UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Home exam: ECON5200/9200 – Advanced Microeconomics

Exam period: Dec. 3, 2012, at 09:00 a.m. – Dec. 6, 2012, at 12:00 noon (unless other individual deadline granted)

Grades are given: Jan. 3, 2013

Guidelines:
Submit your exam answer electronically to: submissions@econ.uio.no (this generates an automatic reply to acknowledge receipt of the e-mail). Last day for submission is **Thursday, December 6, at 12:00 noon.** (Unless other deadline is granted.)

Written text should be in pdf format. Please remember to also submit *Delcaration* which you will find on the course web page. This must be submitted as a separate document.

Use your **candidate number** both as the name of the file you submit, and as the author name in the file. Do NOT use your name! You will find your candidate number on your StudentWeb. If you have problems, please contact Tone Enger at tone.enger@econ.uio.no.

Further instructions:

- The questions are in English, but you can give your answers in English, Norwegian, Swedish or Danish.
- The home exam will be marked. Students on masters level are awarded on a descending scale using alphabetic grades from A to E for passes and F for fail. Students on PhD-level are awarded either a passing of failing grade.
- Your answer must fill the formal requirements, found at http://www.sv.uio.no/studier/ressurser/kildebruk/ (Norwegian) or http://www.sv.uio.no/english/studies/resources/sources-and-references/ (English).
- It is of importance that your paper is submitted by the deadline (see above). Papers submitted after the deadline, **will not be corrected**.*)
- All papers must be submitted to the e-mail address given above. You must not submit your paper to the course teacher.

*) The rules for illness during exam also applies for the home exams. Please see http://www.sv.uio.no/english/studies/admin/exams/postponed-exam/index.html for further details.

The 2012 Exam in ECON 5200

Instructions: The maximal score is 20 for each of the five problems below. Please write on you PC and submit the exam electronically as a pdf file by Thursday, Dec 6th, before noon (12:00), i.e. lunch-time. Each of you must send an individually written exam, which is not copy-pasted from others. To ensure that compliance to these rules is incentive compatible, we will substract points at a high rate for answers that arrive too late, for example.

If anything is unclear, explicitly state your assumption before you proceed based on that assumption.

Problem 1. .

A consumer with initial wealth M faces the risk of an accident. The probability of the accident occurring is fixed exogenously, and equal to q. If the accident occurs he loses L (where $L \leq M$) .

(a). Define risk aversion.

(b). In the present context, how are full-insurance contracts characterized.

(c). Suppose the consumer is risk-averse, and a risk-neutral insurance company steps in. Show that any Pareto-efficient insurance contract provides full insurance.

(d). Is it the case that any full-insurance contract is also Pareto-efficient?

Problem 2.

Setup.

Bonds and insurance policies (both of which were examined in the lectures) are examples of financial assets. The aim of this problem is to lay the first stones towards a more general treatment of financial assets in the context of consumer theory.

Consider $T + 1$ time periods, with $t = 1$ representing 'today' and $t > 1$ representing future time periods. Suppose also that for each $t > 1$ there are S possible contingencies, representing uncertainty about the future. A pair (t, s) determines a *state of the world*. Let W denote the set of all states of the world. A financial asset is a vector $\underline{a}^i \in \mathbb{R}^{ST}$ specifying one payout for each possible future state of the world. Let A denote the $ST \times I$ matrix whose columns represent all tradable assets, so that I denotes the total number of tradable assets. We refer to A as the *asset structure*. We will suppose in this problem that $rank(A) = ST$.

A *portfolio* $\underline{\varphi} \in \mathbb{R}^I$ is a combination of tradable assets, such that φ_i indicates the quantity of asset i contained in the portfolio. The portfolio $\underline{\varphi}$ therefore induces payout vector $A\underline{\varphi}$ in future states, where $\varphi_i < 0$ indicates short selling of asset i. Let $\underline{q}$ denote the price vector of the tradable assets at $t = 1$.

If the number of assets is large, different portfolios may induce identical payout vectors. For a long time, one of financial traders' main role was to seek out arbitrage opportunities between such portfolios. Nowadays this is all computerized. There are as a result, at any point in time, approximately no arbitrage opportunities remaining. Intuitively, the no arbitrage condition creates a link between the prices of different assets. It is possible to show in particular that if the no arbitrage condition holds then there exists $\underline{\pi}$ such that

$$\underline{q} = {}^{t}A\underline{\pi} \tag{1}$$

For this problem's sake suppose the consumer only cares about available wealth in each state of the world. As usual, let u denote a utility function representing the consumer's preferences.

Suppose that the consumer receives income y_w in each state of the world $w \in W$. It will be useful to distinguish first-period income from later-periods income; let in this case $\underline{y} = (y_1, \underline{y}_{-1})$. The consumer problem is then:

$$\max_{\underline{\varphi},\underline{x}} u(\underline{x}) \quad s.t. \quad x_1 \leq y_1 - \underline{q}.\underline{\varphi} \;\; ; \;\; \underline{x}_{-1} \leq \underline{y}_{-1} + A\underline{\varphi} \tag{2}$$

Two optimization problems are said to be *equivalent* iff there exists a bijection between their respective solution sets. The aim of this problem is to show that problem (2) reduces to another, much simpler formally, and much more insightful economically.

(a). Assuming (1) holds for some vector $\underline{\pi} \gg 0$, show that (2) is equivalent to

$$\max_{\underline{x}\geq 0} u(\underline{x}) \quad s.t. \quad \underline{\xi}.\underline{x} \leq \underline{\xi}.\underline{y} \tag{3}$$

(b). Discuss. In particular, what insights do we gain from the result derived in (a)?

References. You may want to look take a look at Chapter 19 in *Microeconomic Theory* by Mas-Colell, Whinston, and Green.

Problem 3

Consider the following delegation problem: A risk-neutral firm hires a risk-averse worker to perform a specific task. The agent chooses an effort intensity, e, which positively affects the performance y. Specifically, suppose that $y = e + \rho$, where ρ is a random variable normally distributed with zero mean and variance σ^2. An increase in σ^2 identifies a more uncertain environment. The effort cost is a monotonic increasing and convex function. Assume agent's preferences are as of the constant absolute risk-averse type.

(a) Show that the optimal linear contract is characterized by an optimal piece rate (i.e. a variable compensation component) decreasing in the randomness of the performance. Argue why the marginal return to agents' actions is independent of the underlying riskiness of the environment;

(b) Discuss how the negative trade-off between risk and incentives should affect the optimal design of compensation schemes;

(c) Introduce the possibility of multitasking and assume that all agents are risk-neutral with heterogenous preferences in the private benefits enjoyed from each task. Using the analysis by Prendergast ("The Tenuous Trade-off between Risk and Incentives", *The Journal of Political Economy*, 2002, Vol. 110, No. 5, pp. 1071-1102) show how the optimal piece rate might increase with the measure of uncertainty, reverting the main conclusion of point (a). Highlight: i) the main driving assumptions, ii) the correlation between the marginal return to agent's actions and uncertainty, iii) the implications in terms of optimal compensation schemes, and iv) how good/bad measure of performance might compromise the result;

(d) Select one extension of the model (pp. 1086-1093) and discuss briefly a possible application.

Problem 4

Consider a bilateral bargaining game among two players, which are bargaining over a surplus of size 1. In period 0, player 1 begins by making a proposal, say $(x, 1-x)$, where x represents the part of the surplus the she demands for herself. Player 2 can either accept or reject the proposal. If he rejects the offer neither receives any surplus:

(a) By solving backward, find the SPE of the finite session game. Let $\delta \in (0,1)$ be the individual discount factor, common to both players, and consider the infinite repetition of the bargaining game with alternating offers. Show that there exists a unique SPE and discuss its property in terms of surplus distribution;

(b) Extend the game to multilateral bargaining. Using the analysis by Baron and Ferejohn ("Bargaining in Legislatures", *The American Political Science Review*, 1989, Vol. 83, No. 4, pp. 1181-1206), provide a description of the finite-session bargaining game with *Closed* and *Open Rule* in its extensive form ($\Gamma \equiv \langle I, H, P, \{\upsilon_i\}_i \rangle$);

(c) Consider a *Closed Rule* finite-session game. Show that in equilibrium the distribution of benefits reflects a majoritiarian distribution. Discuss the role of discount factor and compare your result with the bilateral bargaining game;

(d) Show that in the infinite repeated version of the legislative bargaining the Folk-Theorem holds and explain why in a bilateral version the Folk-Theorem cannot be achieved. Finally, discuss how stationary SPE refine the set of SPE;

(e) Prove that, if amendments are governed by an *Open Rule*, then the benefits are distributed more evenly compared to *Closed Rule* and the legislature may not complete its task in the first session;

(f) Give an intuition on how your results on surplus distribution would change if players have an outside option, (for simplicity consider the *Closed Rule* game).

Problem 5

This problem builds on Chapter 23 in the book as well as on the 16-paged article "How (Not) to Sell Nuclear Weapens", by Jehiel, Philippe, Moldovanu, Benny, and Stacchetti, Ennio (1996), *American Economic Review* 86 (4): 814-829.

(a) Besides nuclear weapons, to which extent does the Munch-museum's potential sale of one of its paintings (currently publictly displayed) on the private market fit the models in the article? Limit your answer to one page.

(b) Consider the model in section I-II of the article. Can you for this model derive the Vickrey-Clarke-Groves mechanisms, such they are defined in our book (use the symbols used in the article)?

(c) Compare this VCG mechanism to the mechanism proposed in Section III of the article: How do they differ?

(d) In the model with private information (Section IV in the paper), can you derive the expected externality mechanism, such it is defined in our book? Compare to the mechanism suggested by the authors at pages 822-823 and explain how they differ.