L') + (1 - \alpha) U(L'')$.

Capacities are real-valued functions defined on $\mathcal{E}$, that generalize the notion of a probability measure. Formally, a capacity is a normalized set function.

Definition 1. A capacity is a function $\nu : \mathcal{E} \to \mathbb{R}$ that assigns real numbers to events, such that
(i) $E, F \in \mathcal{E}$, $E \subseteq F$ implies $\nu(E) \leq \nu(F)$, (monotonicity)
(ii) $\nu(\varnothing) = 0$ and $\nu(\mathcal{S}) = 1$ (normalization).
A probability measure $\mu : \mathcal{E} \to \mathbb{R}$ is a capacity that also satisfies the following property
(iv) $E, F \in \mathcal{E}$, $\mu(E \cup F) = \mu(E) + \mu(F) - \mu(E \cap F)$ (additivity).

In order to define the Choquet integral with respect to a capacity and to compare it with the usual Lebesgue integral taken with respect to a probability measure, it is convenient to associate with an act $f \in \mathcal{F}$, the coarsest (finite) partition over $\mathcal{S}$, of the form $\{E_1, \ldots, E_n\}$ to which the act f is measurable and *ordered*. That is, for any pair of states $s, t \in S$, if both s and t are in some $E \in \{E_1, \ldots, E_n\}$ then $f(s) = f(t)$, otherwise $f(s) \neq f(t)$. Furthermore for any $s \in E_i$ and $t \in E_j$, $i < j$ implies $f(s) \succsim f(t)$. For each $i = 1, \ldots, n$, if we let L_i be the lottery prize resulting if a state in E_i obtains, then f may be expressed in the form $f = [L_1 \text{ on } E_1; \ldots; L_n \text{ on } E_n]$. Throughout the rest of this paper, if an act is expressed in this form, then the associated partition should be taken to be one with respect to which that act is measurable and ordered.

Definition 2. Fix an affine utility function $U : \mathcal{L} \to \mathbb{R}$, capacity $\nu : \mathcal{E} \to [0,1]$, and any act $f = [L_1 \text{ on } E_1; \ldots; \ L_n \text{ on } E_n]$. The Choquet expected utility of the act f with respect to U and ν is defined to be

$$\text{CEU}(f) = \sum_{i=1}^{n-1} \left(U(L_i) - U(L_{i+1})\right) \nu \left(\cup_{j=1}^{i} E_j\right) + U(L_n) \tag{1}$$

$$= U(L_1)\nu(E_1) + \sum_{i=2}^{n} \left(U(L_i)\right) \left(\nu \left(\cup_{j=1}^{i} E_j\right) - \nu \left(\cup_{j=1}^{i-1} E_j\right) \right) \tag{2}$$

The expression on the right-hand-side of (2) may be interpreted as saying that the decision weight placed on the event yielding a lottery prize equal in preference to a particular lottery L, is equal to the difference between the capacity of the event that yields a lottery prize equal to or better than L and the capacity of the event yielding a strictly better lottery prize. If the capacity in definition 2 is actually a probability measure $\mu(.)$ (that is, it also satisfies additivity) then the expression on the right-hand-side of (2) collapses to the standard expected utility formulation, $\text{SEU}(f) = \sum_{i=1}^{n} U(L_i)\mu(E_i)$.

Notice that, when restricted to the set of constant acts, the Choquet Expected Utility functional is simply $U(.)$ and so is affine. If we normalize this utility function by setting $U(\delta_M) := 1$ and $U(\delta_0) := 0$, then the CEU representation may be viewed as involving the assignment to each lottery L a utility equal to the *probability* $U(L)$ which makes the lottery $U(L)\delta_M + (1 - U(L))\delta_0$ indifferent to L. Furthermore, the CEU representation also entails the assignment to each event $E \in \mathcal{E}$, a capacity equal to the *probability* $\nu(E)$ which makes the constant act $\nu(E)\delta_M + (1 - \nu(E))\delta_0$ indifferent to the act $[\delta_M \text{ on } E; \ \delta_0 \text{ on } E]$.

For a simple example illustrating how these assignments can be combined to construct the Choquet Expected Utility of an act, consider the act $g = [L \text{ on } A; \ L' \text{ on } \mathcal{S} - A]$. Suppose $L \sim U(L)\delta_M + (1 - U(L))\delta_0$, $L' \sim U(L')\delta_M + (1 - U(L'))\delta_0$. Since by our convention $L \succsim L'$, we have $U(L) \geq U(L')$. So, if we replace L by $U(L)\delta_M + (1 - U(L))\delta_0$ and L' by $U(L')\delta_M + (1 - U(L'))\delta_0$ in g, we form the act $g' = $

$$\begin{bmatrix} U(L)\delta_M + (1 - U(L))\delta_0 & \text{on } A \\ \\ U(L')\delta_M + (1 - U(L'))\delta_0 & \text{on } \mathcal{S} - A \end{bmatrix} =$$

$$[1 - U(L)] \begin{bmatrix} \delta_0 & \text{on } A \\ \\ \delta_0 & \text{on } \mathcal{S} - A \end{bmatrix} + [U(L) - U(L')] \begin{bmatrix} \delta_M & \text{on } A \\ \\ \delta_0 & \text{on } \mathcal{S} - A \end{bmatrix} + U(L') \begin{bmatrix} \delta_M & \text{on } A \\ \\ \delta_M & \text{on } \mathcal{S} - A \end{bmatrix}$$
$$\tag{3}$$

Now, suppose further that $\nu(A)\delta_M + (1 - \nu(A))\delta_0 \sim [\delta_M \text{ on } A; \ \delta_0 \text{ on } \mathcal{S} - A]$. If we replace $[\delta_M \text{ on } A; \ \delta_0 \text{ on } \mathcal{S} - A]$ in (3) by $\nu(A)\delta_M + (1 - \nu(A))\delta_0$ then the act g' is transformed into

the constant act

$$g'' = [1 - U(L)]\delta_0 + [U(L) - U(L')][\nu(A)\delta_M + (1 - \nu(A))\delta_0] + U(L')\delta_M$$
$$= ([U(L) - U(L')]\nu(A) + U(L'))\delta_M + (1 - [U(L) - U(L')]\nu(A) - U(L'))\delta_0$$

Notice that the probability weight on δ_M for g'' is the Choquet expected utility of g according to the rule given by the expression in the right-hand-side of (1). The following axioms provide a set of conditions that are both necessary and sufficient to allow us to infer that $g \sim g'$ and $g' \sim g''$ and so (by transitivity of indifference) that $g \sim g''$, thereby allowing us to make the assignment $\mathrm{CEU}(g) := [U(L) - U(L')]\nu(A) + U(L')$.

We begin with the standard ordering axiom and the most elementary forms of continuity and monotonicity axioms for the preference relation.

Axiom 1 (*Ordering*)
The preference relation $\succsim$ is complete, reflexive and transitive.

For any pair of outcomes x and y in $\mathcal{X}$, let $\mathcal{L}_{\{x,y\}}$ denote the set of lotteries whose support is a subset of $\{x, y\}$. We only require the following weak Archimedean property with respect to probability mixtures of two lotteries which share a common two-outcome support.

Axiom 2 (*[Two-outcome] Mixture Continuity*).
For any pair of outcomes $x, y \in \mathcal{X}$ and any pair of roulette lotteries $L', L'' \in \mathcal{L}_{\{x,y\}}$, and any act $f \in \mathcal{L}$, where $L' \succ f \succ L''$, there is $\alpha, \beta \in (0, 1)$ such that $\alpha L' + (1 - \alpha)L'' \succ f \succ \beta L' + (1 - \beta)L''$.

We impose the simplest monotonicity axiom for lotteries: if two lotteries have a common two-outcome support, then the one that places more weight on the preferred outcome ranks higher.

Axiom 3 (*[Two-outcome] Mixture Monotonicity*).
For any pair of outcomes $x, y \in \mathcal{X}$, such that $\delta_x \succ \delta_y$, any pair of numbers $\alpha, \beta \in (0, 1]$,
$\alpha\delta_x + (1 - \alpha)\delta_y \succsim \beta\delta_x + (1 - \beta)\delta_y \Leftrightarrow \alpha \geq \beta$.

We also impose the simplest notion of set dominance for elementary bets: if A is a subset of B then 'betting on A' is not strictly preferred to 'betting on B'.

Axiom 4 (*Event Dominance*).
For any pair of outcomes $x, y \in \mathcal{X}$, such that $\delta_x \succ \delta_y$, and any pair of events $A, B \in \mathcal{E}$, such that $A \subset B$, $[\delta_x$ on $B; \delta_y$ on $\mathcal{S} - B] \succsim [\delta_x$ on $A; \delta_y$ on $\mathcal{S} - A]$.

The last two axioms are the principle substitution axioms, that in conjunction with the first four, permit us to apply von Neumann-Morgenstern's theorem twice. The first application enables us to calibrate the utility of lotteries and the second enables us to calibrate the capacity of every event, in the manner suggested above. More specifically, the axiom, *Lottery Substitution of Indifference*, considers the replacement of a lottery prize on an event in an act with an equally desirable lottery prize. Such a replacement is assumed to leave the overall desirability of the act unaffected.

Axiom 5 (*Lottery Substitution of Indifference*).
For any act $f = [L_1 \text{ on } E_1; \ldots; \ L_n \text{ on } E_n] \in \mathcal{F}$, and lottery L' and any $i = 1, \ldots, n$,
if $L' \sim L_i$ then $f \sim [L_1 \text{ on } E_1; \ldots; \ L_{i-1} \text{ on } E_{i-1}; \ L' \text{ on } E_i; \ L_{i+1} \text{ on } E_{i+1}; \ldots; \ L_n \text{ on } E_n]$.

The final axiom, is the independence axiom restricted to pairs of comonotonic acts belonging to the same indifference class taking mixtures of a third act that is pairwise comonotonic with the other two.

Axiom 6 (*Comonotonic Independence of Indifference*)
For any α in $(0, 1]$, and any three acts $f, g, h \in \mathcal{F}$ such that $f(s) \succ f(t)$ implies $g(s) \succsim g(t)$, $g(s) \succ g(t)$ implies $h(s) \succsim h(t)$, and $h(s) \succ h(t)$ implies $f(s) \succsim f(t)$, for all $s, t \in S$; if $f \sim g$ then $\alpha f + (1 - \alpha) h \sim \alpha g + (1 - \alpha) h$.

3 The Representation and Proof

Theorem 1 *Suppose $\succsim$ satisfies Axiom 0, then the following two statements are equivalent:*

(a) *The preference relation $\succsim$ on $\mathcal{F}$ satisfies Axioms 1-6, that is,* Ordering, Mixture Continuity, Mixture Monotonicity, Event Dominance, Lottery Substitution of Indifference *and* Comonotonic Independence of Indifference.

(b) *There exists a unique capacity ν on $\mathcal{E}$ and a unique affine real-valued function U on $\mathcal{L}$, with $U(\delta_M) = 1$ and $U(\delta_0) = 0$, such that for all $f, g \in \mathcal{F}$*

$$f \succsim g \ \Leftrightarrow \ \int U \circ f \, d\nu \geq \int U \circ g \, d\nu.$$

Proof. We begin with a preliminary result that states that if an act lies in preference between a pair of degenerate lotteries, then there is a unique probability mixture of those two lotteries which is indifferent to that act.

Lemma 2 ([Two-outcome] Mixture Solvability) *Axioms 1-3 (that is, Ordering, Mixture Continuity and Mixture Monotonicity) imply that $\succsim$ satisfies the following solvability property: for any pair of outcomes $x, y \in \mathcal{X}$, such that $\delta_x \succ \delta_y$, and any act $f \in \mathcal{F}$, such that $\delta_x \succsim f \succsim \delta_y$, there exists a unique α in $[0, 1]$, such that $\alpha\delta_x + (1 - \alpha)\delta_y \sim f$.*

For a proof see FISHBURN (1970), Lemma 3.1, p.33.

We are now in a position to show **(a)** implies **(b)**, by explicitly constructing the CEU-representation for $\succsim$. We proceed by first deriving an Expected Utility representation for the preference relation restricted to the set of constant acts. That is, we construct the affine real-valued function U defined on $\mathcal{L}$. In the second step, we use this U to calibrate the decision weights on events to construct the capacity ν defined on $\mathcal{E}$, that enables us to extend the representation to the entire set of acts.

Step 1. Constructing the EU-Representation on $\succsim$ restricted to $\mathcal{L}$, the set of constant acts.

Set $U(\delta_M) := 0$ and $U(\delta_0) := 1$. For any $y \in \mathcal{X}$ set $U(\delta_y) := \beta$, where, by Lemma 2 (Mixture Solvability), β is the unique solution to $\beta\delta_M + (1 - \beta)\delta_0 \sim \delta_y$. Since all constant acts are pair-wise comonotonic, notice that for any $L = \sum_{i=1}^{m} \alpha_i \delta_{x_i} \in \mathcal{L}$ we can apply Axiom 6 (Comonotonic Independence of Indifference) and transitivity of indifference (Axiom 1) m times to obtain

$$
\begin{aligned}
L &\sim \alpha_1 \left(U(\delta_{x_1}) \delta_M + (1 - U(\delta_{x_1})) \delta_0 \right) + \sum_{i=2}^{m} \alpha_i \delta_{x_i} \\
&\sim \cdots \sim \sum_{i=1}^{m} \alpha_i \left(U(\delta_{x_i}) \delta_M + (1 - U(\delta_{x_i})) \delta_0 \right) \\
&= \left(\sum_{i=1}^{m} \alpha_i U(\delta_{x_i}) \right) \delta_M + \left(1 - \left(\sum_{i=1}^{m} \alpha_i U(\delta_{x_i}) \right) \right) \delta_0
\end{aligned}
$$

Hence for any pair of constant acts $L = \sum_{i=1}^{m} \alpha_i \delta_{x_i}$ and $L' = \sum_{j=1}^{m'} \beta_j \delta_{x_j}$, transitivity of preference (Axiom 1) implies $L \succsim L'$ if and only if

$$
\begin{aligned}
&\left(\sum_{i=i}^{m} \alpha_i U(\delta_{x_i}) \right) \delta_M + \left(1 - \left(\sum_{i=i}^{m} \alpha_i U(\delta_{x_i}) \right) \right) \delta_0 \\
\succsim\ &\left(\sum_{j=i}^{m'} \beta_j U(\delta_{x_j}) \right) \delta_M + \left(1 - \left(\sum_{j=1}^{m'} \beta_j U(\delta_{x_j}) \right) \right) \delta_0.
\end{aligned}
$$

But by Axiom 3 (Mixture Monotonicity) this holds if and only if

$$
\left(\sum_{i=i}^{m} \alpha_i U(\delta_{x_i}) \right) \geq \left(\sum_{j=i}^{m'} \beta_j U(\delta_{x_j}) \right).
$$

Hence the affine function $U\left(\sum_{i=1}^{m}\alpha_i\delta_{x_i}\right) = \sum_{i=1}^{m}\alpha_i U\left(\delta_{x_i}\right)$ represents $\succsim$ restricted to $\mathcal{L}$.

Step 2. Constructing the CEU-Representation for $\succsim$.

Fix any $f = [L_1 \text{ on } E_1; \ldots; \ L_n \text{ on } E_n] \in \mathcal{F}$. For each $i = 1, \ldots, n$, it follows from Step 1 that there is a unique number $U\left(L_i\right) \in [0,1]$, for which

$$L_i \sim U\left(L_i\right)\delta_M + \left(1 - U\left(L_i\right)\right)\delta_{x_*}.$$

For each $i = 1, \ldots, n-1$, it follows from Lemma 2 that there exists a unique ν_i satisfying

$$[\delta_M \text{ on } E_1 \cup \ldots \cup E_i; \ \delta_0 \text{ on } E_{i+1} \cup \ldots \cup E_n] \sim \nu_i \delta_M + \left(1 - \nu_i\right)\delta_0.$$

From Axiom 3 (Mixture Monotonicity) it follows that $1 \geq U\left(L_1\right) \geq \ldots \geq U\left(L_n\right) \geq 0$. From Axiom 4 (Event Dominance) it follows that $0 \leq \nu_1 \leq \ldots \leq \nu_{n-1} \leq 1$. By applying Axiom 5 (Lottery Substitution of Indifference) n times we obtain

$$f = \begin{bmatrix} L_1 & \text{on } E_1 \\ \vdots & \vdots \\ L_n & \text{on } E_n \end{bmatrix} \sim \begin{bmatrix} U\left(L_1\right)\delta_M + \left(1 - U\left(L_1\right)\right)\delta_0 & \text{on } E_1 \\ \vdots & \vdots \\ U\left(L_n\right)\delta_M + \left(1 - U\left(L_n\right)\right)\delta_0 & \text{on } E_n \end{bmatrix}$$

$$= \left(1 - U\left(L_1\right)\right)\begin{bmatrix} \delta_0 & \text{on } E_1 \\ \delta_0 & \text{on } E_2 \\ \delta_0 & \text{on } E_3 \\ \vdots & \vdots \\ \delta_0 & \text{on } E_{n-1} \\ \delta_0 & \text{on } E_n \end{bmatrix} + \left(U\left(L_1\right) - U\left(L_2\right)\right)\begin{bmatrix} \delta_M & \text{on } E_1 \\ \delta_0 & \text{on } E_2 \\ \delta_0 & \text{on } E_3 \\ \vdots & \vdots \\ \delta_0 & \text{on } E_{n-1} \\ \delta_0 & \text{on } E_n \end{bmatrix} + \cdots$$

$$+ \left(U\left(L_{n-1}\right) - U\left(L_n\right)\right)\begin{bmatrix} \delta_M & \text{on } E_1 \\ \delta_M & \text{on } E_2 \\ \delta_M & \text{on } E_3 \\ \vdots & \vdots \\ \delta_M & \text{on } E_{n-1} \\ \delta_0 & \text{on } E_n \end{bmatrix} + U\left(L_n\right)\begin{bmatrix} \delta_M & \text{on } E_1 \\ \delta_M & \text{on } E_2 \\ \delta_M & \text{on } E_3 \\ \vdots & \vdots \\ \delta_M & \text{on } E_{n-1} \\ \delta_M & \text{on } E_n \end{bmatrix}$$

By applying Axiom 6 (*Comonotonic Independence of Indifference*) $n-1$ times we have f is indifferent to:

$$(1 - U(L_1))\,\delta_0 + (U(L_1) - U(L_2))\,[\nu_1\delta_M + (1 - \nu_1)\,\delta_0] + (U(L_2) - U(L_3))\,[\nu_2\delta_M + (1 - \nu_2)\,\delta_0]$$

$$+ \ldots + (U(L_{n-1}) - U(L_n))\,[\nu_{n-1}\delta_M + (1 - \nu_{n-1})\,\delta_0] + U(L_n)\,\delta_M$$

$$= \left[\sum_{i=1}^{n-1}(U(L_i) - U(L_{i+1}))\,\nu_i + U(L_n)\right]\delta_M + \left[1 - U(L_n) - \sum_{i=1}^{n-1}(U(L_i) - U(L_{i+1}))\,\nu_i\right]\delta_0.$$

Hence if we take any given pair of acts

$$f = \begin{bmatrix} L_1 & \text{on } E_1 \\ \vdots & \vdots \\ L_n & \text{on } E_n \end{bmatrix} \text{ and } g = \begin{bmatrix} L_1' & \text{on } E_1' \\ \vdots & \vdots \\ L_{n'}' & \text{on } E_{n'}' \end{bmatrix}$$

and apply the above methods, it follows from Axiom 3 (Mixture Monotonicity) that

$$f \succsim g \text{ if and only if}$$

$$\left[\sum_{i=1}^{n-1}(U(L_i) - U(L_{i+1}))\,\nu_i + U(L_n)\right] \geq \left[\sum_{j=1}^{n'-1}\left(U(L_j') - U(L_{j+1}')\right)\nu_j' + U(L_{n'}')\right].$$

Hence, if we set, $\nu(\emptyset) := 0$, $\nu(S) := 1$ and $\nu\left(\cup_{j=1}^{i}E_i\right) := \nu_i$ then we have established that $\succsim$ can be represented by the Choquet expected utility functional

$$\text{CEU}\left(\begin{bmatrix} L_1 & \text{on } E_1 \\ \vdots & \vdots \\ L_n & \text{on } E_n \end{bmatrix}\right) = \sum_{i=1}^{n-1}(U(L_i) - U(L_{i+1}))\,\nu\left(\cup_{j=1}^{i}E_j\right) + U(L_n)$$

$$= U(L_1)\,\nu(E_1) + \sum_{i=2}^{n}(U(L_i))\left(\nu\left(\cup_{j=1}^{i}E_j\right) - \nu\left(\cup_{j=1}^{i-1}E_j\right)\right)$$

as required. $\qquad\square$

Finally we show **(b)** implies **(a)**. Axioms 1-3 are immediate from the existence and form of the functional representation. Axiom 4 follows since for any pair of events $A, B \in \mathcal{E}$, and any two outcomes, x and y for which $U(\delta_x) > U(\delta_y)$,

$$\text{CEU}([\delta_x \text{ on } B; \delta_y \text{ on } \mathcal{S} - B]) - \text{CEU}([\delta_x \text{ on } A; \delta_y \text{ on } \mathcal{S} - A]) = [\nu(B) - \nu(A)][U(\delta_x) - U(\delta_y)] \geq 0.$$

Since ν is a capacity, $A \subset B$ implies $\nu\left(A\right) \leq \nu\left(B\right)$, which means CEU $\left(\left[\delta_x \text{ on } B; \; \delta_y \text{ on } \mathcal{S} - B\right]\right)$ $\geq$ CEU $\left(\left[\delta_x \text{ on } A; \; \delta_y \text{ on } \mathcal{S} - A\right]\right)$, as required.

To see that Axiom 5 holds, notice that for the act $f = \left[L_1 \text{ on } E_1; \ldots; \; L_n \text{ on } E_n\right]$, consider the act obtained by replacing L_j on E_j with L_j', where $L_j' \sim L_j$, that is $U\left(L_j'\right) = U\left(L_j\right)$. Observe that the act obtained by this replacement, is the act

$$g = \left[L_1 \text{ on } E_1; \ldots L_{j-1} \text{ on } E_{j-1}; \; L' \text{ on } E_j; \; L_{j+1} \text{ on } E_{j+1}; \ldots; \; L_n \text{ on } E_n\right].$$

Hence

$$\text{CEU}\left(f\right) - \text{CEU}\left(g\right) = \left(U\left(L_j\right) - U\left(L_j'\right)\right)\left(\nu\left(\cup_{k=1}^{j} E_k\right) - \nu\left(\cup_{k=1}^{j-1} E_k\right)\right) = 0$$

as required. To see that Axiom 6 holds, consider any three pairwise comonotonic acts f, g and h. Let $\{E_1, \ldots, E_n\}$ be the coarsest ordered partition with respect to which *all* three acts are measurable. That is, we can express $f = \left[L_1 \text{ on } E_1; \ldots; \; L_n \text{ on } E_n\right]$, $g = \left[L_1' \text{ on } E_1; \ldots; \; L_n' \text{ on } E_n\right]$ and $h = \left[L_1'' \text{ on } E_1; \ldots; \; L_n'' \text{ on } E_n\right]$, where $L_i \succsim_i L_{i+1}$, $L_i' \succsim_i L_{i+1}'$ and $L_i'' \succsim_i L_{i+1}''$, for all $i = 1, \ldots, n-1$. Thus, for any α in $(0, 1]$, we obtain

$$\text{CEU}\left(\alpha f + \left(1 - \alpha\right) h\right) - \text{CEU}\left(\alpha g + \left(1 - \alpha\right) h\right)$$
$$= \left[U\left(\alpha L_1 + \left(1 - \alpha\right) L_1''\right) - U\left(\alpha L_1' + \left(1 - \alpha\right) L_1''\right)\right] \nu\left(E_1\right)$$
$$+ \sum_{i=2}^{n} \left[U\left(\alpha L_i + \left(1 - \alpha\right) L_i''\right) - U\left(\alpha L_i' + \left(1 - \alpha\right) L_i''\right)\right]\left(\nu\left(\cup_{j=1}^{i} E_j\right) - \nu\left(\cup_{j=1}^{i-1} E_j\right)\right)$$
$$= \alpha U\left(L_1 - L_1'\right) \nu\left(E_1\right) + \sum_{i=2}^{n} \alpha U\left(L_i - L_i'\right)\left(\nu\left(\cup_{j=1}^{i} E_j\right) - \nu\left(\cup_{j=1}^{i-1} E_j\right)\right)$$
$$= \alpha\left(\text{CEU}\left(f\right) - \text{CEU}\left(g\right)\right).$$

And in particular this implies that if $f \sim g$ then $\alpha f + \left(1 - \alpha\right) h \sim \alpha g + \left(1 - \alpha\right) h$, as required. ∎

References

Anscombe, F.J. & Aumann, R.J. (1963). "A Definition of Subjective Probability". *Annals of Mathematical Statistics 34*, 199-205.

Gilboa, I. (1987), "Expected utility with purely subjective non-additive probabilities," *Journal of Mathematical Economics*, **16**, 65-88.

Schmeidler, D. (1989), "Subjective probability and expected utility without additivity," *Econometrica*, **57**, 571-587.

Savage, L.J. (1954). *The Foundations of Statistics.* New York: Dover Publications 1972.

Nr.	Author	Title
03-32	Siegfried K. Berninghaus Christian Korth Stefan Napel	Reciprocity - an indirect evolutionary analysis
03-31	Peter Albrecht Cemil Kantar	Random Walk oder Mean Reversion? Eine statistische Analyse des Kurs/Gewinn-Verhältnisses für den deutschen Aktienmarkt
03-30	Jürgen Eichberger David Kelsey Burkhard Schipper	Ambiguity and Social Interaction
03-29	Ulrich Schmidt Alexander Zimper	Security And Potential Level Preferences With Thresholds
03-28	Alexander Zimper	Uniqueness Conditions for Point-Rationalizable Solutions of Games with Metrizable Strategy Sets
03-27	Jürgen Eichberger David Kelsey	Sequential Two-Player Games with Ambiguity
03-26	Alain Chateauneuf Jürgen Eichberger Simon Grant	A Simple Axiomatization and Constructive Representation Proof for Choquet Expected Utility
03-25	Volker Stocké	Informationsverfügbarkeit und Response-Effects: Die Prognose von Einflüssen unterschiedlich kategorisierter Antwortskalen durch Antwortsicherheiten und Antwortlatenzen
03-24	Volker Stocké	Entstehungsbedingungen von Antwortverzerrungen durch soziale Erwünschtheit. Ein Vergleich der Prognosen der Rational-Choice Theorie und des Modells der Frame-Selektion
03-23	Daniel Schunk	Modeling the Use of Nonrenewable Resources Using a Genetic Algorithm
03-22	Brian Deal Daniel Schunk	Spatial Dynamic Modeling and Urban Land Use Transformation: An Ecological Simulation Approach to Assessing the Costs of Urban Sprawl

Nr.	Author	Title
03-21	Thomas Gschwend Franz Urban Pappi	Stimmensplitting und Koalitionswahl
03-20	Thomas Langer Martin Weber	Does Binding or Feeback Influence Myopic Loss Aversion - An Experimental Analysis
03-19	Peter Albrecht Carsten Weber	Asset/Liability Management of German Life Insurance Companies: A Value-at-Risk Approach in the Presence of Interest Rate Guarantees
03-18	Markus Glaser	Online Broker Investors: Demographic Information, Investment Strategy, Portfolio Positions, and Trading Activity
03-17	Markus Glaser Martin Weber	September 11 and Stock Return Expectations of Individual Investors
03-16	Siegfried K. Berninghaus Bodo Vogt	Network Formation and Coordination Games
03-15	Johannes Keller Herbert Bless	When negative expectancies turn into negative performance: The role of ease of retrieval.
03-14	Markus Glaser Markus Nöth Martin Weber	Behavioral Finance
03-13	Hendrik Hakenes	Banks as Delegated Risk Managers
03-12	Elena Carletti	The Structure of Bank Relationships, Endogenous Monitoring and Loan Rates
03-11	Isabel Schnabel	The Great Banks' Depression - Deposit Withdrawals in the German Crisis of 1931
03-10	Alain Chateauneuf Jürgen Eichberger Simon Grant	Choice under Uncertainty with the Best and Worst in Mind: Neo-additive Capacities.
03-09	Peter Albrecht Carsten Weber	Combined Accumulation- and Decumulation-Plans with Risk-Controlled Capital Protection

Nr.	Author	Title
03-08	Hans-Martin von Gaudecker Carsten Weber	Surprises in a Growing Market Niche - An Evaluation of the German Private Annuities Market
03-07	Markus Glaser Martin Weber	Overconfidence and Trading Volume
03-06	Markus Glaser Thomas Langer Martin Weber	On the trend recognition and forecasting ability of professional traders
03-05	Geschäftsstelle	Jahresbericht 2002
03-04	Oliver Kirchkamp Rosemarie Nagel	No imitation - on local and group interaction, learning and reciprocity in prisoners break
03-03	Michele Bernasconi Oliver Kirchkamp Paolo Paruolo	Expectations and perceived causality in fiscal policy: an experimental analysis using real world data
03-02	Peter Albrecht	Risk Based Capital Allocation
03-01	Peter Albrecht	Risk Measures
02-51	Peter Albrecht Ivica Dus Raimond Maurer Ulla Ruckpaul	Cost Average-Effekt: Fakt oder Mythos?
02-50	Thomas Langer Niels Nauhauser	Zur Bedeutung von Cost-Average-Effekten bei Einzahlungsplänen und Portefeuilleumschichtungen
02-49	Alexander Klos Thomas Langer Martin Weber	Über kurz oder lang - Welche Rolle spielt der Anlagehorizont bei Investitionsentscheidungen?
02-48	Isabel Schnabel	The German Twin Crisis of 1931
02-47	Axel Börsch-Supan Annamaria Lusardi	Saving Viewed from a Cross-National Perspective
02-46	Isabel Schnabel Hyun Song Shin	Foreshadowing LTCM: The Crisis of 1763

Nr.	Author	Title
02-45	Ulrich Koch	Inkrementaler Wandel und adaptive Dynamik in Regelsystemen
02-44	Alexander Klos	Die Risikoprämie am deutschen Kapitalmarkt
02-43	Markus Glaser Martin Weber	Momentum and Turnover: Evidence from the German Stock Market
02-42	Mohammed Abdellaoui Frank Voßmann Martin Weber	An Experimental Analysis of Decision Weights in Cumulative Prospect Theory under Uncertainty
02-41	Carlo Kraemer Martin Weber	To buy or not to buy: Why do people buy too much information?
02-40	Nikolaus Beck	Kumulation und Verweildauerabhängigkeit von Regeländerungen
02-39	Eric Igou	The Role of Lay Theories of Affect Progressions in Affective Forecasting
02-38	Eric Igou Herbert Bless	My future emotions versus your future emotions: The self-other effect in affective forecasting
02-37	Stefan Schwarz Dagmar Stahlberg Sabine Sczesny	Denying the foreseeability of an event as a means of self-protection. The impact of self-threatening outcome information on the strength of the hindsight bias
02-36	Susanne Abele Herbert Bless Karl-Martin Ehrhart	Social Information Processing in Strategic Decision Making: Why Timing Matters
02-35	Joachim Winter	Bracketing effects in categorized survey questions and the measurement of economic quantities
02-34	Joachim Winter	Design effects in survey-based measures of household consumption
02-33	Stefan Schwarz Dagmar Stahlberg	Motivational influences on the strength of the hindsight bias

Nr.	Author	Title
02-32	Stefan Schwarz Dagmar Stahlberg	Strength of hindsight bias as a consequence of meta-cognitions
02-31	Roman Grunwald	Inter-Organisationales Lernen und die Integration spezialisierten Wissens in Kooperationen - Eine empirische Untersuchung anhand von kooperativen Entwicklungsprojekten
02-30	Martin Hellwig	The Relation Between Real Wage Rates and Employment: An Intertemporal General-Equilibrium Analysis
02-29	Moshe Ben-Akiva Daniel McFadden Kenneth Train Axel Börsch-Supan	Hybrid Choice Models: Progress and Challenges
02-28	Angelika Eymann Axel Börsch-Supan Rob Euwals	Risk Attitude, Impatience, and Asset Choice
02-27	Axel Börsch-Supan Alexander Ludwig Joachim Winter	Aging and International Capital Flows
02-26	Rüdiger F. Pohl Stefan Schwarz Sabine Sczesny Dagmar Stahlberg	Gustatory hindsight bias
02-25	Axel Börsch-Supan	What We Know and What We Do NOT Know About the Willingness to Provide Self-Financed Old-Age Insurance
02-24	Florian Heiss	Specification(s) of Nested Logit Models
02-23	Axel Börsch-Supan	Kann die Finanz- und Sozialpolitik die Auswirkungen der Bevölkerungsalterung auf den Arbeitsmarkt lindern?
02-22	Tito Boeri Axel Börsch-Supan Guido Tabellini	Would you Like to Reform the Pension System? The Opinions of European Citizens

Nr.	Author	Title
02-21	Axel Börsch-Supan Florian Heiss Miki Seko	Housing Demand in Germany and Japan - Paper in memoriam of Stephen Mayo
02-20	Siegfried K. Berninghaus Karl-Martin Ehrhart	The power of ESS: An experimental study
02-19	Douglas Gale Martin Hellwig	Competitive Insurance Markets with Asymmetric Information: A Cournot-Arrow-Debreu Approach*
02-18	Michele Bernasconi Oliver Kirchkamp	The Expectations view on fiscal policy - An experiment using real world data
02-17	Oliver Kirchkamp Rosemarie Nagel	Reinforcement, repeated games, and local interaction
02-16	Volker Stocké	Die Vorhersage von Fragenreihenfolgeeffekten durch Antwortlatenzen: Eine Validierungsstudie
02-15	Thomas Kittsteiner Jörg Nikutta Eyal Winter	Discounting in Sequential Auctions
02-14	Christian Ewerhart	Banks, Internal Models and the Problem of Adverse Selection
02-13	Christian Ewerhart Eyal Winter	Limited Backward Induction as an Expression of Bayesian Rationality
02-12	Christian Ewerhart	Enabling Goal-Directed Planning and Control: Experiences with the Implementation of Value Management in an Internationally Operating Stock Exchange
02-11	Christian Ewerhart Karsten Fieseler	Procurement Auctions and Unit-Price Contracts
02-10	Susanne Abele	How to Influence Cooperation Subtly
02-01	Geschäftsstelle	Jahresbericht 2001

Nr.	Author	Title
02-09	Volker Stocké	Soziale Erwünschtheit bei der Erfassung von Einstellungen gegenüber Ausländern. Theoretische Prognosen und deren empirische Überprüfung
02-08	Volker Stocké Bettina Langfeldt	Ex-post Implementation with Interdependent Valuations
02-07	Benny Moldovanu Christian Ewerhart	A Stylized Model of the German UMTS Auction
02-06	Benny Moldovanu Aner Sela	Contest Architecture
02-05	Benny Moldovanu Christian Ewerhart	The German UMTS Design: Insights From Multi-Object Auction Theory
02-04	Alex Possajennikov	Cooperative Prisoners and Aggressive Chickens: Evolution of Strategies and Preferences in 2x2 Games
02-03	Alex Possajennikov	Two-Speed Evolution of Strategies and Preferences in Symmetric Games
02-02	Markus Ruder Herbert Bless	Mood and the reliance on the ease of retrieval heuristic
01-52	Martin Hellwig Klaus M. Schmidt	Discrete-Time Approximations of the Holmström-Milgrom Brownian-Motion Model of Intertemporal Incentive Provision
01-51	Martin Hellwig	The Role of Boundary Solutions in Principal-Agent Problems with Effort Costs Depending on Mean Returns
01-50	Siegfried K. Berninghaus	Evolution of conventions - some theoretical and experimental aspects
01-49	Dezsö Szalay	Procurement with an Endogenous Type Distribution
01-48	Martin Weber Heiko Zuchel	How Do Prior Outcomes Affect Risky Choice? Further Evidence on the House-Money Effect and Escalation of Commitment

Nr.	Author	Title
01-47	Nikolaus Beck Alfred Kieser	The Complexity of Rule Systems, Experience, and Organizational Learning
01-46	Martin Schulz Nikolaus Beck	Organizational Rules and Rule Histories
01-45	Nikolaus Beck Peter Walgenbach	Formalization and ISO 9000 - Changes in the German Machine Building Industry
01-44	Anna Maffioletti Ulrich Schmidt	The Effect of Elicitation Methods on Ambiguity Aversion: An Experimental Investigation
01-43	Anna Maffioletti Michele Santoni	Do Trade Union Leaders Violate Subjective Expected Utility?Some Insights from Experimental Data
01-42	Axel Börsch-Supan	Incentive Effects of Social Security Under an Uncertain Disability Option
01-41	Carmela Di Mauro Anna Maffioletti	Reaction to Uncertainty and Market Mechanism:Experimental Evidence
01-40	Marcel Normann Thomas Langer	Altersvorsorge, Konsumwunsch und mangelnde Selbstdisziplin: Zur Relevanz deskriptiver Theorien für die Gestaltung von Altersvorsorgeprodukten
01-39	Heiko Zuchel	What Drives the Disposition Effect?
01-38	Karl-Martin Ehrhart	European Central Bank Operations: Experimental Investigation of the Fixed Rate Tender
01-37	Karl-Martin Ehrhart	European Central Bank Operations: Experimental Investigation of Variable Rate Tenders
01-36	Karl-Martin Ehrhart	A Well-known Rationing Game
01-35	Peter Albrecht Raimond Maurer	Self-Annuitization, Ruin Risk in Retirement and Asset Allocation: The Annuity Benchmark
01-34	Daniel Houser Joachim Winter	Time preference and decision rules in a price search experiment

Nr.	Author	Title
01-33	Christian Ewerhart	Iterated Weak Dominance in Strictly Competitive Games of Perfect Information
01-32	Christian Ewerhart	THE K-DIMENSIONAL FIXED POINT THEOREM OF PROVABILITY LOGIC
01-31	Christian Ewerhart	A Decision-Theoretic Characterization of Iterated Weak Dominance
01-30	Christian Ewerhart	Heterogeneous Awareness and the Possibility of Agreement
01-29	Christian Ewerhart	An Example for a Game Involving Unawareness: The Tragedy of Romeo and Juliet
01-28	Christian Ewerhart	Backward Induction and the Game-Theoretic Analysis of Chess
01-27	Eric Igou Herbert Bless	About the Importance of Arguments, or: Order Effects and Conversational Rules
01-26	Heiko Zuchel Martin Weber	The Disposition Effect and Momentum
01-25	Volker Stocké	An Empirical Test of the Contingency Model for the Explanation of Heuristic-Based Framing-Effects
01-24	Volker Stocké	The Influence of Frequency Scales on the Response Behavior. A Theoretical Model and its Empirical Examination
01-23	Volker Stocké	An Empirical Examination of Different Interpretations of the Prospect Theorýs Framing-Hypothesis
01-22	Volker Stocké	Socially Desirable Response Behavior as Rational Choice: The Case of Attitudes Towards Foreigners
01-21	Phillipe Jehiel Benny Moldovanu	License Auctions and Market Structure
01-20	Phillipe Jehiel Benny Moldovanu	The European UMTS/IMT-2000 License Auctions

Nr.	Author	Title
01-19	Arieh Gavious Benny Moldovanu Aner Sela	Bid Costs and Endogenous Bid Caps
01-18	Benny Moldovanu Karsten Fieseler Thomas Kittsteiner	Partnerships, Lemons and Efficient Trade
01-17	Raimond Maurer Martin Pitzer Steffen Sebastian	Construction of a Transaction Based Real Estate Index for the Paris Housing Market
01-16	Martin Hellwig	The Impact of the Number of Participants on the Provision of a Public Good
01-15	Thomas Kittsteiner	Partnerships and Double Auctions with Interdependent Valuations
01-14	Axel Börsch-Supan Agar Brugiavini	Savings: The Policy Debate in Europe
01-13	Thomas Langer	Fallstudie zum rationalen Entscheiden: Contingent Valuation und der Fall der Exxon Valdez
01-12	Peter Albrecht Raimond Maurer Ulla Ruckpaul	On the Risks of Stocks in the Long Run:A Probabilistic Approach Based on Measures of Shortfall Risk
01-11	Peter Albrecht Raimond Maurer	Zum systematischen Vergleich von Rentenversicherung und Fondsentnahmeplänen unter dem Aspekt des Kapitalverzehrrisikos - der Fall nach Steuern
01-10	Gyöngyi Bugàr Raimond Maurer	International Equity Portfolios and Currency Hedging: The Viewpoint of German and Hungarian Investors
01-09	Erich Kirchler Boris Maciejovsky Martin Weber	Framing Effects on Asset Markets - An Experimental Analysis -

Nr.	Author	Title
01-08	Axel Börsch-Supan Alexander Ludwig Joachim Winter	Aging, pension reform, and capital flows: A multi-country simulation model
01-07	Axel Börsch-Supan Annette Reil-Held Ralf Rodepeter Reinhold Schnabel Joachim Winter	The German Savings Puzzle
01-06	Markus Glaser	Behavioral Financial Engineering: eine Fallstudie zum Rationalen Entscheiden
01-05	Peter Albrecht Raimond Maurer	Zum systematischen Vergleich von Rentenversicherung und Fondsentnahmeplänen unter dem Aspekt des Kapitalverzehrrisikos
01-04	Thomas Hintz Dagmar Stahlberg Stefan Schwarz	Cognitive processes that work in hindsight: Meta-cognitions or probability-matching?
01-03	Dagmar Stahlberg Sabine Sczesny Friederike Braun	Name your favourite musician: Effects of masculine generics and of their alternatives in german
01-02	Sabine Sczesny Sandra Spreemann Dagmar Stahlberg	The influence of gender-stereotyped perfumes on the attribution of leadership competence
01-01	Geschäftsstelle	Jahresbericht 2000
00-51	Angelika Eymann	Portfolio Choice and Knowledge
00-50	Oliver Kirchkamp Rosemarie Nagel	Repeated Game Strategies in Local and Group Prisoner's Dilemma
00-49	Thomas Langer Martin Weber	The Impact of Feedback Frequency on Risk Taking: How general is the Phenomenon?
00-48	Niklas Siebenmorgen Martin Weber	The Influence of Different Investment Horizons on Risk Behavior

Nr.	Author	Title
00-47	Roman Inderst Christian Laux	Incentives in Internal Capital Markets
00-46	Niklas Siebenmorgen Martin Weber	A Behavioral Approach to the Asset Allocation Puzzle
00-45	Thomas Langer Rakesh Sarin Martin Weber	The Retrospective Evaluation of Payment Sequences: Duration Neglect and Peak-and-End-Effects
00-44	Axel Börsch-Supan	Soziale Sicherung: Herausforderungen an der Jahrhundertwende
00-43	Rolf Elgeti Raimond Maurer	Zur Quantifizierung der Risikoprämien deutscher Versicherungsaktien im Kontext eines Multifaktorenmodells
00-42	Martin Hellwig	Nonlinear Incentive Contracting in Walrasian Markets: A Cournot Approach
00-41	Tone Dieckmann	A Dynamic Model of a Local Public Goods Economy with Crowding
00-40	Claudia Keser Bodo Vogt	Why do experimental subjects choose an equilibrium which is neither risk nor payoff dominant
00-39	Christian Dustmann Oliver Kirchkamp	The Optimal Migration Duration and Activity Choice after Re-migration
00-38	Niklas Siebenmorgen Elke U. Weber Martin Weber	Communicating Asset Risk: How the format of historic volatility information affects risk perception and investment decisions
00-37	Siegfried K. Berninghaus	The impact of monopolistic wage setting on innovation and market structure
00-36	Siegfried K. Berninghaus Karl-Martin Ehrhart	Coordination and information: Recent experimental evidence
00-35	Carlo Kraemer Markus Nöth Martin Weber	Information Aggregation with Costly Information and Random Ordering: Experimental Evidence

Nr.	Author	Title
00-34	Markus Nöth Martin Weber	Information Aggregation with Random Ordering: Cascades and Overconfidence
00-33	Tone Dieckmann Ulrich Schwalbe	Dynamic Coalition Formation and the Core
00-32	Martin Hellwig	Corporate Governance and the Financing of Investment for Structural Change
00-31	Peter Albrecht Thorsten Göbel	Rentenversicherung versus Fondsentnahmepläne, oder: Wie groß ist die Gefahr, den Verzehr des eigenen Vermögens zu überleben?
00-30	Roman Inderst Holger M. Müller Karl Wärneryd	Influence Costs and Hierarchy
00-29	Dezsö Szalay	Optimal Delegation
00-28	Dezsö Szalay	Financial Contracting, R&D and Growth
00-27	Axel Börsch-Supan	Rentabilitätsvergleiche im Umlage- und Kapitaldeckungsverfahren: Konzepte, empirische Ergebnisse, sozialpolitische Konsequenzen
00-26	Axel Börsch-Supan Annette Reil-Held	How much is transfer and how much insurance in a pay-as-you-go system? The German Case.
00-25	Axel Börsch-Supan	Rentenreform und die Bereitschaft zur Eigenvorsorge: Umfrageergebnisse in Deutschland
00-24	Christian Ewerhart	Chess-like games are dominancesolvable in at most two steps
00-23	Christian Ewerhart	An Alternative Proof of Marshallś Rule
00-22	Christian Ewerhart	Market Risks, Internal Models, and Optimal Regulation: Does Backtesting Induce Banks to Report Their True Risks?
00-21	Axel Börsch-Supan	A Blue Print for Germany's Pension Reform
00-20	Axel Börsch-Supan	Data and Research on Retirement in Germany

Nr.	Author	Title
00-19	Henning Plessner Tilmann Betsch	Sequential effects in important sport-decisions: The case of penalties in soccer
00-18	Susanne Haberstroh Ulrich Kühnen Daphna Oyserman Norbert Schwarz	Is the interdependent self a better communicator than the independent self? Self-construal and the observation of conversational norms
00-17	Tilmann Betsch Susanne Haberstroh Connie Höhle	Explaining and Predicting Routinized Decision Making: A Review of Theories
00-16	Susanne Haberstroh Tilmann Betsch Henk Aarts	When guessing is better than thinking: Multiple bases for frequency judgments
00-15	Axel Börsch-Supan Angelika Eymann	Household Portfolios in Germany
00-14	Annette Reil-Held	Einkommen und Sterblichkeit in Deutschland: Leben Reiche länger?
00-13	Nikolaus Beck Martin Schulz	Comparing Rule Histories in the U.S. and in Germany: Searching for General Principles of Organizational Rules
00-12	Volker Stocké	Framing ist nicht gleich Framing. Eine Typologie unterschiedlicher Framing-Effekte und Theorien zu deren Erklärung
00-11	Oliver Kirchkamp Rosemarie Nagel	Local and Group Interaction in Prisoners' Dilemmas
00-10	Oliver Kirchkamp Benny Moldovanu	An experimental analysis of auctions with interdependent valuations
00-09	Oliver Kirchkamp	WWW Experiments for Economists, a Technical Introduction
00-08	Alain Chateauneuf Alain Chateauneuf	Organizational Learning through Rule Adaptation: From the Behavioral Theory to Transactive Organizational Learning

Nr.	Author	Title
00-07	Raimond Maurer Steffen Sebastian	Inflation Risk Analysis of European Real Estate Securities
00-06	Martin Hellwig	Costly State Verification: The Choice Between Ex Ante and Ex Post Verification Mechanisms
00-05	Peter Albrecht Raimond Maurer	100% Aktien zur Altersvorsorge - Über die Langfristrisiken einer Aktienanlage
00-04	Douglas Gale	Aging and the Pension Crisis: Flexibilization through Capital Markets
00-03	Axel Börsch-Supan	Data and Research on Saving in Germany
00-02	Raimond Maurer Alexander Mertz	Internationale Diversifikation von Aktien- und Anleiheportfolios aus der Perspektive deutscher Investoren
00-01	Office SFB504	Jahresbericht 1999
99-89	Holger M. Müller Roman Inderst	Project Bundling, Liquidity Spillovers, and Capital Market Discipline
99-88	Raimond Maurer Gyöngyi Bugàr	Efficient Risk Reducing Strategies by International Diversification: Evidence from a Central European Emerging Market
99-87	Berit Ernst Alfred Kieser	In Search of Explanations for the Consulting Explosion. A Critical Perspective on Managers' Decisions to Contract a Consultancy
99-86	Martin Hellwig Andreas Irmen	Wage Growth, Productivity Growth, and the Evolution of Employment
99-85	Siegfried K. Berninghaus Werner Gueth Claudia Keser	Decentralized or Collective Bargaining in a Strategy Experiment
99-84	Jan Vleugels	Bidding Against an Unknown Number of Competitors With Affiliated Information
99-83	Stefan Schwarz Ulf-Dietrich Reips	Drop-out wegen JavaScript:

Nr.	Author	Title
99-82	Holger M. Müller Karl Wärneryd	Inside vs Outside Ownership - A Political Theory of the Firm
99-81	Ralf Rodepeter Joachim Winter	Rules of thumb in life-cycle savings models
99-80	Michael Adam Raimond Maurer	Risk Value Analysis of Covered Short Call and Protective Put Portfolio Strategies
99-79	Peter Albrecht	Rendite oder Sicherheit in der Altersversorgung - unvereinbare Gegensätze?
99-78	Karsten Fieseler	The Efficient Bilateral Trade of an Indivisible Good: Successively Arriving Information
99-77	Karsten Fieseler	Optimal Leasing Durations: Options for Extension
99-76	Peter Albrecht Raimond Maurer	Zur Bedeutung einer Ausfallbedrohtheit von Versicherungskontrakten - ein Beitrag zur Behavioral Insurance
99-75	Benny Moldovanu Aner Sela	The Optimal Allocation of Prizes in Contests
99-74	Phillipe Jehiel Benny Moldovanu	Efficient Design with Interdependent Valuations
99-73	Phillipe Jehiel Benny Moldovanu	A Note on Revenue Maximization and Efficiency in Multi-Object Auctions
99-72	Eva Brit Kramer Martin Weber	Über kurz oder lang - Spielt der Anlagehorizont eine berechtigte Rolle bei der Beurteilung von Investments?
99-71	Karsten Fieseler Thomas Kittsteiner Benny Moldovanu	Partnerships, Lemons and Efficient Trade
99-70	Dagmar Stahlberg Sabine Sczesny Stefan Schwarz	Exculpating Victims and the Reversal of Hindsight Bias

Nr.	Author	Title
99-69	Karl-Martin Ehrhart Claudia Keser	Mobility and cooperation: on the run
99-68	Roman Inderst Holger M. Müller	Delegation of Control Rights, Ownership Concentration, and the Decline of External Finance
99-67	Eric Igou Herbert Bless Michaela Wänke	Ursachen der Verwässerung oder: Konversationslogische Aspekte des "Dilution-Effektes"
99-66	Stefan Schwarz Dagmar Stahlberg	Auswirkungen des Hindsight Bias auf ökonomische Entscheidungen
99-65	Susanne Abele Karl-Martin Ehrhart	Why Timing Matters: Differential Effects of Uncertainty about the Outcome of Past versus Current Events
99-64	Thomas Langer Martin Weber	Prospect-Theory, Mental Accounting and Differences in Aggregated and Segregated Evaluation of Lottery Portfolios
99-63	Andreas Laschke Martin Weber	Der "Overconfidence Bias" und seine Konsequenzen in Finanzmärkten
99-62	Nikolaus Beck Peter Walgenbach	From Statistical Quality Control, over Quality Systems to Total Quality Management - The Institutionalization of a New Management Approach
99-61	Paul Povel Michael Raith	Endogenous Debt Contracts With Undistorted Incentives
99-60	Nikolaus Beck Alfred Kieser	Unspectacular Organizational Change in Normal Times: Rule Change as a Routine Activity
99-59	Roman Inderst Holger M. Müller	Why Peaches Must Circulate Longer than Lemons
99-58	Roman Inderst	Bargaining with Sequential Buyers under Incomplete Information
99-57	Roman Inderst	Bargaining with a Possibly Committed Seller

Nr.	Author	Title
99-56	Roman Inderst	Efficiency Wages under Adverse Selection and the Role of Rigid Wages
99-55	Daniel Probst	Evolution, Automata and Repeated Games
99-54	Christian Laux Daniel Probst	The Ambiguous Effects of Rankings: Strategically Biased Forecasting by Advisers
99-53	Martin Hellwig Andreas Irmen	Endogenous Technical Change in a Competitive Economy
99-52	Roman Inderst Holger M. Müller	Competitive Search Markets with Adverse Selection
99-51	Abdolkarim Sadrieh Werner Gueth Peter Hammerstein Stevan Harnard Ulrich Hoffrage Bettina Kuon Betrand R. Munier Peter M. Todd Massimo Warglien Martin Weber	Is there evidence for an adaptive toolbox?
99-50	Ulrich Hoffrage Gerd Gigerenzer	How to Foster Diagnostic Insight in Experts
99-49	Martin Lages Ulrich Hoffrage Gerd Gigerenzer	Intransitivity of fast and frugal heuristics
99-48	Axel Börsch-Supan Joachim Winter	Pension reform, savings behavior and corporate governance
99-47	Craig R. Fox Martin Weber	Ambiguity Aversion, Comparative Ignorance, and the Role of Context
99-46	Manfred Hassebrauck Cornelia Vogt Michael Diehl	Der Einfluß von Prototypen auf die Informationssuche bei Entscheidungen

Nr.	Author	Title
99-45	Manfred Hassebrauck Cornelia Vogt Michael Diehl	Das "prototype matching"-Modell des Entscheidungsverhaltens: Der Einfluß kognitiver Belastung, Zeitdruck und Stimmung
99-44	Axel Börsch-Supan Patrizia Tumbarello Robert Palacios	Pension systems in the Middle East and North Africa: A window of opportunity
99-43	Reinhold Schnabel	Vermögen und Ersparnis im Lebenszyklus in Westdeutschland
99-42	Reinhold Schnabel	The Declining Participation in the German PAYG-Pension System
99-41	Reinhold Schnabel	Social Security Reform and Intergenerational Redistribution in Germany
99-40	Reinhold Schnabel	The Golden Years of Social Security – Life-cycle Income, Pensions and Savings in Germany
99-39	Stefan Schwarz Sabine Sczesny Dagmar Stahlberg	Der Hindsight Bias bei gustatorischen Entscheidungen
99-38	Axel Börsch-Supan Annette Reil-Held	Family Resources in Retirement. Germany
99-37	Axel Börsch-Supan Rob Euwals Angelika Eymann	Portfolio Choice with Behavioral Decision Mechanisms
99-36	Axel Börsch-Supan	Template for International Savings Comparisons Project
99-35	Stefan Schwarz Dagmar Stahlberg	Hindsight Bias: The Role of Perfect Memory and Meta-Cognitions
99-34	Dagmar Stahlberg Stefan Schwarz	Would I Have Known It All Along if I Would Hate to Know It? The Hindsight Bias in Situations of High and Low Self Esteem Relevance

Nr.	Author	Title
99-33	Ulrich Hoffrage Ralph Hertwig Gerd Gigerenzer	Hindsight Bias: A By-product of Knowledge Updating
99-32	Ralph Hertwig Ulrich Hoffrage	Begrenzte Rationalität: Die Alternative zu Laplace'schen und schlechter Software
99-31	Raimond Maurer Ulrich Hoffrage	An Expected Utility Approach to Probabilistic Insurance: A Comment on Wakker, Thaler and Tversky (1997)
99-30	Henning Plessner Susanne Haberstroh Tilmann Betsch	The effects of affect-based attitudes on judgment and decision making
99-29	Tilmann Betsch Andreas Glöckner Susanne Haberstroh	A Micro-World Simulation to Study Routine Maintenance and Deviation in Repeated Decision Making
99-28	Jan Walliser Joachim Winter	Tax incentives, bequest motives and the demand for life insurance: evidence from Germany
99-27	Joachim Winter	Ökonometrische Analyse diskreter dynamischer Entscheidungsprozesse
99-26	Gerd Bohner Dagmar Stahlberg Dieter Frey	Einstellungen
99-25	Ulrich Hoffrage Martin Weber Ralph Hertwig Valerie Chase	How to keep children save in traffic: Find the daredevils while they are young.
99-24	Elke Kurz Gerd Gigerenzer Ulrich Hoffrage	Representations of uncertainty and change: Three case studies with experts
99-23	Stefan Krauss Laura Martignon Ulrich Hoffrage	Simplifying Bayesian Inference: The General Case

Nr.	Author	Title
99-22	Ulrich Hoffrage, Ralph Hertwig	Hindsight Bias: A Price Worth Paying for Fast and Frugal Memory
99-21	Ulrich Hoffrage	Irren ist wahrscheinlich. Medizinische Experten und Laien bewerten Risiken oft falsch.
99-20	Claudia Keser, Jean-Louis Rulliére, Marie-Claire Villeval	Union Bargaining Strength as a Public Good: Experimental Evidence
99-19	Rüdiger F. Pohl, Dagmar Stahlberg, Dieter Frey	I'm not trying to impress you, but I surely knew it all along! Self-presentation and hindsight bias
99-18	Dagmar Stahlberg, Lars-Eric Petersen, Dirk Dauenheimer	Preferences for and Evaluation on Self-Relevant Information Depending on the Elaboration of the Self-Schemata Involved
99-17	Rob Euwals	Do mandatory pensions decrease household savings? Evidence for the Netherlands.
99-16	Roman Inderst	A Note on the Strategic Foundation of Competitive Equilibrium in Buyer Markets
99-15	Michael Adam, Raimond Maurer	An Empirical Test of Risk-Adjusted Performance of Call Option Writing and Put Option Buying Hedge-Strategies
99-14	Annette Reil-Held, Reinhold Schnabel	Vom Arbeitsmarkt in den Ruhestand: Die Einkommen deutscher Rentner und Rentnerinnen
99-13	Peter Walgenbach	Das Konzept der Vertrauensorganisation - Eine theoriegeleitete Betrachtung
99-12	Herbert Bless, Michaela Wänke	Can the same information be typical and atypical? How perceived typicality moderates assimilation and contrast in evaluative judgements
99-11	Eric Igou, Herbert Bless, Wolfram Schenck	Stärkere Framing Effekte durch mehr Nachdenken? Einflüsse der Bearbeitungszeit auf Lösungen des "Asian-disease"-Problems

Nr.	Author	Title
99-10	Dirk Dauenheimer, Dagmar Stahlberg, Sandra Spreemann, Constantine Sedikides	Self-Enhancement, Self-Verification, or Self-Assessment? The Intricate Role of Trait Modifiability in the Self-Evaluation Process
99-09	Cornelia Hegele, Peter Walgenbach	Was kann der Apfel von der Birne lernen, oder wozu brauchen Unternehmen Benchmarking?
99-08	Michaela Wänke	Assimilation and Contrast as a Function of the direction of Comparison
99-07	Michael Woywode	Ein lerntheoretisches Modell zur Erklärung der Unternehmensent-wicklung
99-06	Tilmann Betsch, Susanne Haberstroh, Andreas Glöckner, Klaus Fiedler	The Pros and Cons of Expertise: Routine Strength and Adaptation in Recurrent Acquisition and Disposal Decisions
99-05	Ulrich Koch	Regeländerungsprozesse und organisatorisches Lernen: Zum Übergang individueller Erfahrungen in eine organisationale Wissensbasis
99-04	Alfred Kieser, Ulrich Koch, Michael Woywode	Wie man Bürokratien das Lernen beibringt
99-03	Joachim Winter	Strukturelle ökonometrische Verfahren zur Analyse von Renteneintrittsentscheidungen
99-02	Axel Börsch-Supan, Annette Reil-Held, Ralf Rodepeter, Reinhold Schnabel, Joachim Winter	Ersparnisbildung in Deutschland: Meßkonzepte und Ergebnisse auf Basis der EVS
99-01	Office SFB504	Jahresbericht 1998
98-61	Siegfried K. Berninghaus, Karl-Martin Ehrhart	Long-run Evolution of Local Interaction Structures in Games

Nr.	Author	Title
98-60	Isabel Gödde, Reinhold Schnabel	Does Family Background Matter? - Returns to Education and Family Characteristics in Germany
98-59	Holger M. Müller	Why Tender Offers Should be Financed with Debt
98-58	Ralf Rodepeter, Joachim Winter	Savings decisions under life-time and earnings uncertainty:
98-57	Thomas Langer, Martin Weber	Entscheidungsanalyse
98-56	Reinhold Schnabel	Rates of Return of the German Pay-As-You-Go Pension System
98-55	Raimond Maurer, Steffen Sebastian	Immobilienfonds und Immobilienaktiengesellschaften als finanzwirtschaftliche Substitute für Immobiliendirektanlagen
98-54	Michaela Wänke, Herbert Bless, Eric Igou	Next to a star: Paling, shining or both? Turning inter-exemplar contrast into inter-exemplar assimilation
98-53	Gerd Gigerenzer, Laura Martignon, Ulrich Hoffrage, Joerg Rieskamp, Jean Czerlinski, Dan G. Goldstein	One-reason decision making.
98-52	Gerd Gigerenzer, Ralph Hertwig, Ulrich Hoffrage, Peter Sedlmeier	Cognitive illusions reconsidered
98-51	Gerd Gigerenzer, Ulrich Hoffrage	Overcoming Difficulties in Bayesian Reasoning: A Reply to Lewis & Keren and Mellers & McGraw
98-50	Roman Inderst	Signaling in a Search Market
98-49	Paul Povel, Michael Raith	Liquidity Constraints, Production Costs and Output Decisions

Nr.	Author	Title
98-48	Joachim Winter	Does Firms' Financial Status Affect Plant-Level Investment and Exit Decision
98-47	Michele Bernasconi, Oliver Kirchkamp	Why monetary policy matters — An experimental study of saving, inflation and monetary policies in an overlapping generations model
98-46	Oliver Kirchkamp	Simultaneous Evolution of Learning Rules and Strategies
98-45	Martin Weber, Jan Pieter Krahnen, Frank Voßmann	Risikomessung im Kreditgeschäft: Eine empirische Analyse bankinterner Ratingverfahren
98-44	Axel Börsch-Supan	Anreizprobleme in der Renten- und Krankenversicherung
98-43	Martin Hellwig	On the Economics and Politics of Corporate Finance and Corporate Control
98-42	Axel Börsch-Supan	Demographie, Entwicklung und Stabilität der Sozialversicherung in Deutschland
98-41	Axel Börsch-Supan	Zur deutschen Diskussion eines Übergangs vom Umlage- zum Kapitaldeckungsverfahren in der Gesetzlichen Rentenversicherung
98-40	Axel Börsch-Supan	A Model under Siege: A Case Study of the Germany Retirement Insurance System
98-39	Martin Hellwig	Financial Intermediation with Risk Aversion
98-38	Martin Hellwig	Risk Aversion and Incentive Compatibility with Ex Post Information Asymmetry
98-37	Roman Inderst, Christian Pfeil	Duopolistic Competition in Search Markets
98-36	Roman Inderst	Incentives Schemes as a Signaling Device
98-35	Roman Inderst	Multi-Issue Bargaining with Endogenous Agenda
98-34	Roman Inderst	Competition Drives Up Prices

Nr.	Author	Title
98-33	Roman Inderst	A Note on the Limited Value of Time for Screening
98-32	Roman Inderst	Screening With Endogenous Reservation Values
98-31	Paul Povel	optimal bankruptcy laws
98-30	Martin Hellwig	Systemische Risiken im Finanzsektor
98-29	Axel Börsch-Supan	Incentive Effects of Social Security on Labor Force Participation: Evidence in Germany and Across Europe
98-22	Phillipe Jehiel Benny Moldovanu	Efficient Design with Interdependent Valuations
98-21	Benny Moldovanu Aner Sela	Patent Licensing to Bertrand Competitors
98-20	Alfred Kieser	How Management Science, Consultancies and Business Companies (Do not) Learn from Each Other. Applying Concepts of Learning to Different Types of Organizations and to Interorganizational Learning
98-16	Tilmann Betsch Babette Brinkmann Klaus Fiedler Katja Breining	When prior knowledge overrules new evidence: Adaptive use of decision strategies and role behavioral routines
98-15	Klaus Fiedler	Illusory Correlations: Explicating and Stimulating Their Apparent and Less Apparent Origins
98-14	Klaus Fiedler Babette Brinkmann Tilmann Betsch Beate Wild	A Sampling Approach to Biases in Conditional Probability Judgments: Beyond Baserate-Neglect and Statistical Format
98-13	Tilmann Betsch Stefan Krauss	Eine Kritik an der klassischen Framing - Studie, eine konzeptuelle Replikation und eine Bewertung der Prospect Theory.

Nr.	Author	Title
98-12	Siegfried K. Berninghaus Karl-Martin Ehrhart Claudia Keser	Conventions and Local Interaction Structures: Experimental Evidence
98-11	Michael Kilka Martin Weber	What Determines the Shape of the Probability Weighting Function under Uncertainty?
98-10	Tilmann Betsch Frank Siebler Peter Marz Stefan Hormuth Dorothee Dickenberger	The moderating role of category salience and category focus in judgments of set size and frequency of occurence.
98-08	Peter Albrecht	Alterssicherung und Vorsorgebedarf im Spannungsfeld von Versicherungs- und Investmentprodukten
98-07	Axel Börsch-Supan Annette Reil-Held Reinhold Schnabel	Pension Provision in Germany
98-06	Martin Hellwig Klaus M. Schmidt	Discrete-Time Approximations of the Holmström-Milgrom Brownian-Motion, Model of Intertemporal Incentive Provision
98-05	Tilmann Betsch G. - M. Biel C. Eddelbuettel A. Mock	Natural sampling and base-rate neglect
98-04	Martin Hellwig	Allowing for Risk Choices in Diamond's "Financial Intermediation as Delegated Monitoring"
98-03	Martin Weber Lukas Mangelsdorff	Hindsight-Bias im Prinzipal-Agent-Kontext: Die Aktennotiz als Antwort?
98-02	Alfred Kieser Nikolaus Beck Risto Tainio	Limited Rationality, Formal Organizational Rules, and Organizational Learning (OL)
98-01	Office SFB504	Sonderforschungsbereich 504 Jahresbericht 1998

Nr.	Author	Title
97-44	Raimond Maurer Michael Adam	Analytische Evaluation des Risiko-Chance-Profils kombinierter Aktien- und Optionsstrategien
97-43	Holger M. Müller	The Mirrlees-Problem Revisited
97-42	Annette Reil-Held	Bequests and Aggregate Wealth Accumulation in Germany
97-41	Axel Börsch-Supan	Übergangsmodelle vom Umlage - zum Kapitaldeckungsverfahren in der deutschen Rentenversicherung
97-40	Siegfried K. Berninghaus Karl-Martin Ehrhart Claudia Keser	The invisible hand: Experiments on strategy selection in population games
97-39	Axel Börsch-Supan Annette Reil-Held	Retirement Income: Level, Risk, and Substitution Among Income Components
97-38	Holger M. Müller	The First-Best Sharing Rule in the Continuous-Time Principal-Agent Problem with Exponential Utility
97-37	Holger M. Müller	Randomization in Dynamic Principal-Agent Problems
97-36	Gyöngyi Bugàr Raimond Maurer	International Portfolio Diversification for European countries: The viewpoint of Hungarian and German investors
97-35	Martin Hellwig	Banks, Markets, and the Allocation of Risks in an Economy
97-34	Nikolaus Beck Alfred Kieser	Standard Operating Procedures and Organizational Learning
97-33	Thomas Langer Peter Waller	Implementing Behavioral Concepts into Banking Theory: The Impact of Loss Aversion on Collateralization
97-32	Guenther Franke Martin Weber	Risk-Value Efficient Portfolios and Asset Pricing

Nr.	Author	Title
97-31	Axel Börsch-Supan	Das deutsche Rentenversicherungssystem: Probleme und Perspektiven
97-30	Claudia Keser Marc Willinger	Principals
97-29	Siegfried K. Berninghaus Karl-Martin Ehrhart Claudia Keser	Coordination Games: Recent Experimental Results
97-28	Peter Albrecht	A Stochastic Approach for the Quantification of Default Risk of OTC-Financial Derivatives
97-27	Dagmar Stahlberg A. Maass	Hindsight bias: Impaired memory or biased reconstruction?
97-26	Manfred Hassebrauck Cornelia Vogt Michael Diehl	Das "prototype matching"-Modell des Entscheidungsverhaltens: Darstellung des Modells und erste Ergebnisse
97-24	Claudia Keser	SUPER: Strategies used in public goods experimentation rounds
97-23	Axel Börsch-Supan	Germany: A social security system on the verge of collaps
97-22	Axel Börsch-Supan	Privatisierungsmöglichkeiten der Sozialversicherung in Europa
97-21	Axel Börsch-Supan	Capital productivity and the nature of competition
97-20	Axel Börsch-Supan Reinhold Schnabel	Social security and retirement in germany
97-19	Raimond Maurer	Ertrag und Shortfall Risiko von Wertsicherungsstrategien mit Optionen unter alternativen Zielrenditen: Empirische Evidenzen für den deutschen Aktienmarkt
97-18	Peter Albrecht	Risk based capital allocation and risk adjusted performance management in property/liability-insurance: A risk theoretical framework

Nr.	Author	Title
97-17	Peter Albrecht Raimond Maurer Matthias Möller	Shortfall-Risiko/Excess-Chance-Entscheidungskalküle: Grundlagen und Beziehungen zum Bernoulli-Prinzip
97-16	Claudia Keser Karl-Martin Ehrhart Siegfried K. Berninghaus	Coordination and local interaction: Experimental evidence
97-15	Herbert Bless Tilmann Betsch Axel Franzen	Framing the framing effect: The impact of context cues on solutions to the "asian disease" problem
97-14	Michael Kilka Martin Weber	Home Bias in International Stock Return Expectation
97-13	Jan Vleugels	Bidding against an unknown number of competitiors sharing affiliated information
97-12	Dov Monderer Aner Sela	Fictitious play and- no-cycling conditions
97-11	S. Hon-Suir Dov Monderer Aner Sela	A learning approach to auctions
97-10	Karl H. Schlag Aner Sela	You play (an auction) only once
97-09	Aner Sela	One against all in the fictitious play process
97-08	Benny Moldovanu	William Vickrey und die Auktionstheorie - Anmerkungen zum Nobelpreis 1996
97-07	M. Tietzel Benny Moldovanu	Goethe
97-06	Phillipe Jehiel Benny Moldovanu	Auctions with Downstream Interaction among Buyers
97-05	Phillipe Jehiel Benny Moldovanu	Resale Markets and the Assignment of Property Rights

Nr.	Author	Title
97-04	Phillipe Jehiel Benny Moldovanu E. Stacchetti	Multidimensional Mechanism Design for Auctions with Externalities
97-03	Karsten Fieseler	Bidding for unit-price contracts - How craftsmen should bid
97-02	Martin Hellwig	Unternehmensfinanzierung, Unternehmenskontrolle und Ressourcenallokation: Was leistet das Finanzsystem?
97-01	Ralf Rodepeter	Identifikation von Sparprofilen im Lebenszyklus
	Daniel Schunk	The Pennsylvania Reemployment Bonus Experiments: How a survival model helps in the analysis of the data
	Volker Stocké	Measuring Information Accessibility and Predicting Response-Effects: The Validity of Response-Certainties and Response-Latencies
	Volker Stocké Bettina Langfeldt	Umfrageeinstellung und Umfrageerfahrung. Die relative Bedeutung unterschiedlicher Aspekte der Interviewerfahrung für die generalisierte Umfrageeinstellung