Written Exam Economics summer 2022

Financial Markets Microstructure

August 27, 2022

This exam question consists of 03 pages in total

Answers only in English.

A take-home exam paper cannot exceed 10 pages – and one page is defined as 2400 keystrokes

The paper must be uploaded as <u>one PDF document</u>. The PDF document must be named with exam number only (e.g. '1234.pdf') and uploaded to Digital Exam.

Be careful not to cheat at exams!

Exam cheating is for example if you:

- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts
- Reuse parts of a written paper that you have previously submitted and for which you have received a pass grade without making use of quotation marks or source references (self-plagiarism)
- Receive help from others in contrary to the rules laid down in part 4.12 of the Faculty of Social Science's common part of the curriculum on cooperation/sparring

You can read more about the rules on exam cheating on your Study Site and in part 4.12 of the Faculty of Social Science's common part of the curriculum.

Exam cheating is always sanctioned by a written warning and expulsion from the exam in question. In most cases, the student will also be expelled from the University for one semester.

Final re-exam

Write up your responses to questions below and submit them to Digital Exam. The deadline to submit the responses is Aug 27, 22:00. No cooperation with other students is permitted.

Be concise, but show your work and explain your answers. Be clear about the assumptions you make. Some questions are open ended in that they may not have a unique correct answer. You are allowed to refer to textbooks, lecture notes, slides, problem sets, etc.

Problem 1: Isolated markets

The war in Ukraine led to the isolation of the Russian financial market: both Russian companies' and Russian investors' access to foreign capital markets got heavily restricted, and vice versa, as a result of other countries' sanctions and Russia's own regulations.

Discuss the implications of such an isolation for:

1. Allocative efficiency: will Russian and foreign assets be allocated efficiently among investors? Why/why not?
2. Informational efficiency: will Russian and foreign assets be priced efficiently? Why/why not?

Problem 2: Islandsbanki

> COPENHAGEN, April 19 2022 (Reuters) – Iceland said on Tuesday a sale of the state's remaining share in Islandsbanki would not go ahead as planned due to lack of transparency in a sale of the bank's shares last month. ...
>
> "The implementation of the sale did not fully meet the government's expectations, including transparency and clear disclosure of information," it said in a statement. ...
>
> The state sold off 35% of Islandsbanki last year in Iceland's largest ever initial public offering. ... In January, state holding company Icelandic State Financial Investments (ISFI) got permission to sell its remaining 65% stake, of which 22.5% were sold last month ... in an oversubscribed auction.[1]

In the context of the case presented above, answer the following question: how can the lack of transparency and clear disclosure of information affect the results during such a stock offering?

Problem 3: Dynamic limit order book with adverse selection

NOTE: this problem is long and difficult. Make as much progress as you can and show your work.

This problem explores the effects of informed trading in a version of the Parlour model that we have seen in class. Suppose that there is one asset, whose fundamental value v is unknown, and whose market valuation evolves according to $\mu_t = \mathbb{E}[v \mid \Omega_t] = \mu_{t-1} + \epsilon_t$, where $\epsilon_t \in \{-\sigma, \sigma\}$ with equal probabilities is period-t news, publicly announced at the end of period t (after any period-t orders are submitted).[2] In every period t, one risk-neutral trader arrives at the market. With probability π the trader is *informed* and already knows this period's news ϵ_t. With probability $1-\pi$ the trader is *uninformed* but has an idiosyncratic valuation $y_t \in \{-\sigma, \sigma\}$ with equal probabilities, which is independent of all $\{\epsilon_t\}$. The period-t uninformed trader thus values the asset at $v + y_t$.

[1] https://www.reuters.com/article/iceland-banks-islandsbanki-idUSL2N2WH0NS

[2] Object Ω_t denotes all public information available to the market at (the end of) period t.

Suppose that in every period, there is one ask price $a_t = \mu_{t-1} + S$ and one bid price $b_t = \mu_{t-1} - S$, where S denotes the half-spread, constant across periods. Each arriving trader can choose between submitting a limit order for one unit at the respective price or a market order against an existing order in the limit order book. A limit order is valid for one period and is automatically cancelled if it is not traded against by the next trader.[3] Let $d_t \in \{\varnothing, MS, LS, LB, MB\}$ denote the order submitted by period-t trader, where $d_t = \varnothing$ means the trader abstains from trading, and the other four denote, respectively, the market sell, limit sell, limit buy, and market buy orders.

1. What is the expected utility of a period-t *informed* trader from using a limit buy order, as a function of its execution probability p_{MS}?
2. What is the expected utility of a period-t *uninformed* trader from using a limit buy order, as a function of its execution probability p_{MS}?
3. What are the expected utilities that the informed and uninformed traders get from using a market buy order (assuming a limit sell order is in the book)? How do they depend on ϵ_{t-1}?

We shall look for equilibrium in which traders use a market order if they get a good price, while otherwise an uninformed trader uses a limit order, and an informed trader abstains. I.e., in the presence of a fitting limit order in the book, trading strategies $d_t^I(\epsilon_t, \epsilon_{t-1})$ and $d_t^U(y_t, \epsilon_{t-1})$ for the informed and the uninformed traders are given by:

$$\begin{aligned} d_t^I(+\sigma,+\sigma) &= MB & \qquad d_t^U(+\sigma,+\sigma) &= MB \\ d_t^I(+\sigma,-\sigma) &= LS & \qquad d_t^U(+\sigma,-\sigma) &= LB \\ d_t^I(-\sigma,+\sigma) &= LB & \qquad d_t^U(-\sigma,+\sigma) &= LS \\ d_t^I(-\sigma,-\sigma) &= MS & \qquad d_t^U(-\sigma,-\sigma) &= MS \end{aligned}$$

4. Derive the execution probabilities p_{MS}. Are they different for the informed and the uninformed traders? Why/why not?
5. For which values of S is it optimal for a period-t trader to use a market buy order when $\epsilon_{t-1} = \sigma$ and $\epsilon_t / y_t = +\sigma$ (for the informed/uninformed trader, respectively)?
6. For which values of S are $d_t^I(+\sigma,-\sigma) = LS$ and $d_t^U(+\sigma,-\sigma) = LB$ the optimal strategies in their respective cases?
7. Argue that your answers to the two previous questions apply also to the four remaining cases (a very short verbal argument is expected). Derive the final conditions that S must satisfy for the strategies assumed above to constitute an equilibrium.
8. Do the conditions you derived above impose any restrictions on π? If yes, explain intuitively why the desired equilibrium may not exist when π is out of bounds.
9. The equilibrium under consideration involves informed traders sometimes trading *against* their private information (when $\epsilon_t = +\sigma$ they may submit a limit *sell* order and vice versa). Discuss intuitively why such a situation arises.

   NOTE: you can attempt to answer this question even if you have not answered some or all of the parts 4-9 above.
10. Finally, most of the problem above looked at one specific equilibrium. Are there any other equilibria of this game (for a given S)?

    NOTE: this is a bonus question, i.e., it is extremely long and difficult. You are welcome to attempt it and show your work after you have solved the rest of the exam, but you are not expected to provide a

[3] To be clear: a limit order submitted in period t can **not** be cancelled or repriced when ϵ_t is revealed.

complete answer.