SUGGESTED ANSWERS for

Final exam, M.Sc. in Economics summer school 2017

Behavioral and Experimental Economics

Question 1: Loss aversion

Loss aversion is a core concept of behavioral economics. It can potentially explain important phenomena which cannot easily be accounted for by standard economics.

Pick **two** examples of research discussed during the summer school (in assignments or the lecture) to illustrate. For each example, describe the setting we discussed (survey study, lab or field experiment) in sufficient detail, explain what role loss aversion plays in the setting, and discuss the potential relevance of the finding for economic theory or policy.

A: Below, I provide just some examples with short descriptions. Other examples may be admissible. To obtain the full number of points, students need to describe the setting in similar detail as in the lecture notes or assignments.

1. Nominal inertia: Fehr and Tyran (AER 2001) find an asymmetry in nominal inertia after positive and negative monetary shocks in a lab experiment which shows payoffs in nominal terms. After a negative shock, prices must fall and subjects have to move from high to low nominal payoffs in the table. If subjects are prone to nominal loss aversion, they will be reluctant to do so. With a positive shock it is the reverse. Relevance: explains asymmetric real effect of monetary expansion vs. contraction.

2. The endowment effect means that people value objects they own more highly than objects they do not own. Example: Classroom experiment with decorated mugs. Willingness to pay for a mug was only about half as high as the willingness to accept money to return a mug. Relevance: Coase theorem breaks down (which assumes WTP = WTA) which is important for various policies suggested in environmental economics.

3. Downward nominal wage rigidity. Workers resist real wage cuts more when they come with nominal wage cuts (because they are salient) than when they come with nominal wage increases. Example: Survey study by Agell and Bennmarker (2003) with Swedish human resource managers finds managers think workers will resist a real wage cut more when it comes with a nominal cut. Relevance: targeting positive inflation rates by central banks can be justified by nominal wage rigidity. Positive inflation rates facilitate structural adjustment to regional or sectoral shocks.

4. Improving schooling outcomes. Fryer, Levitt, List, Sadoff (NBER WP 2012) present a field experiment in which teachers in Chicago heights. In one treatment ("gains"), they promise teachers end-of-year-bonus according to improvement in test scores of their pupils (in expectation $4000) in the other treatment ("losses"), they give teachers $4000 upfront and make them repay the difference if improvement in scores is below average. Finding: large gains in pupils' math test scores with loss framing, no impact of teacher incentives when framed as gains. Relevance: cheap way to increase pupils' achievements which are highly relevant for (labor market) outcomes later in life.

5. "Asian disease problem" (Kahneman and Tversky, 1981 Science). Example of first-wave (survey) research. Two scenarios which differ whether the consequences of

programs to combat an Asian disease are presented in terms of lives saved ("gains") or of people dying ("losses"). In each scenario, there is a safe but on average unattractive option and a risky but on average more attractive option. Finding: respondents favor the safe option with gains framing but the risky option in the loss frame. That is, popularity of a given program strongly depends on how it is presented. Relevance: policy choices may be influenced by their presentation.

6. Myopic loss aversion (MLA). We discussed various studies on MLA. Example: Lab experiment by Gneezy and Potters (QJE 1997): If a risky asset similar to a stock (paying a an uncertain dividend) is frequently evaluated, people are less likely to hold the asset than if evaluated infrequently. Investors seem to shy away from making on average profitable investments because of the possibility of losses (the risk of a loss falls with longer horizons). Implication: people do not take enough risk which would be profitable in the long run. Relevance: might explain low participation rate in the stock market.

7. Andersson, Holm, Tyran and Wengström (Management Science, 2016) show that deciding for others reduces loss aversion in a large sample of the Danish population. Use multiple price list technique with price lists that do or do not involve losses. Relevance: loss aversion is likely to be an emotional response to fear rather than a deep preference.

8. (only briefly discussed): Myopic loss aversion has been invoked to explain the "equity premium puzzle" (Benartzi and Thaler QJE 1995). Relevance: large premium for holding stocks over bonds cannot be explained by invoking risk aversion, would require implausibly high values.

9. (only briefly discussed): Odean (JoF 1998) shows that investors are more reluctant to sell stocks at a loss than at a gain (disposition effect). Effect: investors tend to keep losers in their portfolio and sell the winners. Relevance: lower returns.

Question 2: General issues

a) In what ways is it problematic when an experimental study does not implement a ceteris paribus variation? Use Slembeck and Tyran (JEBO 2004) to illustrate.

A: If the variation is controlled the experimenter can still identify a causal effect of the total variation if behavior is systematically different as a result. But if treatments differ in several respects, it is impossible to identify exactly which of the changes caused the behavioral change between treatments, and to what extent). Slembeck and Tyran (JEBO 2004) is an example. In their treatment "competition" differes from "base" by providing subjects with information about the performance of the competitors (which means they can learn from them) and by changing incentives (rank-order tournament). The results show that both variations together causally improved choices (the three-door anomaly was reduced) but the study does not allow to isolate whether it was observation or payoffs that drives the effect (or to what extent they each do).

b) Can experiments which fail to induce preferences as explained in the Induced Value Theory (Smith, AER 1982) nevertheless be interesting? Use an example to illustrate.

A: Control in the sense of inducing preferences is critical for some experiments (e.g. for those wanting to test the capacity of Double Auction vs. Posted Offer markets to equilibrate) but may be less important for other experiments. Sometimes, we would like to measure social preferences rather than to induce preferences. Example: In the ultimatum game (or the cooperation game with punishment stage) we measure to some extent the willingness to punish unfair behavior etc.)

c) Explain the expression "experimenter demand effect". Why are such effects a problem? What can be done to mitigate the problem?

A: Experimenter demand effects occur when the experimenter (knowingly or not knowingly) suggests a particular type of behavior to experimental subjects (e.g. by the wording of instructions). Possible solution in the lab: Neutral behavior/wording, experimenter does not know the theoretical prediction or purpose of the experiment. Experimental subjects believe that they should behave in a particular manner (e.g. economically rational) because they are observed by the experimenter (e.g. an economist). Possible solution: The degree of observation or subject anonymity can be varied in the lab. Example: Double blind procedure, in online experiments (e.g. iLEE) subjects participate remotely and are completely anonymous to the researcher. Alternative solution: implement a "natural field experiment" in which participants do not know that they are participating in an experiment

Question 3: Individual irrationality and aggregate outcomes

a) Provide a definition of bounded rationality.
Hint: Refer to the definition of rationality in Camerer and Fehr (Science 2006)

A: "The rationality assumption consists of two components: first, individuals are assumed to form, on average, correct beliefs about events in their environment and about other people's behavior; second, given their beliefs, individuals choose those actions that best satisfy their preferences. If individuals exhibit, however, systematically biased beliefs about external events or other people's behavior or if they systematically deviate from the action that best satisfies their preferences, we speak of bounded rationality."

b) Consider a "guessing game" in which $N > 2$ players choose a number [0, 100]. The player closest to a target $T = pM$ wins a prize, where M is the average number chosen by all players and $0 < p < 1$. If several players are equidistant to T, the prize is shared among these players.
Assume a share $0 < s < 1$ of players is boundedly rational in the sense that they choose the best reply to a belief $b > 0$ about what everyone else chooses, while the remaining players are fully rational in the sense that they play a best reply to what everyone chooses.

b1) In what ways is the share s of players boundedly rational? Explain with reference to the definition you gave in a) above.

A: These players do not "form, on average, correct beliefs … about other people's behavior" but they do "choose those actions that best satisfy their preferences", "given their beliefs"

b2) What belief B^* do the fully rational players hold in equilibrium if $0 > s > 1$? Provide a formal expression.

A: Fully rational players choose a best reply r to what everyone does, i.e. to the average choice $M = (1\text{-}s)r + sa$. In contrast, the choice a of the boundedly rational players is a best reply to their exogenous belief b, $a = pb$. That is, the fully rational players choose $r = pM$. Solving for r yields the equilibrium choice $r^* = psa\,/[1\text{-}p(1\text{-}s)]$, and the (equilibrium) belief of the fully rational players is $B^* = r^*/p = M^*$, i.e. $B^* = sa\,/[1\text{-}p(1\text{-}s)] = spb\,/[1\text{-}p(1\text{-}s)]$.

b3) What is the sign of $\partial B^*/\partial b$?
The sign is positive ($\partial B^*/\partial b = sp\,/[1\text{-}p(1\text{-}s)] > 0$), i.e. equilibrium beliefs increase with the belief (and therefore the action) of the boundedly rational players because of strategic

complementarity ($0 < p < 1$). This means that the best reply r^* is increasing in M^* (and hence, also in b).

b4) Does an increase in the share of irrational players s increase or decrease the deviation of aggregate outcomes from the standard prediction in the game above? Is the change proportional to s? Why (not)?

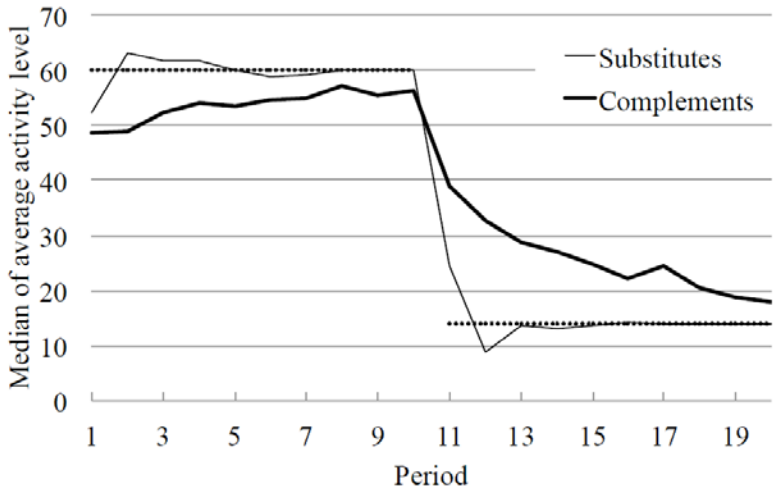
A: An increase in the share of irrational players s increases the deviation from the standard prediction (the standard prediction is that everyone chooses zero when $s = 0$) for two reasons. First because of a direct effect: there are more irrational and fewer fully rational players. This effect is proportional to the share s. Second, because of an indirect effect: rational players partly imitate the irrational players with strategic complementarity. The indirect effect adds to the direct effect when $0 < p < 1$. Therefore, the increase is more than proportional.

b5) How do equilibrium beliefs B^* change when the factor P is negative ($0 > P > -1$) instead of positive ($0 < p < 1$)?

A: Formal: $spb/[1-p(1-s)] > sPb/[1-P(1-s)]$ iff $p > P$, i.e. equilibrium beliefs are lower with ($0 > P > -1$) than with ($0 < p < 1$). Intuition: with ($0 < p < 1$) we have strategic complements. In this case, fully rational agents want to partly imitate the boundedly rational ones. With ($0 > P > -1$) we have strategic substitutes. In this case, rational agents want to choose numbers to partly compensate the behavior of the boundedly rational ones, i.e. they hold lower beliefs and choose lower numbers as with strategic complements (they would choose negative numbers if they could).

c) Cooper, Schneider and Waldman (GEB forthcoming) use a guessing game with $T = pM + d$, with $d > 0$ and $0 > P > -1$ in one treatment and $0 < p < 1$ in another treatment. Describe the main outcomes in the two treatments.

A: They observe slow adjustment of choices after a shock to the system (parameters change such that equilibrium choices drop from 60 to 14) with $0 < p < 1$, i.e. with strategic complements, but rapid adjustment with strategic substitutes $0 > P > -1$, see their figure 1.



Question 4: Dividends of democracy

a) Tyran and Feld (SJE 2006) claim that their experimental results provide support for a "dividend of democracy".

a1) Describe the treatments MildEnd and MildEx and the corresponding standard predictions. Hint:

$$E_i = (20 - g_i) + 0.5 \cdot \sum_{j=1}^{3} g_j$$

A: Subjects play a one-shot public goods (linear VCM) game in groups of three players. Each has 20 points and can allocate them to a "Private account" or "Public account". All points allocated to the public account are multiplied by a factor (marginal per capita return) of 0.5. Hence, contributing is efficient but not individually rational for a self-interested player. In MildEnd, before subjects make decisions in the PG game, a majority vote is held a sanction meted out to everyone who less than fully contributes to the public account. But the sanction is too weak (4 points) to deter free riding by rational and self-interested players. The standard prediction therefore is that nobody contributes. Hence, the mild sanction will be rejected. MildEx is the same as MildEnd except that there is no voting. The mild sanction is imposed in this case.

a2) What is the main result of the study? *Hint*: refer to the "dividend of democracy"

A: The sanction is often (60% of the cases) accepted in MildEnd, and contributions to the public account are about twice as high with the sanction in MildEnd than in MildEx. The authors interpret this effect as a "dividend of democracy" because efficiency is higher when a given (mild) sanction is accepted in a vote than when it is imposed to voters.

a3) The authors argue with reference to the table below that selection effects are an implausible explanation for the main result of the study. Explain why selection may in principle play a role in this experiment and what should be observed in the table in case such effects were strong.

	Yes-voters	**No-voters**
If mild law Accepted	A 62%	B 68%
If mild law Rejected	C 17%	D 23%

A: Suppose there are two types of subjects: cooperative and non-cooperative ones. Suppose types are unobservable. Suppose cooperative types contribute more to the public account than non-cooperative types. Suppose cooperative types vote for mild law, and it is accepted only if many cooperative players happen to be in the same group. If this were the case, mild law is accepted because of selection of types into groups and groups that happen to accept the law also tend to cooperate more because they (by chance) consist of cooperative players. Hence, we would see a correlation between acceptance of the law and cooperative behavior, but this correlation would be driven by selection of subjects with unobservable characteristics into groups, not by a causal effect of the law.

If this were the case, we should see that yes-voters (those who vote in favor on mild law) contribute more than No-voters. But this is not case in the table above. Instead, players contribute more when the law is accepted (independent of whether they voted for it) than when it is rejected. This speaks for a causal effect.

b) It has been argued that a "dividend of democracy" can be obtained through positive information aggregation in majority voting.

b1) Explain the information aggregation effect using an example of a common interest situation with 3 voters where each voter has a probability of $p_i = 0.6$ to make the correct choice. Assume that abstention is not allowed and voters cast their votes independently and sincerely.
Hint: Condorcet Jury Theorem.

A: The groups makes the correct choice when a majority of votes is cast for the correct option. This is the case if all three voters vote for the correct alternative, which happens with probability $0.6 \times 0.6 \times 0.6 = 21.6\%$. The group also makes the correct choice when two out of three voters make the correct choice, which happens with probability $0.6 \times 0.6 \times 0.4 = 14.4\%$, and there are three possibilities for one of the three voters to cast the wrong vote, hence the total probability to make the correct choice for the committee is: 21.6% + 3*14.4% = 64.8% which is more than the individual probability to make the correct choice $p_i = 60\%$. The difference is called information aggregation effect.

b2) How is the information aggregation related to the "wisdom of the crowds"?

A: Information aggregation is stronger in larger committees. As the size of the committee goes to infinity, the probability of the committee to make the correct choice (quickly) goes to 1. In this sense, "larger crowds" are more "wise".

b3) Morton, Piovesan and Tyran (WP 2012) experimentally investigate information aggregation in voting. Describe their treatments "baseline" and "opinions".

A: Subjects take majority votes on 30 quiz questions in committees of $n = 5$ voters. There are 2 possible answers, 1 is correct. The authors use 20 easy and 10 hard questions such that the average voter "gets it right" overall (i.e. on the typical issue, $p > 0.5$) but a majority may "get it wrong" on a specific issue (the hard questions). Each subject earns 10 DKK for a correct committee decision, independent of how the subject voted. No abstention, no communication, no feedback before the end of the experiment. In the Opinions treatment (OT) all voters learn what policies voters in prefer but not whether these are the "right" policies, similar to an opinion poll. Specifically, voters are told the %age of subjects who answered A and B in baseline treatment (BT, which was run before the OT). In the BT voters do not get any information about how others decided in previous votes.

b4) How does the "opinions" treatment in Morton et al. (WP 2012) shape what the authors call "the dark side of the vote"? Why?

The "dark side of the vote" refers to negative information aggregation predicted by the Condorcet Jury Theorem when $p_i < 0.5$ (i.e. when voters are biased as in the "hard" questions). The authors observe positive information aggregation with easy questions but negative information aggregation with hard questions in the baseline treatment. In the Opinions treatment both positive and negative information aggregation becomes more pronounced. The reason is that voters tend to ignore their own signals and follow the public information. Doing so can be rational under some assumptions.

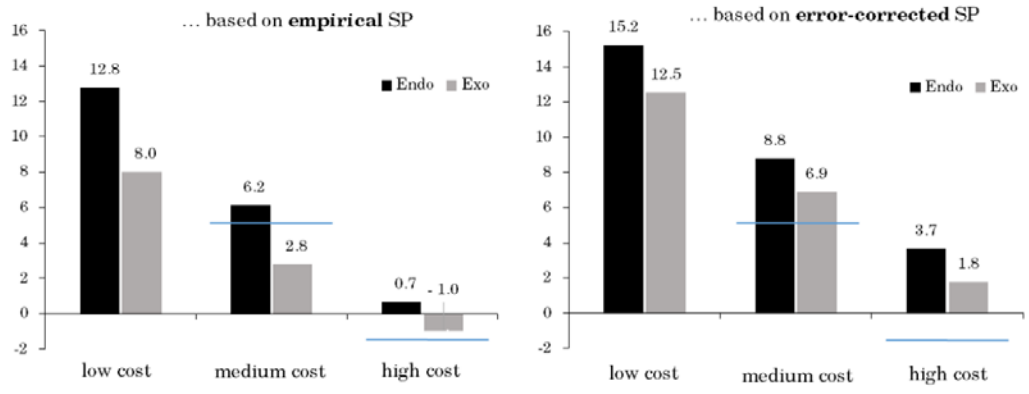
c) Mechtenberg and Tyran (WP 2016) study information aggregation in a setting in which subjects can delegate the choice to an expert or can demand to make the choice themselves by majority voting.

c1) The authors investigate the extent of "rational ignorance". What does it mean in the context of their experiment? *Hint*: The cost of information varies across treatments.

A: The authors use a design with a common interest situation (as in Morton et al. above), but with costly information acquisition. That is, voters can buy information (in which case they obtain an informative signal $p > 0.5$ about whether A or B is the right choice). If they do not, they get an uninformative signal ($p = 0.5$). The rational decision to buy information is complex in this setting in which abstention is possible. Buying the information has a cost but also a benefit, through information aggregation. This benefit is decreasing with the number of informed voters. Buying information is like providing a public good, it improves the outcome for all, hence free-riding incentives prevail. Because of these incentives the cost of information acquisition may dominate the benefit for a self-interested voter and he rationally may decide to remain uninformed (i.e. to be "rationally ignorant").

c2) What are the main findings in Mechtenberg and Tyran (WP 2016)? Hint: refer to the figure below.

A: Rational ignorance is *less prevalent* than predicted by standard theory because subjects buy more information than predicted which improves information aggregation through voting, and makes *voting more efficient than delegation* compared to what is predicted. However, information demand (and hence rational ignorance) *responds systematically* to the cost of information. The height of the bars in the figure below shows the efficiency gain of voting vs. delegating to the expert (there are two ways of calculating, by either correcting success probabilities for errors (right panel) or not). With two exceptions, all bars are above the zero line, meaning that voting was more efficient than delegation. This is so because subjects buy more information than predicted by standard theory. Hence, rational ignorance was less pronounced than predicted. Another main finding is that information demand was higher in Endo (where voters demand the vote in a petition) than in Exo (where voting is imposed). In this sense, *Endo vs. Exo* represents an endogeneity premium (or, dividend of democracy).



Notes: Panels show efficiency of voting (EV), i.e. the net excess return of voting over delegating the policy choice to the expert as a percentage of earnings with expert judgment for $q_L = 0.6$. Expected net group earnings with voting are SP x 25€ x n - kc_j, where k is the number of informed voters, $n = 7$ is the number of group members. Expected net group earnings with delegation is q_L x 25€ x n. Left panel uses empirical (uncorrected) success probabilities (SP), right panel uses error-corrected SP. Horizontal lines indicate EV in Pareto-dominant pure-strategy subgame equilibria with voting.