Monetary incentives in the loss domain
An experimental comparison of three rewarding schemes including real losses

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The status of monetary incentives in economics

- **A drawing line between experimental economists and decision theorists**
  - Some flexibility among the latter
  - Some intransigency among the former
  - A symptomatic feature: publications! The lack of monetary incentives seems to be a sufficient reason to motivate a rejection in most economic journals

- **The usual argument among economists**
  - The decision maker is an ***homo economicus*** who does not think/work hard unless she is paid and sufficiently paid for that

    Davis and Holt (1993); Gibbons (1997); Harrison (1994); Lazear (2000); Smith (1976); Smith and Levin (1996)

    - Without any performance-based procedure, subjects will not make any effort when answering the questions
    - Without any (cognitive) effort, poor performance and unreliable data

  - **Empirically**, monetary incentives seem to **reduce the variance** of the data and **favour convergence towards optimality**

    Hertwig and Ortmann (2001); Burke (1996); Harrison and Rutström (2004); van Wallendael and Guignard (1992)

Some counterarguments (1)

- **The link between monetary incentives, effort and performance is not so tight**

  - **(Extrinsic) monetary incentives do not (always) affect effort**, while intrinsic motivation does

    Bonner and Sprinkle (2002); Camerer (1995); Henrich (2001); Lee, Locke and Phan (1997); Ryan and Deci (2000)

  - **Effort does not (always) improve performance** (due to cognitive limitations, for instance)

    Camerer (1992); Tversky and Kahneman (1992)

Some counterarguments (2)

- **Monetary incentives may be detrimental to intrinsic motivation and reduce performance**
  - **Monetary incentives are likely to harm intrinsic motivation and be detrimental to effort, thus to performance**

    Baron (2000); Deci, Koestner and Ryan (1999); Frey (1997); Frey and Oberholzer-Gee (1997); Gneezy and Rustichini (2000); Kreps (1997)

  - **Monetary incentives may result in greater effort … but lower performance**, be it:
    - because capital is more important than labor for the task under consideration

      Camerer and Hogarth (1999)

    - because incentives induce some distorsive rationalization of an intuition-based decision

      Haberstroh, Betsch and Aarts (2000); Slovic et al. (2004); Wilson and Schooler (1991)

A question that is still in debate

- Somewhat **contradictory meta-analytic** studies or surveys:

  Bonner and Sprinkle (2002), Camerer and Hogarth (1999), Hertwig and Ortmann (2001), Jenkins et al. (1998), Read (2005) ...

- **Holt and Laury (2002)'s well-known recent study**:
  - Directly confronts Kahneman and Tversky (1979)'s claim that hypothetical choices are a good proxy of real choices.
  - Show that real incentives change behavior (towards more RA).
  - But also a much criticized study (Heinemann, 2003; Harrison, Johnson, McInnes & Rutström, 2005)

- In question: **opportunistic samples**, the selection of the subjects may sharply influence the results

  Hertwig and Ortmann (2007)

- Moderate incentives seem to improve performance, but **high incentives appear to decrease it**

  Pokorny (2007)

The positioning of our study

- Evaluate the impact of incentives on a kind of behaviour for which no performance criterium exists: **behaviour towards risk**
- Evaluate the impact of incentives in a specific domain: the **loss domain** (delicate implementation of incentives)
- Compare some **simple** procedures that can be easily reproduced in any experiment

→ We are **not testing any sophisticated procedure**

→ **Focus on a very specific point**

→ **No claim to provide a definitive answer to the complex incentive question *in general***

A specific case: experimenting over losses (1)

- **An ethical difficulty**: Making subjects lose their own money is ethically questionable

- **A first practical difficulty**: Most subjects may not accept to take part in an experiment that may make them lose their own money

- **A second practical difficulty**: Hypothetical choices are often considered as … non realistic, thus leading to meaningless and unreliable data.

  e.g.: Cox and Grether (1996), Harrison (1994), Kühberger et al. (2002)

A specific case: experimenting over losses (2)

- **A third practical difficulty**: The most natural procedure (an initial endowment from which subjects can lose without losing their own money) can be subject to some biases, and especially a « house money » effect (Thaler and Johnson, 1990)

  Typically, **the 'house money' effect consists in more risk seeking (RS) after a prior gain**

  → Arkes and Blumer (1985), Gärling and Romanus (1997), Romanus et al. (1996), Thaler and Johnson (1990) actually find more RS when a prior gain is introduced

  → Arkes et al. (1988) and Isen and Patrick (1985) find less RS when losses are real

  → Clark (2002) does not find any 'house money' effect either (but: Harrison, 2006 criticizes the statistical analysis of the data)

So: What to do in the loss domain? Which payment scheme to adopt?

Our basic assumption

The random-lottery procedure with real losses is a procedure that allows to capture the subject's genuine preferences

→ we use it as a **benchmark** allowing to evaluate the accuracy of other payment procedures

- Some other studies consider that the genuine real procedure = a procedure involving a unique choice

  Beattie and Loomes (1997)
  Cubitt, Starmer and Sugden (1991, 1998)

- But: cannot be usually considered as an appropriate experimental payment procedure (because experiments never introduce a unique choice).

Qu.1: Are monetary incentives necessary in the loss domain?
OR
Do hypothetical choices differ from real ones?

- Difficult to introduce real losses in an experiment. So:

Can hypothetical losses be considered as an acceptable proxy?

- **The potential bias**: If subjects do not consider hypothetical losses seriously, they may be tempted to take more risks than when they are likely to lose their own money

- **Tested assumption**

A1: Subjects exhibit more RS when choices are hypothetical than real

→ Comparison between hypothetical losses and real losses

(Subsidiary) Qu.2:
Are monetary incentives necessary in the gain domain?
OR
Do hypothetical choices differ from real ones?

- **The potential bias**: If subjects do not consider hypothetical gains seriously, they may be tempted to take more risks (or be less risk averse) than when they are *really* likely to win

- **Tested assumption**

A2: Subjects exhibit more RS when choices are hypothetical than real

→ Comparison between hypothetical gains and real gains

Qu.3: Is the usual loss-with-initial-endowment procedure appropriate? (1)

- Difficult to introduce real losses in an experiment. So:

Can 'covered' losses be considered as an acceptable proxy?

- **Two potential and opposite biases** (Thaler and Johnson, 1990) :

3.1: the « prospect theory with memory » effect

- Subjects may **translate losses into gains** (by substracting each loss from the initial endowment)
- Insofar as people do not treat losses as gains (convex utility vs. concave utility; RS vs. RA), the procedure is biased towards RA

3.2: the « house money » effect

- Subjects may not consider losses as real, and be **playing with house money**
- The procedure is biased towards RS

Qu.3: Is the usual loss-with-initial-endowment procedure appropriate? (2)

- **Tested assumptions**

A3.1: When losses are ‘covered’, subjects

- behave as if they were facing the corresponding gains and
- exhibit **less risk seeking** than when losses are real

→ Comparison between 'covered' losses recoded as gains and the corresponding real gains

A3.2: When losses are ‘covered’, subjects

- exhibit **more risk seeking** than when losses are real

→ Comparison between 'covered losses' and real losses

How to test the four assumptions (and answer the research questions)

	Hypo. losses	Real losses	Cov. losses	Hypo. gains	Real gains
Real losses	**A1**		**A3.2**		
Real gains			**A3.1 (recoded)**	**A2**	

The experimental design (1)

- **A within-subject design**
  - More reliable than a between-subject design
  - But a potential bias: memory effects across sessions

- **A paper-and-pencil series of questionnaires** allowing to investigate:
  - each subject's risk attitude through the determination of certainty equivalents
  - the subjective components of risk attitude (utility, probability weighting)

The experimental design (2)

- **A questionnaire with both loss and gain choice situations**
  - **Hypothetical, real and 'covered' losses, only the incentive procedure differs** (A1, A3.2)
  - **Real gains**:

    → to allow the comparison with 'covered' losses (to see whether people consider ‘covered’ losses as if they were gains and recode them as such) (A3.1)

    AND

    → to make the experiment more attractive!
  - **Hypothetical gains** (as a bonus) :

    → to allow the comparison between real gains and hypothetical ones (A2)
  - To make comparisons possible, gain choice situations are built from loss ones by a **simple translation** (+20 euros, being the initial endowment in the 'covered' treatment)

    Ex: (-5, 0.75; -15, 0.25) is translated into (15, 0.75; 5, 0.25)

The experimental design (3)

- **A gain and a loss part in each questionnaire**
  - Half of the subjects first answer loss (resp. gain) questions
  - To allow the detection of any **order effect**

- **In each part, 2 sub-parts**
  - **1st one**: « Outcome part » → Consequences vary but not probabilities.

    Three different orders to avoid any order effect

    NB: Gains: 75% chances (high p) of winning the highest amount

    Losses: 25% chances (low p) of losing the largest amount

  - **2nd one**: « Probability part » → Probabilities vary but not consequences.

    Same order for every subject (from the lowest to the highest probability)

The experimental design (4)

- **For each subject, the sessions are strictly identical** (same questionnaire, same order)**, except the payment scheme**
  - **Session 1**: hypothetical gains and losses
  - **Session 2**: real gains and losses
  - **Session 3**: hypothetical gains (only for the sake of control) and 'covered' real losses (with an initial endowment)

- **The variables we aim at comparing**
  - **Primarily**: Certainty equivalents
  - **Secondarily**:
    - Utility and probability weighting parameters
    - Probability weights

The experimental procedure (1)

- **46 voluntary subjects**
  - Possible selection bias towards risk seeking (only risk seekers may be interested taking part in such an experiment)
  - But: the typical findings seem to have the same flavour as in previous studies (with even more risk aversion …)
- **Significant gains and losses**
  - Highest gain on the *whole* experiment: 80 euros
  - Largest loss: 20 euros
  - The asymmetry is meant to counter loss aversion and make the experiment attractive
  - The pretty high level of losses is meant to make them matter for the subject
- **12 loss situations and the corresponding 12 gain situations**
  - [-10, -5] and [10, 15], [-20, 0] and [0, 20], etc.
  - + a special gain situation [0, 60] to make the experiment more attractive
- **3 widely time-spaced sessions** (15 days at least between each session, and usually 3 weeks including a vacation)
- **Small groups from 1 to 7 subjects**

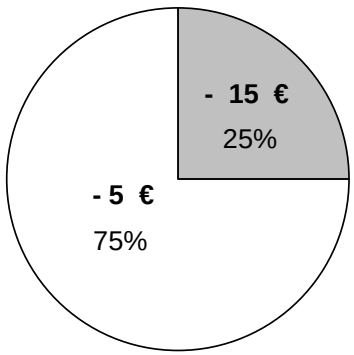
The experimental procedure (2)

- **Two parts (gains/losses) and two sub-parts**
  - **Outcome part**:
    - ✓ Only consequences vary, with p=0.75 for the best consequence in each task)
    - ✓ Allows the estimation of utility function u (using an expo-power parametric form);
  - **Probability part**:
    - ✓ Consequences are kept constant (0/(-)20) while probabilities vary (5 probas from 0.05 to 0.95)
    - ✓ Allows the estimation of probability weighting function w (using Goldstein and Einhorn, 1987 and Prelec, 2000, two-parameter parametric specifications).

- **Controlling for order effects**
  - 18 gain/loss and 18 loss/gain questionnaires to detect a potential order effect between the domains of consequences
  - 3 different questionnaires A, B and C to avoid any order effects across lotteries in the « outcome part » of the questionnaire
  - Because abrupt changes in probability are cognitively complicated to deal with and tend to result in inconsistencies, the same increasing (from 0.05 to 0.95) order was chosen for everyone in the « probability part » of the questionnaires

- **Checking consistency**
  - **Loss part:** Lottery (0, 0.75; -20) is given in both the outcome and probability parts
  - **Gain part**: Lottery (0, 0.25; 20) is given in both the outcome and probability parts

A typical choice situation

Situation A (aléatoire)		Situation B (certaine)	
	Vous Choisissez A	Vous Choisissez B	
		X	- 5.00 €
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	X		- 15.00 €

Instructions to the subjects (1)

- **The recruitment campaign → only little information about the expe.**
  - Subjects aware they can lose or win
  - They know the probability of winning at the end of the experiment is higher, with a potential gain of 80 euros and a potential loss of 20 euros
  - No information as regards the precise probability of gain and loss
  - No information as regards the content of each session
  - Students who accept to participate must (morally) commit themselves to take part in the whole experiment (no defection actually)

- **Session 1: Hypothetical gains and losses**
  - At the beginning of the session, subjects are informed they will receive a 3 euros flat payment at the end of the session.
  - They are also told they should put themselves in each choice situation and think seriously *as if* they could lose or win for real

Instructions to the subjects (2)

- **Session 2: Real gains and losses**
  - At the beginning of the session, subjects are informed that their final payment will be determined as follows. They will be invited to pick up:
    - a situation among the 25 choice situations (which can be either a gain or loss situation), and then
    - a specific line in the selected choice situation, that will be played for real. Their earnings or losses will depend on the choice they made when fulling in the questionnaire.
  - They are told that their interest is to answer sincerely and to carefully think about their choices

- **Session 3: Hypothetical gains and 'covered' losses**
  - At the beginning of the session, subjects are given a 20 euros endowment and they are informed that their final payment will be determined as follows:
    - Gain situations are only hypothetical
    - A loss situation, and then a question, will be picked up and played for real to determine their final payment as in the second session
    - To help them consider the losses as real losses, they are presented the lotteries as inducing them to potentially *lose an amount* comprised between nothing and 20 euros.

NB: A more sophisticated and theoretically efficient procedure would have been to supply the subjects with the initial endowment a few days, weeks or even months before the experiment (as in Thaler and Johnson, 1990, Laury, 2006 or Bosch-Domenech and Silvestre, 2006 for instance) to minimize integration. But our intention was to use a procedure that could be easily reproduced.

Some general results (1)

- **Subjects' consistency**:
  - Rather good
    - Losses: p = 0.95 in hypo, p = 0.1 in real, p = 0.73 in 'covered'. Consistency is even better in hypothetical choices!!
    - Gains: p = 0.34 in hypo, p = 0.26 in real
  - No difference in consistency between the 3 treatments (Anova and Friedman tests)

- **Order effects:**
  - See whether subjects who answered the loss (resp. gain) part before the loss (resp. gain) part behave differently
  - **No significant effect**

- **Gain/loss effects:**
  - See whether subjects who lost (their own) money in the second session behave differently in the 3rd session as those who have won
  - Mann-Whitney tests on each pair of ECs: **No significant effect**

Some general results (2)

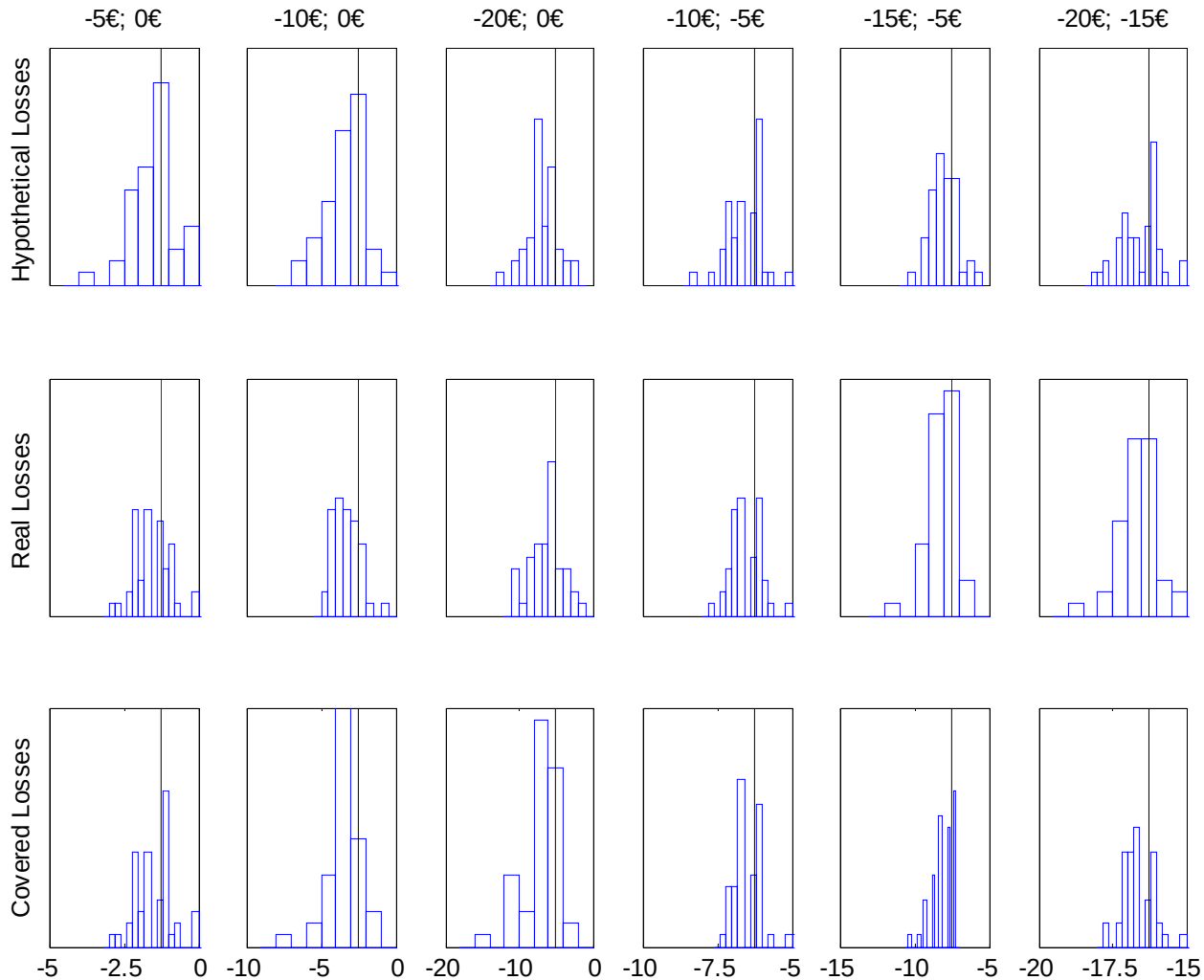
- **Gender effects:**
  - See whether males behave differently as females
  - **No significant effect** → **Pooling of the data**

- **An opportunistic sample? → No apparent selection bias**
  - Subjects' behavior appears to be consistent with the usual fourfold pattern:

	Small probabilities	**High probabilities**
Gains	**Risk seeking (proba. part)**	**Risk aversion (outcome part)**
Losses	**Risk aversion (outcome part)**	**Risk seeking (proba. part)**

  - Utility is convex over losses and concave over gains
  - Underweighting of small probabilities and Overweighting of large probabilities

LOSSES, outcome part: the CE distributions



- EC < EV: risk aversion
- Consistent with the 4-fold pattern: RA in losses with low probability (0.25)

Some statistics

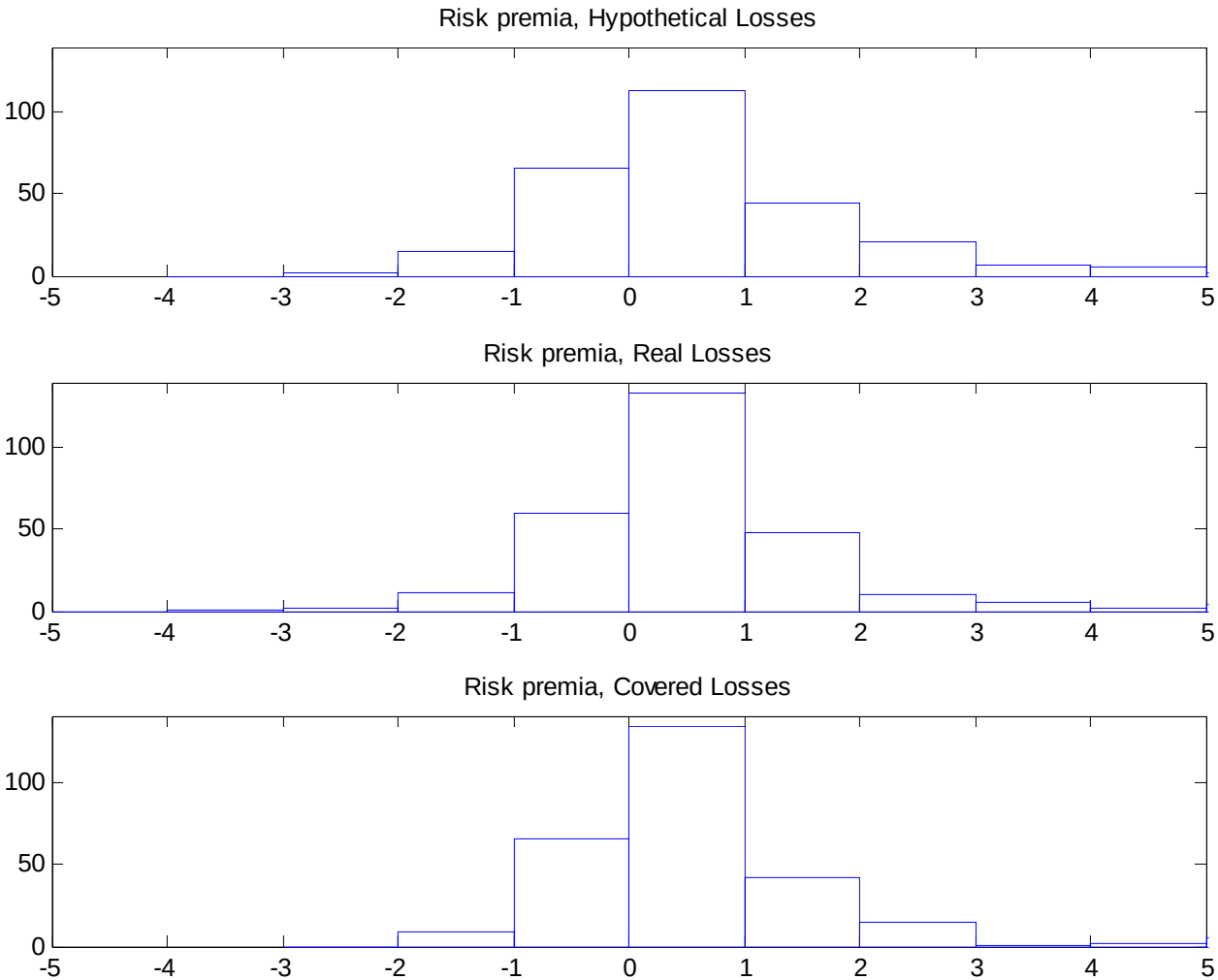
EC by EC

- **Very similar distributions** between the sessions (no significant difference using Kolmogorov-Smirnov tests)
- **Very similar CE between sessions** (Friedman tests all p-values >0.26)
- Less dispersion in the real treatment than in the hypothetical one (as measured by the IQR). But no significant difference in variance (Levene's test)
- Only 1 significant difference ((-15; -10), hypo vs covered) (Wilcoxon tests on pairs of ECs)

Factorial Anovas

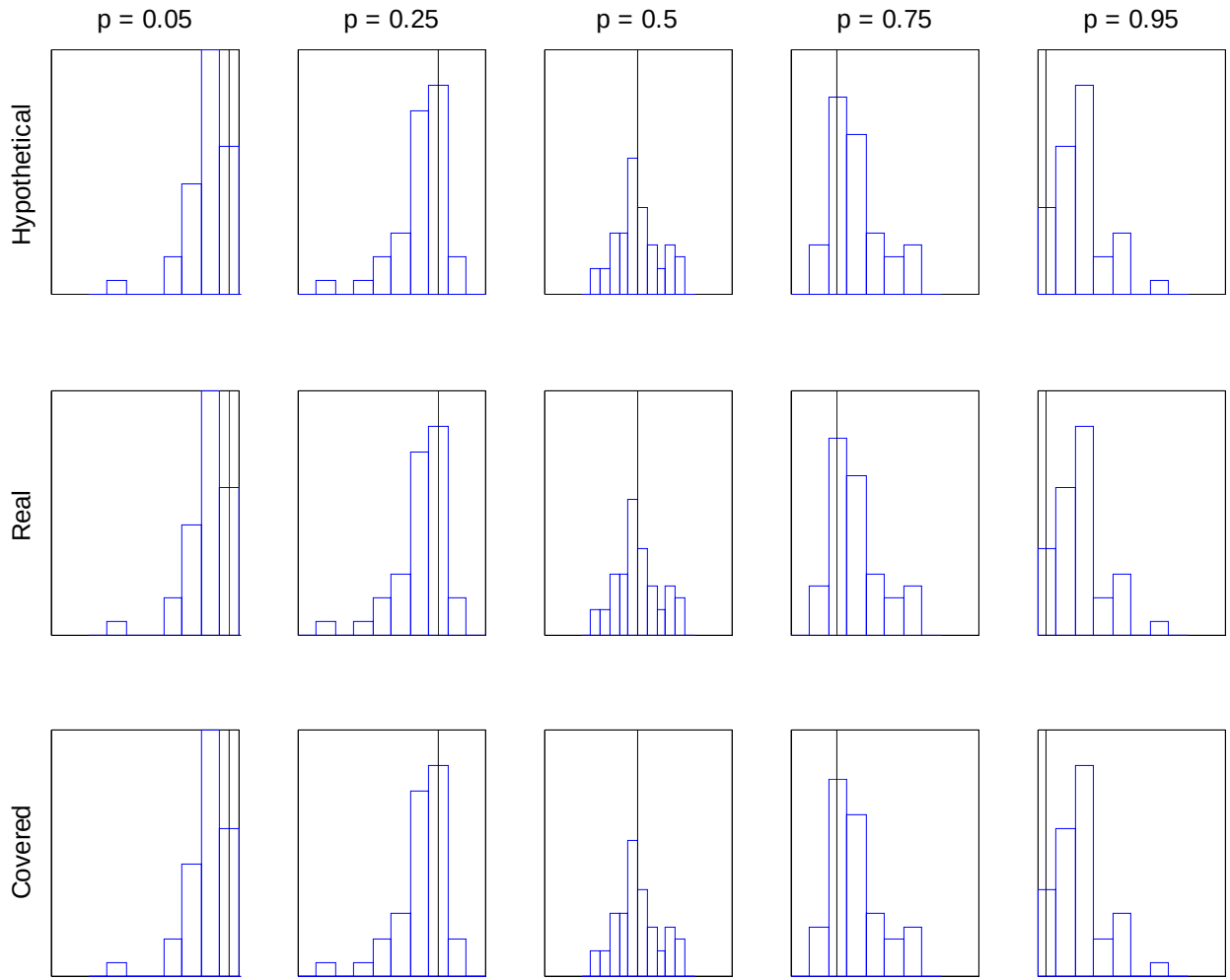
- For each lottery, the risk premium RP=EV-CE is computed
- Anova repeated measures on RP
  - ✓ Repeated: Lottery, session
  - ✓ Between: Gain/Loss order, Lottery order, gender
- Significant effect on RP:
  - ✓ Lottery ($p = 0.0001$)
  - ✓ Interaction lottery x session ($p = 0.001$): Sessions only have an indirect effect
  - ✓ **No order effect**, **no gender effect**

Pooled risk premia



Higly similar distributions !!!

LOSSES, probability part: the CE distributions



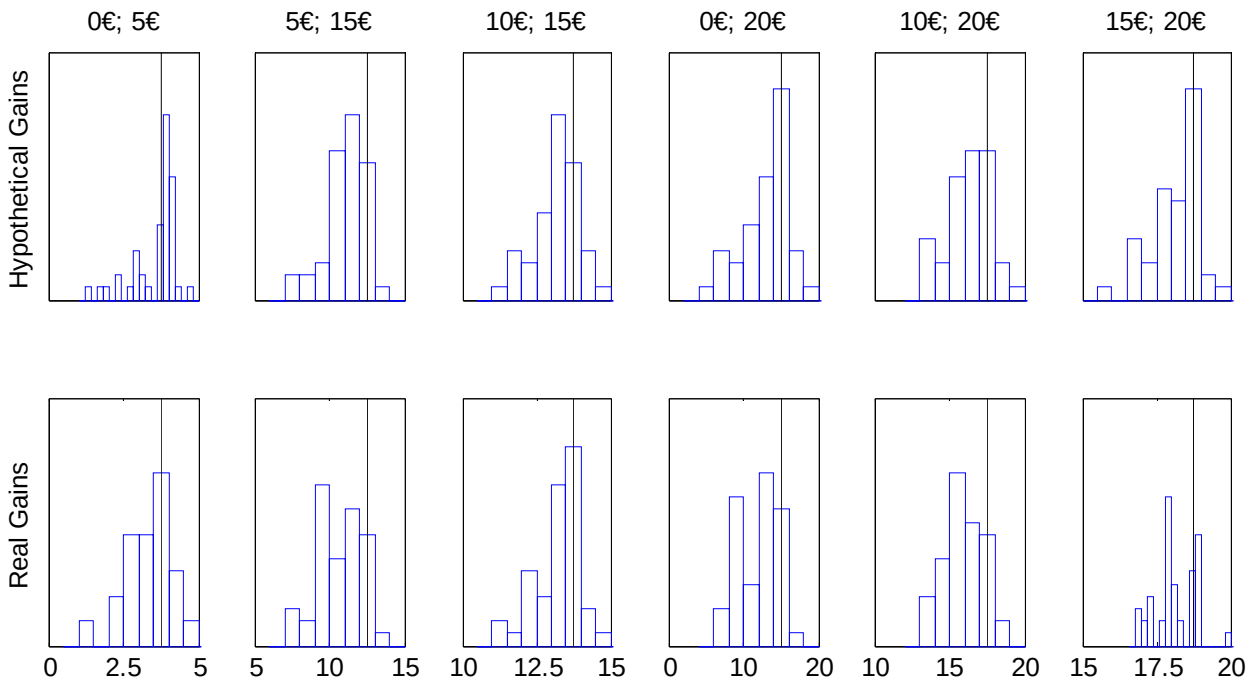
- EC vs. EV depends on the probability → RS increases with p
- Consistent with the 4-fold pattern: RA in losses with low probability, RS in losses with moderate and high probability

Some statistics

- Very similar distributions (no difference using KS or Friedman, except for p = 75%)

- EC by EC
  - No significant difference **hypo/real**, **hypo/couv**
  - 2 significant differences **real/covered** (50% and 75%)

GAINS, outcome part: the CE distributions



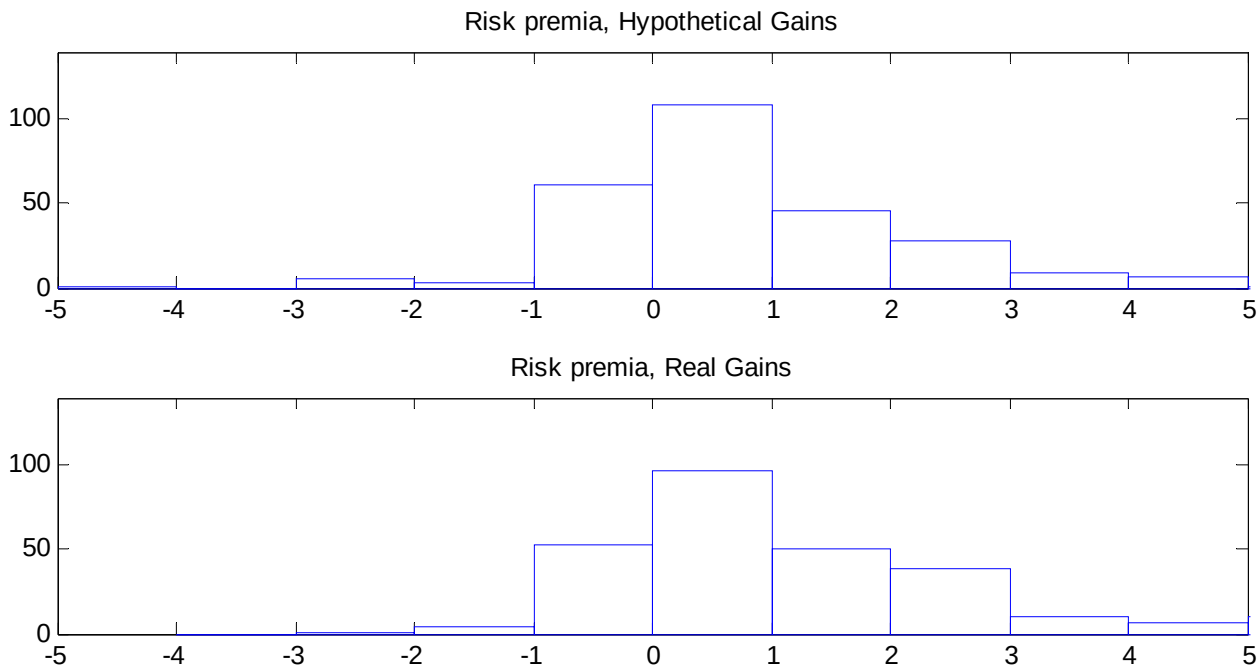
- EC < EV: RA
- Consistent with the 4-fold pattern: RA in gains with high probability (0.75)

Some statistics

- **EC by EC**
  - Very similar distributions between sessions (no significant difference using KS tests)
  - Only 1 significant difference **hypo/real** (0; 20) (using Wilcoxon tests on pairs of ECs)
  - **BUT**: Only 1 NON significant difference **real/recoded 'covered' losses** (0; 5) (Wilcoxon)
  - **AND**: 2 NON significant differences **hypo/recoded 'covered' losses** (0; 20); (10, 20) (Wilcoxon)

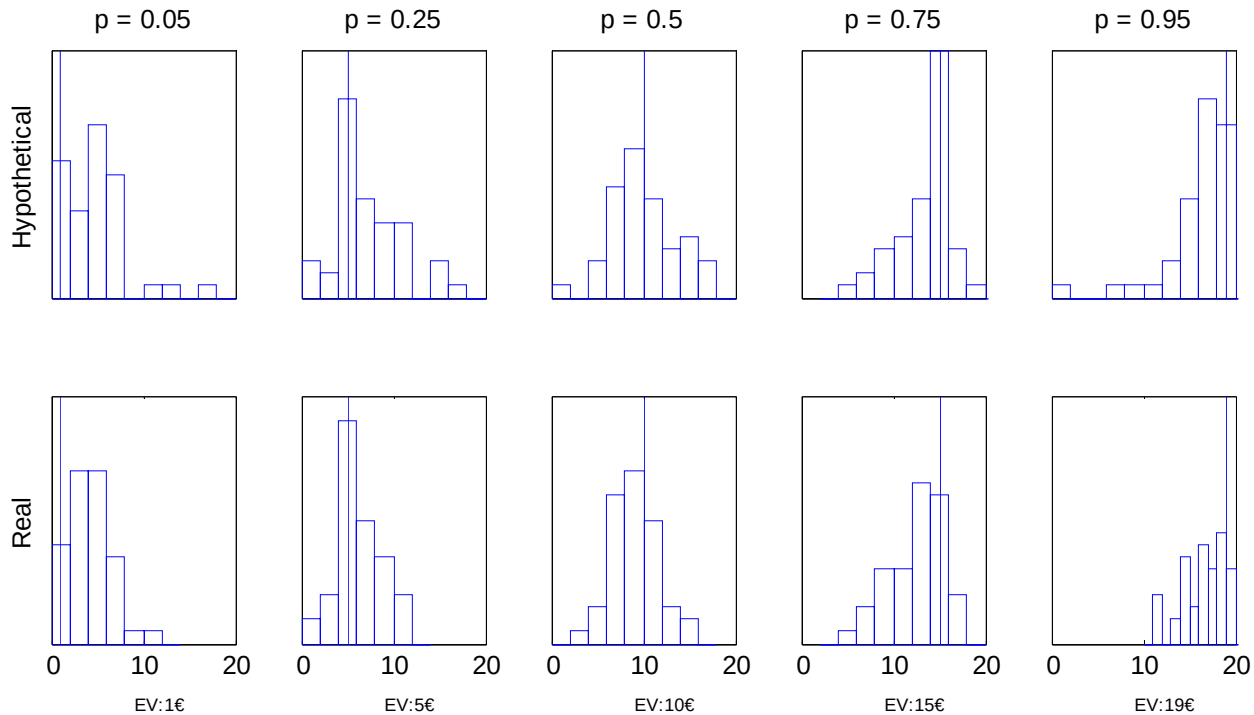
- **Factorial Anovas**
  - For each lottery, the risk premium RP=EV-CE is computed
  - Anova repeated measures on RP
    - ✓ Repeated: Lottery, session
    - ✓ Between: Gain/Loss order, Lottery order, gender
  - Significant effect on RP:
    - ✓ Lottery ($p = 0.0001$)
    - ✓ **Session** ($p = 0.03$)
    - ✓ Interaction lottery x session ($p = 0.004$): Sessions also have an indirect effect
    - ✓ No order effect, no gender effect

Pooled risk premia



Higly similar distributions !!!

Gains, probability part: the CE distributions



- EC vs. EV depends on the probability → RA increases with p
- Consistent with the 4-fold pattern: RS in gains with low probability, RA in gains with moderate and high probability

Some statistics

- Very similar distributions (no difference using KS or Friedman)

- EC by EC
  - No significant difference **real/recoded 'covered' losses** and **hypo/recoded 'covered' losses**
  - 3 significant differences **hypo/real** (intermediate probabilities: 25%, 50%, 75%)

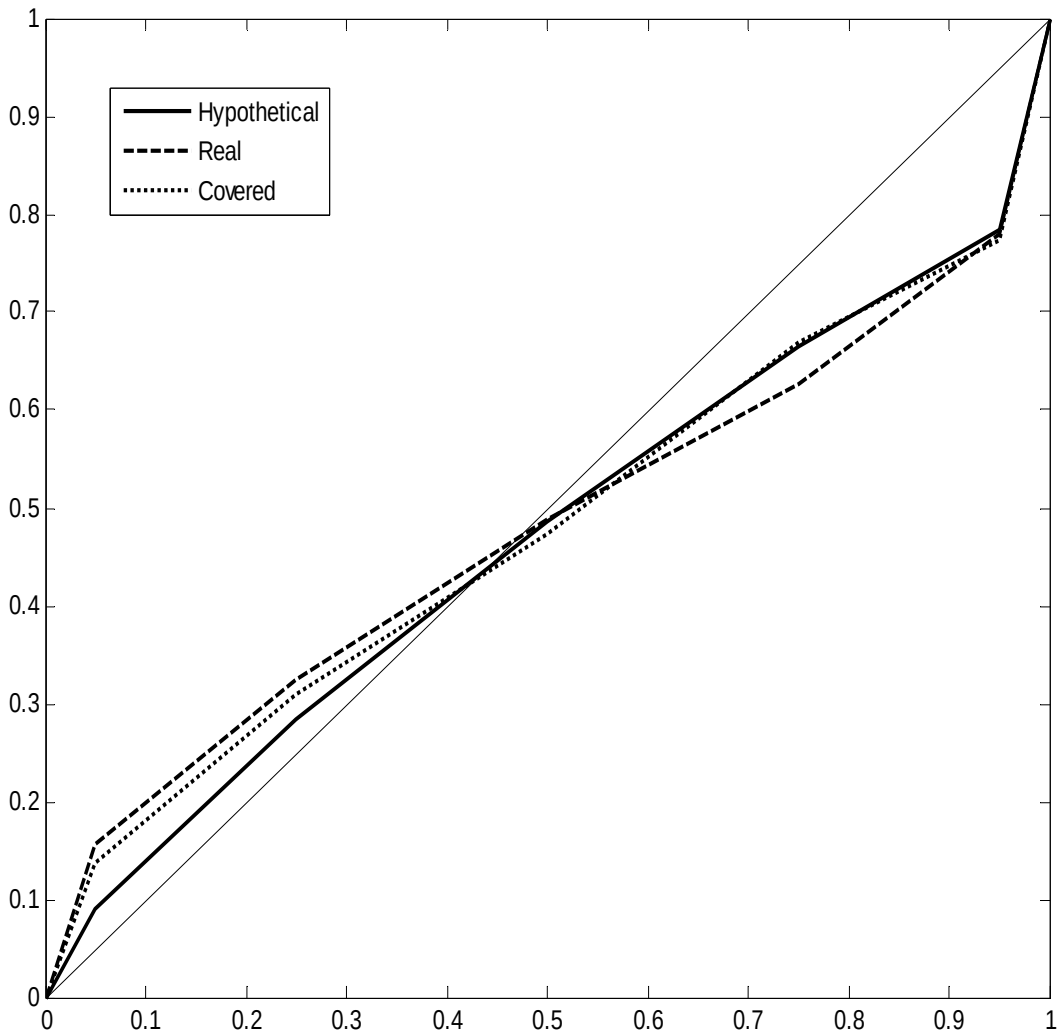
  → **Similar extreme CEs** (cf. possibility and certainty effects), **but different intermediary CEs** between sessions (Wilcoxon, $p < 0.05$)

The utility functions under PT (with expo-power specification)

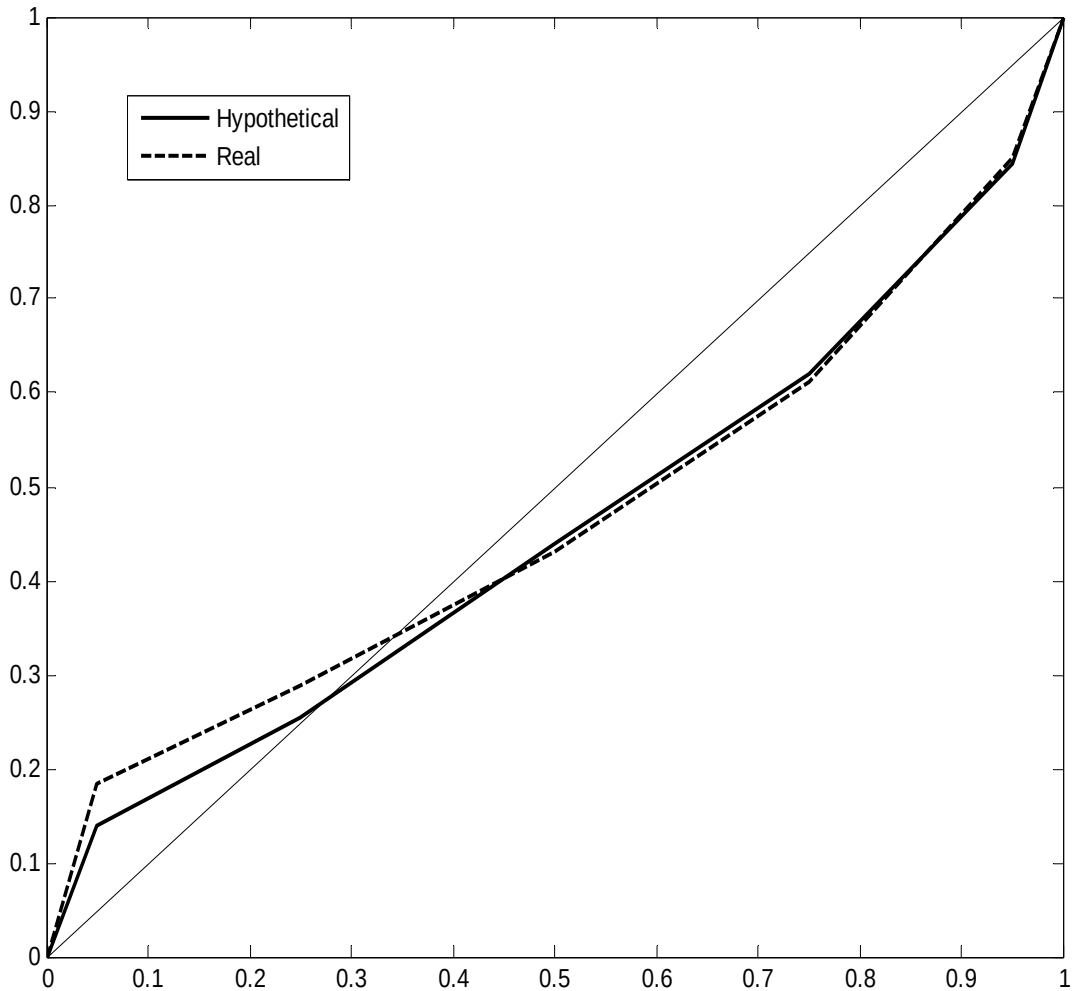
Median data	Expo-power	
	Losses	Gains
Hypothetical	1.31	1.44
Real	1.21	1.17
Covered	1.27	

- No difference in losses
  Some difference in gains

The pwf in the 3 loss situations



The pwf in the 2 gain situations



The probability weighting functions (with GE specification & expo-power utility)

Median data	Goldstein and Einhorn (1987)			
	Losses		Gains	
	Curvature	Elevation	Curvature	Elevation
Hypothetical	0.61	0.90	0.63	0.82
Real	0.53	1.15	0.56	0.89
Covered	0.64	1.08		

- No difference in losses
  No difference in gains

Some implications of the results

- No significant difference between Real, Covered and Hypothetical losses as regards behaviour (A1, A3.2)

  → One should be allowed to choose his/her preferred payment procedure in the loss domain (when investigating risk attitude)

- Significant difference between (recoded) Covered losses and Real gains (A3.1)

  → No house money effect.

  → Instead of using hypothetical losses, one may prefer to introduce a loss-with-initial-endowment procedure (which is a performance-based procedure)

- Difference between Hypothetical gains and Real gains: real gains seem to generate more risk aversion (A2)

  → A performance-based procedure should be used in the gain domain