Answer Sheet to the Written Exam

Financial Markets

June 2014

In order to achieve the maximal grade 12 for the course, the student must excel in all three problems.

Problem 1:

This problem focuses on testing part 1 of the course's learning objectives, that the students show "The ability to readily explain and discuss key theoretical concepts and results from academic articles, as well as their interpretation." The maximal grade is given for an excellent presentation that demonstrates a high level of command of all aspects of the relevant material and containing no or only few minor weaknesses.

(a) Chapter 8 contains the relevant material, in particular section 8.3.

(b) The context is the liquidity externality outlined earlier in 7.3, while box 7.2 and section 7.3.2 provide further explanation that can be summarized here.

(c) Part of this intuition is the last sentence on page 394, that a tax increase can lower the probability of a trade with the informed trader faster than that of trade with the liquidity trader — this relaxes the adverse selection problem for the dealer.

Problem 2:

This problem focuses on testing part 2 of the course's learning objectives, that the students show "The ability to carefully derive and analyze results within an advanced, mathematically specified theoretical model." The maximal grade is given for an excellent presentation that demonstrates a high level of command of all aspects of the relevant material and containing no or only few minor weaknesses.

(a) With $\Delta = 0$, adapt the analysis on page 197.

(b) Go through the arguments on page 197, translating them to the bid side.

(c) With the sign conventions regarding supplied quantity Y in (a) and (b), expressions (1) and (2) have the difference (3), using also $P = 1 - F$. In the special case where $|q| = 0$, we can use that $1/(1-F) + 1/F = (F + 1 - F)/(F - F^2)$ to get (4).

(d) $F(0)$ is the probability that a seller arrives. It's a number in the interval $[0, 1]$. At both ends of the interval, division by zero implies that IS is infinitely large. An interior

minimum is achieved where $F(0)[1-F(0)]$ is a large as possible. This quadratic function of $F(0)$ has its maximum at $F(0)=1/2$ where its value is $1/4$. There, $IS=4C$.

(e) The symmetry assumption means that sell orders larger than $|q|$ arrive just as often as buy orders larger than $|q|$, for any q. In (3), then $1-F(|q|)=P(|q|)=F(-|q|)$, giving the result. In particular, $F(0)=P(0)=1-F(0)$ so $F(0)=1/2$.

(f) Can be solved in two ways. Most obviously, use from (e) that we need to have $2C/F(-|q|)=4C+2\lambda|q|$, i.e., $F(-|q|)=C/(2C+\lambda|q|)$. You may express this as $F(Q)=C/(2C-\lambda Q)$ for $Q\leq 0$. For $Q\geq 0$ you can use symmetry, $F(Q)=1-F(-Q)=(C+\lambda Q)/(2C+\lambda Q)$. You may note that this is an increasing, continuous function, as it should be by earlier assumptions.

(g) The textbook is talking about the dealer's update of the mid-quote in response to order flow. Here, instead, it is a temporary impact on the price for the one transaction.

Problem 3:

This problem focuses on testing part 3 of the course's learning objectives, that the students show "The ability to apply the most relevant theoretical apparatus to analyze a given, new case-based problem." The maximal grade is given for an excellent presentation that demonstrates a high level of command of all aspects of the relevant material and containing no or only few minor weaknesses.

The most obvious connections to our syllabus is to the two articles on HFT, and to chapter 8 on market transparency, which mentions low-latency access to data feeds on page 297.