Written Exam Economics Summer 2020

Financial Markets Microstructure

August 23, 2020

This exam question consists of 3 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. '127.pdf') and uploaded to Digital Exam.

Problem 1

The Parlour model explores traders' choices between market and limit orders. Its bottom line, as we argued in class, is that limit orders result in more favorable prices but at the cost of the execution risk. In particular, we ignored the potential effects of asymmetric information. Suppose now instead that with some probability public information (news) can arrive between periods t and $t+1$ (but not at any other time, and all of these facts are commonly known). This will produce an asymmetry in the sense that trader at $t+1$ will be able to act upon this information, while limit orders submitted by trader t are independent of this news.

Answer the following questions using convincing intuitive arguments. Proceed via backwards induction: i.e., holding previous traders' strategies fixed, state how the strategy of a trader in a given period changes. You do not need to analyze a formal model, but you are welcome to do so if you want to.

1. How will the behavior of traders who arrive at $t+2$ or later change due to the possible arrival of news?
2. What about the trader who arrives at $t+1$?
3. What about the trader who arrives at t?
4. Now suppose that if the period-t trader submitted a limit order, he can revise/cancel his limit order after the news arrives. How do your answers to parts 1-3 change?

Problem 2

This question investigates the inventory risk in uncertain environments within the Stoll model framework. Consider a three-period model, $t \in \{0, 1, 2\}$. There is one asset, whose fundamental value evolves as $\mu_{t+1} = \mu_t + \epsilon_t$, where $\epsilon_t \sim \mathcal{N}(0, \sigma_\epsilon^2)$. The respective μ_t is observed at the beginning of period t.

In periods $t \in \{0, 1\}$ the representative dealer must provide quote schedule $p(q)$ for any incoming order size q (where $q > 0$ means a buy order and $q < 0$ means a sell order). In period $t = 0$ one trader arrives for sure and submits an order denoted by q_0. In period 1 one trader arrives with probability λ and, if he does, submits an order $q_1 = -q_0$. In period $t = 2$ the asset is paid out: every owner of the asset receives a payment μ_2 per unit and the asset has no future value.

Dealer has mean-variance preferences over his final wealth w_2. I.e., in every period he maximizes

$$U(w_2) = \mathbb{E}[w_2] - \frac{\rho}{2}\mathbb{V}(w_2).$$

His initial position in the asset is neutral: $z_0 = 0$. The initial cash holdings c_0 are also normalized to zero. (The dealer can borrow cash and short the asset at no cost). The dealer behaves competitively (is a price-taker).

1. Consider period $t = 1$. Denote the dealer's position at the beginning of the period as z_1. Derive the dealer's quote schedule $p_1(q)$ given z_1.

2. What is the price at which trade will happen at $t = 1$?

3. Consider period $t = 0$. Derive the dealer's quote schedule $p_0(q)$.

4. Explain how $p_0(q)$ depends on λ and why.

   NOTE: if you could not solve parts 1-3, you can still try to make an educated guess here.

5. The problem assumes $q_1 = -q_0$, i.e., that the order flow is perfectly negatively autocorrelated. How justified is this assumption? How does it relate to the dealer's pricing decisions?

   NOTE: if you could not solve parts 1-4, you can still answer this question.

Problem 3

Many real-world trading platforms have "circuit breakers" – automatic safeguards which halt all trading in an asset if its price changes too drastically over a short time. Using the material of the course, discuss what consequences can the existence of such circuit breakers have in terms of market outcomes (liquidity, traders' risk exposure and willingness to trade, price discovery).