SUGGESTED ANSWERS for

Final exam, M.Sc. in Economics summer school 2016

Behavioral and Experimental Economics

Question 1: Methodological aspects

a) Daniel Kahneman was a pioneer of "first-wave" behavioral economics. (i) Explain what is meant by "first-wave" with reference to one example discussed in assignment 1. Matthew Rabin (AER 2013) advocates "second-wave" behavioral economics. (ii) Explain the expression with reference to one example discussed in the lecture.

A: (i) First-wave BE econ was built on research called "judgment and decision making". It was mainly concerned with individual decision making and used mostly hypothetical experiments and questionnaires to demonstrate that real people deviate in important ways from full rationality (and strict self-interest). Examples from the assignment are the questions on money illusion (Shafir et al QJE 1997) or the lottery questions involving gains and losses.
(ii) Second-wave BE econ is concerned with interaction and in particular with how institutions shape incentives that, in turn, shape behavior. Economists are often interested in aggregate-level outcomes (e.g. market outcomes) and it is imperative to know whether particular "anomalies" persist in the environments of interest. Rabin gives the example of labor markets. Examples from the lecture are money illusion (its effects are multiplied with Strategic complements but mitigated with strategic substitutes. Bayesian updating which fails in individual estimation but when there is unlimited buying power and Bayes' rule implies higher values than the base-rate fallacy.

b) Consider an outcome of interest Y that depends on a list of determinants, i.e. $Y = f(X_1, \dots, X_N)$. A causal effect of X_1 on Y is the effect of varying X_1 holding fixed all other determinants $Z = (X_2, \dots, X_N)$. Answer the questions below with reference to the notation introduced in Falk and Heckman (*Science* 2008).

b1) Does an observed causal effect depend on the level of Z? (Hint: refer to "separability")
A: Unless f is separable in X_1, so that $Y = \phi(X_1) + g(Z)$, the level of the Y response to change in X_1 will depend on the level of Z.

b2) Does an observed causal effect depend on the level of X_1? (Hint: refer to "separability")
A: Even in the separable case, unless $\phi(X_1)$ is a linear function of X_1, the causal effect of X_1 depends on the level of X_1 and the size of the variation of X_1.

b3) Explain how "randomization" serves to neutralize the effect of uncontrolled determinants (X_u) on Y.
A: Suppose factor X_U cannot be controlled (or even be observed) by the experimenter. Suppose factor X_1 is varied in a controlled way, and all other factors Z are held constant. Randomized allocation of participants to treatments makes sure that the level of X_U is the same in both treatments. Randomization plus control of X_1 and Z allows to isolate $\Delta Y/\Delta X_1$ at a given (perhaps unknown) level of X_U. In contrast, if participants select into treatments according to X_U, some effect $\Delta Y/(\Delta X_1 \Delta X_U)$ is measured.

Question 2: Markets

Consider a double auction market experiment with 5 buyers and 5 sellers and the following induced values.

| ID number	Value of first unit	Value of second unit	ID number	Value of first unit	Value of second unit
B1	82	72	S1	24	32
B2	88	52	S2	20	48
B3	67	37	S3	36	60
B4	62	43	S4	40	57
B5	57	46	S5	44	54

a) Describe the most important rule of a double auction market experiment (Hint: that rule gave the auction the name "double"). How does it differ from a posted offer market?
A: In a double auction (DA), both buyers and sellers can make offers to the other side of the market and can accept offers from the other side of the market. That is, both buyers and sellers can actively suggest prices. In a posted offer market, only the sellers can make offers to the side of the market (other rules, such as the "no-loss rule", i.e. that buyers are not allowed to bid more than their induced value and vice versa for seller, and the "improvement rule", i.e. that buyers have to outbid the best standing bid and sellers have to undercut the best standing ask are not essential to the DA but speed up convergence)

b) Calculate equilibrium price, quantity and surplus (sum of consumer and producer rent) in the example above.
A: price: 48-52, quantity: 7 (sort bids from high to low, asks from low to high, find the intersection point which determines which are the infra-marginal units), surplus: 236

c) What are the sufficient conditions according to the Induced Value Theory (Smith, AER 1982) to induce the values in such an auction? (*Hint*: consider preferences $V(m_0 + \Delta m, z)$). Are these conditions also necessary?

A: Monotonicity: V_m exists and is positive for each combination of (m, z) ; Salience: the payment Δm depends on the actions of the subject; Dominance: The changes in utilities of a subject during the experiment depend importantly on Δm. The influence of z can be neglected. The conditions are not necessary. Markets usually also converge to equilibrium (as in our demonstration experiment) when no money is paid.

d) Consider the following in a strategic market game in which two firms compete over quantities (as in Huck et al. JEBO 2004):
Market price $p = 100 - Q$, $Q = q_1 + q_2$ and costs are $c_1 = c_2 = 10$.
(i) What are equilibrium quantity predictions?
(ii) What do Huck et al. (2004) find for collusion when 2 such firms compete vs. when 5 such firms compete?

(A: (i) $q_1{}^* = q_2{}^* = 30$ (Take partial derivative of $\pi_1 = (100 - Q)q_1 - c_1q_1$., solve for q_1 and q_2 , substitute one into the other. (ii) the authors find no collusion with 5 firms. Such markets tend to be more competitive than predicted: quantities are larger (prices are below) Nash equilibrium predictions. But with 2 players there is collusion, i.e. quantities are smaller than predicted.

Question 3: Loss aversion

a) Kahneman and Tversky (ECMA 1979) propose a theory of decision making under risk. Discuss the assumptions of this theory that relate to losses
(*Hint*: refer to a figure with four quadrants)
A: Risky prospects are not evaluated in terms of outcomes (final wealth, as in EU) but in terms of changes w.r.t. to reference point r (initial wealth). Losses weigh more heavily than gains of equal size (kink at the reference point): loss aversion. The function is concave in gains but convex in losses → risk aversion in gains but risk loving in losses.
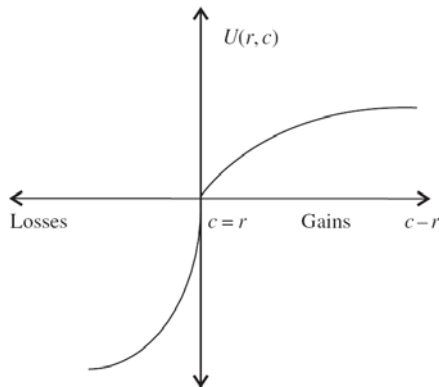
b) Andersson, Holm, Tyran and Wengström (Management Science, 2016) investigate whether deciding for others reduces loss aversion in a large sample of the Danish population.

b1. An important measure in this paper is "the number of safe choices". Explain how the authors construct and interpret the measure.
(*Hint*: refer to the "multiple price list" (MPL) and the notion of a "switch point")

A: In the MPL, subjects are given a series of choices (here: 10) between two gambles (Left vs. Right). Each gamble has two (here: equally likely) outcomes (Heads or Tails). One gamble is "safe" (with low variance), one is risky. The list has 10 lines and choices are ordered such that in the first few choices the safe gamble is relatively more attractive but further down the list, the risky bet is more attractive. A rational subject with consistent preferences switches only once from safe to risky. Hence, the "number of safe choices" (or the location of the "switch point") is an indicator of risk aversion or of loss aversion (depending on whether the options include losses)

b2. What do the authors find with respect to the "the number of safe choices" when comparing treatments "Individual" and "Other"?
(*Hint:* compare conditions in which losses can occur vs. cannot occur)

A: When choices do not involve losses, subjects make the same choices for themselves as they do for others (i.e. same choices in "Individual" and "Other"), but when choices involve losses, they make more risky choices for "other" (lower number of "safe" choices in other).

b3. How do the authors interpret their finding in b2? (*Hint*: refer to emotions)

A: The finding suggests that subjects tend to shy away from potentially profitable gambles because of loss aversion when their own money is at stake but do not shy away when the choice does not involve losing one's own money. This is consistent with the view that loss aversion is an emotional response to fear rather than a "deep preference".

c) Stephens and Tyran (in progress) investigate "money illusion and household finance" in a large sample of the Danish population and refer to the concept of "nominal loss aversion" (NLA).

c1. Explain the expression NLA and how it is measured in this paper.
(*Hint*: the authors construct an index from a set of 8 questions)

A: NLA results from the interaction of loss aversion (i.e. losses loom larger in people's minds than corresponding gains) and nominal thinking (i.e. people tend to think of the value of economic transactions in terms of money). Thus, a given real loss that comes with nominal loss is more salient than if it comes with a nominal gain (or: real losses are less salient when they are obfuscated by inflation).

The authors present subjects with 8 hypothetical scenarios that come in 4 pairs. Subjects are asked to evaluate the "advantageousness" of housing transactions. In each pair, a given real loss is presented either with a nominal gain (at high inflation) or a nominal loss (at low inflation). The NLA index is the (averaged) difference between the evaluations in a pair. It is zero when subjects' evaluations are not influenced by the nominal framing. It is positive if subjects provide better evaluations when the real loss is obfuscated by inflation.

c2. The authors make a distinction between nominal and real assets. (i) How are those characterized? Provide one example each. (ii) What is the authors' hypothesis about how NLA and holdings of nominal and real assets relate?

A: Nominal assets have a nominal face value and an optional nominal income stream. Under normal circumstances, they involve no nominal losses. Examples are cash, bank deposits, bonds. Real assets have no face value, their income stream is determined by real variables. With real assets (and low inflation) under low inflation, nominal losses are common. Examples are Real estate (housing) and equities. (ii) Real assets are less attractive to illuded investors, i.e. NLA and investment in real assets (as measured by the real asset share) is expected to be negatively related.

c3. The table below shows results from Zero-One-Inflated-Beta regressions. (i) Comment on the results shown in the first 5 lines in the table with respect to the dependent variable, the real asset share. (ii) What does a negative sign on the coefficient in the first line imply for the expected earnings of illuded vs. non-illuded investors? Why?
A: (i) Coefficients in the first line show the marginal effect of going from an NLA index value of 0 to a value of 1. Specification 1 (without any controls) shows that subjects have a 14.4% lower share of real assets in their portfolio if they are (fully) prone to NLA compared to when they are not. This effect is robust to including many controls (see specification 5). The next 4 lines show that education (except for having a STEM education) and cognitive ability do not predict asset holdings very well. This means that the significant effect identified from NLA is distinct from having low education or from having low cognitive reflection (CR) or not being intelligent (IST).
(ii) Expected earnings are lower for nominal assets than for real assets (which also tend to be more risky). The authors estimate that having NLA = 1 instead of 0 means that such investors have about 10% lower return p.a.

	(1)	(2)	(3)	(4)	(5)
Money Illusion Index	−0.144***	−0.142***	−0.123**	−0.097**	−0.083**
	(0.047)	(0.049)	(0.048)	(0.047)	(0.036)
IST-M Score		−0.003	0.000	0.002	0.003
		(0.005)	(0.005)	(0.005)	(0.003)
High CR Score		−0.015	−0.032	−0.040	−0.027
		(0.029)	(0.029)	(0.027)	(0.021)
Education (years)		0.013**	0.007	0.007	0.002
		(0.006)	(0.006)	(0.006)	(0.005)
STEM Education		0.113***	0.103***	0.074**	0.025
		(0.030)	(0.030)	(0.032)	(0.028)
Assets (million DKK)					0.278***
					(0.021)
Liabilities (million DKK)					0.106***
					(0.022)
Controls	No	No	Yes[a]	Yes[b]	Yes[b]
Wald χ^2	2.910	9.890	19.760	41.340	111.330
AICc	67.999	53.703	43.634	43.911	−287.261
N	660	660	660	660	660

Question 4: The role of entitlements and needs in fair sharing

Cappelen, Moene, Sørensen, and Tungodden (JEEA 2013) conduct an experiment to evaluate the role of entitlements and needs in fair sharing.

a) What are the main descriptive results of the study?
   (*Hint*: refer to differences in production across countries and assigned "prices", and to sharing patterns across countries)

   A: HI-subjects are almost three times as productive as LI-subjects (about 55$ vs. 20$). Doubling the piece rate (high vs. low) has no effect on output. Subjects are "cosmopolitans" (i.e. do not give more to subjects from their own country) but HI-subjects (and to a lesser degree LI-subjects) give a larger share to LI-subjects: need matters some

b) The authors propose a model of how self-interest is traded off against fairness motives:

$$V^k(y; \cdot) = y - \beta(y - m^e)^2/2X - \delta\alpha(y - m^n)^2/2X$$

   Derive the interior solution y* (assume $\delta = 1$).
   (*Hint*: use $\tau = \beta / (\alpha + \beta)$)

   A: Take partial derivative of V^k with respect to y, and set it = 0 to obtain:

$$y^* = [\tau m^e + (1 - \tau)m^n] + \frac{X}{\beta + \alpha},$$

c) In the model, the fairness view m^e can take three forms. Characterize these forms by using the following expressions: a_i (production of player i), p_i ("price"), X (total income available for distribution)

A: m^E stands for "egalitarian" (share the total income 50:50, no matter what), m^M stands for "meritocratic" (share in proportion to individual production), and m^L stands for "libertarian" (share according to value of production)

$$m^E = X/2,$$

$$m^M = \frac{a_i}{a_i + a_j}X,$$

$$m^L = p_i a_i,$$

d) How does τ relate to the relative weight given to entitlements vs. needs? (*Hint*: refer to question b above)

A: A person mainly acting on needs considerations has a low β and a high α, and consequently a low τ, whereas the opposite is the case for a person mainly acting on entitlement considerations. Thus, τ captures the relative importance of needs and entitlements in the participants' distributional choices. So, high τ indicates much weight on entitlements and little weight on needs.

e) The authors estimate a random utility model. What are the main findings of the estimation?

A: A majority of subjects (the meritocrats or libertarians) find it morally appropriate to transfer more to a more productive recipient.
A majority of subjects (the egalitarians and the meritocrats) find it not justifiable to take the randomly assigned price («pure luck») into account, i.e. hold the view that fair sharing should compensate for luck.
The estimates (visualized in the distribution of τ in their Figure 4), show that «entitlement considerations were clearly more important than needs considerations for most of the participants in this experiment.»

Question 5: Cooperation, Culture, and Institutions

a) Gächter, Herrmann and Thöni (Science 2008 and 2010) investigate cultural and institutional determinants of cooperation. In the figures below, phase 1 (periods 1-10) is a standard linear public goods game, phase 2 is a peer punishment game. (i) What is the prediction of standard theory for phase 2? Explain.

A: No punishment and no cooperation. The reason is that punishment is costly to the punisher, hence nobody wants to punish in the last period. Given no punishment, nobody cooperates (free rider problem).

(ii) How do the authors explain variation in efficiency across countries in phase 2?

A: They find that "antisocial punishment" (i.e. low cooperators punishing high cooperators) is high in countries in which "*norms of civic cooperation*" are low (e.g. attitudes to tax evasion, abuse of the welfare state, or dodging fares on public transport is perceived to be ok) and where the "*rule of law*" is weak (people do not perceive law enforcement institutions as fair, impartial etc.). It seems to be that punishment by peers in not accepted in such countries because players do not think that cooperation is the appropriate course of action. As a consequence, they (blindly) exert counter-punishment which depresses efficiency.
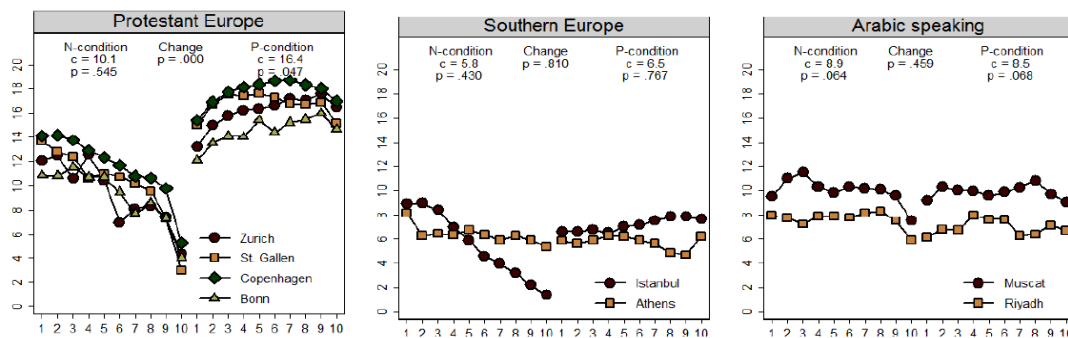
b) Gächter and Schulz (Nature 2016) relate and index of prevalence of rule violations (PRV indicated on the x-axis) to a measure of "intrinsic honesty" in 23 countries as shown below.
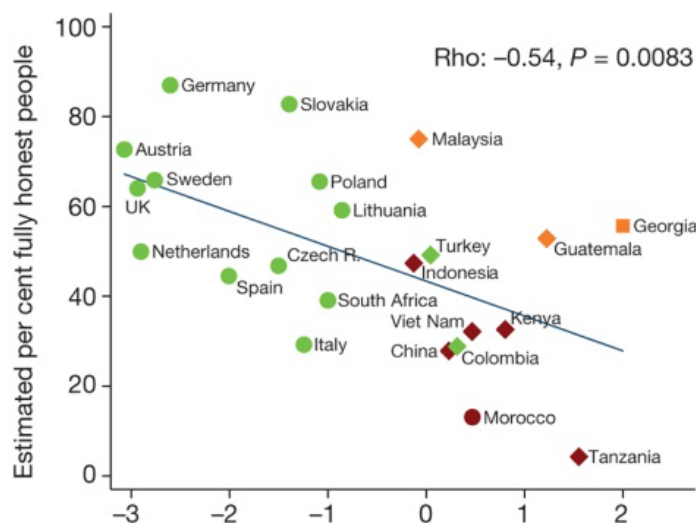
(i) What does the PRV reflect? (*Hint*: the index is composed of three elements)
A: political fraud (measured by an indicator of political rights by Freedom House that measures the democratic quality of a country's political practices); tax evasion (proxied by the size of a country's shadow economy) and corruption (measured by the World Bank's Control of Corruption Index)

(ii) How do the authors measure "intrinsic honesty"? (for 2'568 students in 23 countries)
(iii) How is the "per cent of fully honest people" (y-axis) estimated?
(iv) What does the color coding reflect?

A: (ii) by a die-rolling experiment. Participants were asked to roll a six-sided die placed in a cup twice, but to report the first roll only. Die rolling was unobservable by anyone except the subject. Participants were paid according to the number they reported. Reporting a 1 earned the participant 1 money unit, claiming a 2 earned 2 money units etc., except that reporting a 6 earned nothing. (iii) The percentage of fully honest people is estimated form those reporting 0. (iv) The quality of institutions in each country, proxied by the constraints on executives. Green, yellow, red means high, medium, low quality, respectively.