

## PROBLEMS (SECTIONS 12 ONWARDS)

1. Posit runs approximately fifteen crosses per day in US stocks. If, for example, there are orders entered to buy 100,000 shares and orders to sell 150,000 shares, there is a match for 100,000 shares. In the sell orders, 50,000 shares are unmatched. The unmatched shares can be cancelled or rolled over for another attempt in the next match. Does Posit publicly announce the imbalance? What is the case for and against such an announcement?

Ans: No; Knowledge of the imbalance might attract offsetting buyers, but it would also reveal the clients' trading intentions.

2. Suppose that the most recent quote updates in an NYSE-listed stock is:

NYSE: 50 bid for 5,000 shares; 4,000 shares offered at 50.10

Boston: 50.07 bid for 200 shares; 300 shares offered at 50.12

Pacific: 48.80 bid for 200 shares; 300 shares offered at 50.09

- (a) What is the NBBO?
- (b) The NYSE specialist receives an order to sell 1,000 shares. Can the order be sold to the book at 50?
- (c) The NYSE specialist receives an order to sell 1,000 shares. Can the order be sold to a floor broker at 50.09?
- (d) Suppose that these quotes prevail at the time of a Posit cross. At what price would the match occur?
- (e) Could a cross at this price occur under the proposed Reg NMS?

Ans:

- (a) The best bid is Boston's (50.07 for 200 shares); the best offer is the Pacific's (50.09 for 300 shares).
  - (b) An NYSE execution at 50 would trade through Boston's quote. The rules of the intermarket trading system prohibit this.
  - (c) An NYSE execution at 50.09 doesn't trade through any other quote, and is permissible. (There is no time priority for the Pacific's offer.)
  - (d) The price of the Posit cross is determined by the midpoint of the NYSE bid and offer. (For listed stocks, Posit uses the primary market quote.) The cross would occur at 50.05.
  - (e) Under the proposed Reg NMS, an execution at 50.05 would normally be considered a trade-through. It could take place if the Posit sellers had opted-out of trade-through protection; or, Boston was considered a "non-automated" market.
3. What do the following acronyms stand for: ATS, ECN, NMS, ITS?
  4. Regarding ATSS:

- (a) Could an ATS be named FastExecute? FastExchange? RapidTrade? SpeedQuote? SpeedStockMarket?
- (b) Does an ATS that trades an NYSE-listed stocks have to participate in ITS? (That is, does it have to make its bid and offer accessible to other exchanges that might want to trade against them?)

Ans:

- (a) An ATS can't use in its name " 'exchange,' 'stock market', or similar terms." This rules out FastExchange and SpeedStockMarket. The others are okay.
- (b) It depends on the trading volume. As long as the ATS is small (technically, that it accounts for less than 5% of the total volume in the stock), it does not have to participate. Above 5%, and it must join (to make its quotes publicly visible and accessible).

5. After the NYSE close, the Alphamin Fund routinely enters all unfilled orders into the NYSE crossing session I. What are the dangers of this?

Ans: The NYSE cross occurs at 5pm, roughly one hour after the market closes. If there is news during that hour that makes the closing price "stale", Alphamin will tend to get filled on the wrong side of the market. For example, suppose that Alphamin needs to buy 10,000 shares of XYZ, and that the 4pm closing price of XZY is 25. If negative news occurs after the close, there will be an imbalance of sellers and Alphamin's order is likely to be filled – they'll be buying a price that is too high. This loss is not offset in the other direction. If positive news occurs, Alphamin will be among the buyers in a market with a buy imbalance. They will likely receive a partial (or no) fill.

6. The quote record looks like this:

Time	Bid	Ask
11:01:00	90.10	90.15
11:02:01	90.12	90.19
11:04:39	90.14	90.19
11:06:03	90.16	90.20
11:07:23	90.14	90.18
11:10:03	90.16	90.22

A buy order received by the market at 11:02:00 trades at 90.14. What is the effective spread associated with this trade? Using the SEC timing convention, what is the realized spread associated with this trade?

Ans:

Effective spread =  $2 \times (90.14 - (90.10+90.15)/2) = \$0.03/\text{share}$ ;  
Realized spread =  $2 \times (90.14 - (90.16+90.20)/2) = -\$0.08/\text{share}$

7. The ABC pension fund hasn't paid any particular attention to its order management practices. One day, it calls in a consultant to analyze their trading costs. The consultant

analyzes all of their executions over the past six months and presents the following summary table.

	Market Order Executions	Limit order executions
Number of orders	10,000*	5,000**
Average posted spread (immediately prior to order submission)	\$0.14/share	\$0.20/share
Average effective spreads	\$0.12/share	-\$0.05/share
Average realized spreads (relative to bid/ask midpoint five minutes after execution)	\$0.10/share	\$0.05/share
	* A total of 10,000 market orders were submitted	** A total of 11,000 limit orders were submitted

- What accounts for the discrepancy between orders submitted and orders executed for limit orders?
- What might account for the differences (between market and limit orders) in effective spreads?
- What might account for the differences (between market and limit orders) in realized spreads?
- What might account for the differences (between market and limit orders) in posted spreads?
- The consultant says, “The effective spread measures how much you’re paying for executions relative to the market’s price prior to your entry. Your limit orders obviously have the lowest effective spreads. In fact, you’re making money off of them! Great work! You should be using more limit orders and fewer market orders.” Discuss.

Ans:

- Many limit orders are canceled or fail to execute.
- Market orders almost always execute away from the quote midpoint: above the midpoint for a buy and below for a sell. Limit orders are often priced, if to buy, near the bid (and, if to sell, near the ask). *If such an order executes*, the price will often be favorable. When a buy at the bid executes, for example, the trade price is below the midpoint, and the effective cost is negative.
- When a market order executes, prices tend to move in the direction of the order. (A buy market order tends to move the price up.) A representative example:

The market is 10 bid; offered at 10.24.

A market buy order trades at 10.24 (effective cost = 0.12)

The quotes are revised to 10.02 bid; offered at 10.26.

The bid-ask midpoint after the trade is 10.14 and the realized cost is 0.10.

A buy limit order, on the other hand, will execute (if it does) when it is *hit by an incoming market sell order*, sending the price down. A representative example:

The market is 10 bid; offered at 10.10.

We enter a limit order to buy at 10.

The order executes when hit by a market *sell* order. (The effective cost is – 0.05.)

The revised quotes are 9.90 bid; offered at 10.00. (The midpoint is 9.95; the realized cost is 0.05)

- (d) The posted spread is wider prior to limit order submission. This is because when the spread widens, market orders become more expensive. Traders are more likely to submit limit orders.
- (e) The consultant is ignoring the cost of limit orders that don't execute. These probably gave rise to trades that had to be executed by using market orders at worse prices. If the trade never occurred, we lived with a portfolio imbalance (or whatever it was that caused us to want to trade in the first place).

8. The recent CQS quote record for NIS is (with sizes in 100-share lots):

Time	Bid	Offer	Bid Size	Offer Size	Exchange	Market Maker
9:51:00	100.00	100.10	2	10	N	
9:51:01	100.02	200.00	4	1	P	
9:51:03	0.01	200.00	1	1	P	
9:51:04	100.02	100.10	3	2	N	
9:51:05	100.00	100.12	2	3	M	
9:51:06	100.04	100.12	1	1	T	MADF
9:51:06	100.02	100.12	2	4	T	BRUT
9:51:07	100.02	100.12	1	2	T	MADF
9:51:08	100.00	100.10	2	3	B	
9:51:09	99.95	100.08	2	4	M	
9:51:10	0.01	100.08	1	1	P	

Assume that there was nothing prior to 9:51:00, and nothing more until 9:53:00. What's the NBBO (with sizes) as of 9:52:00?

Ans:

The active participants are N, P, M, B, MADF and BRUT. As of 9:52:00, their bids and offers are:

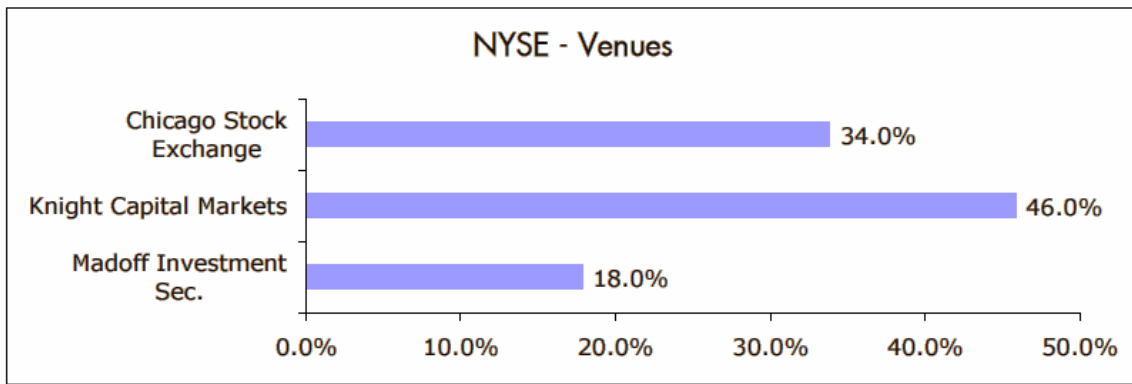
Time	Bid	Offer	Bid Size	Offer Size	Exchange	Market Maker
9:51:04	100.02	100.10	3	2	N	
9:51:06	100.02	100.12	2	4	T	BRUT
9:51:07	100.02	100.12	1	2	T	MADF
9:51:08	100.00	100.10	2	3	B	
9:51:09	99.95	100.08	2	4	M	

9:51:10 0.01 100.08 1 1 P

N, BRUT and MADF are at the best bid, 100.02 with total size 600 shares; M and P are at the best offer for a total of 500 shares.

Note: The “0.01” and “200” quotes entered by the Pacific Exchange are not real prices. The Pacific Exchange quotes derive from the Archipelago ECN. On an ECN, bids and offers are supplied by customers, and sometimes the buy or sell side of the book might be empty. To indicate an empty buy-side, an ECN will often post a one-penny quote; an empty sell-side is indicated by a price that is approximately double the currently prevailing market price.

9. A recent 11ac1-6 report for a retail brokerage contains a graph that discloses where orders for NYSE-listed stocks are routed.



The following passage from the report describes the broker’s relationship with Knight. (A “rebate” is a payment from Knight to the broker)

*Material Aspects of Relationship with Knight Capital Markets:*

100-2000 share market orders receive rebates at the following rates:

- 10% of the NBBO spread on S&P 100 trades with a per share .0225 cap.
- 10% of the NBBO spread on S&P 500 trades with a per share .0175 cap.
- 5% of the NBBO spread on other NYSE and AMEX issues with a per-share .01 cap.

2001-50,000 share market orders receive rebates at the following rates:

- 20% of the NBBO spread on S&P 100 trades with per share .0225 cap.
- 20% of the NBBO spread on S&P 500 trades with per share .0175 cap.
- 10% of the NBBO spread on other NYSE and AMEX issues with a per-share .01 cap.

Price-improved orders and marketable limit orders will receive a rebate of 50% of the above rates.

Rebates are not paid on (1) non-marketable limit orders, (2) pre-opening orders, (3) NYSE and AMEX securities executed at a price under \$5, (4) Manning executions (limit order protection), and (5) Tier III and IV securities (certain non-S&P 500 issues).

- (a) PLQ (not in the S&P 100 or the S&P 500) is 100.10 bid; offered at 100.30. What is the rebate for a 500 share market buy order?
- (b) Why doesn’t the broker simply send orders in listed stocks to the NYSE?

- (c) What are “price-improved orders” and “marketable limit orders”? Why might Knight offer a lower rebate on them.
- (d) Why doesn't Knight offer a rebate on non-marketable limit orders and Manning executions? Note: a Manning execution is an execution of a customer limit order that is triggered by a dealer's trade. For example, suppose that Knight holds a customer limit order to buy at 50, and that Knight (acting as a dealer) buys from a customer at 50. In doing this, Knight has traded ahead of the customer limit order, and by the Manning rules, Knight owes the customer an execution.

Ans:

- (a) The NBBO spread is \$.20; 5% of this is \$ 0.01. On 500 shares, the total rebate is \$5.
- (b) The NYSE doesn't pay for the orders; Knight does.
- (c) A price-price improved order is one in which Knight gave the customer a price better than the NBBO. This would make the order more expensive for Knight to execute.

Marketable limit orders are those that are priced to execute when the order arrives, but might not execute if the quote is moving. For example, if the market is 10 bid; offered at 10.10, a limit order to buy at 10.10 will usually be executed. But marketable limit orders are often used in fast markets when there is a chance that the price will move away from the order. If Knight sells to the customer at 10.10 when the market is moving up, they will have to cover their sale at a higher price. Again, this makes the execution more expensive for Knight.

- (d) A limit order is effectively a bid or offer that originates from a customer. It competes with a dealer's own bid or offer, and thus makes it more difficult for a dealer to make money on other trades. A non-marketable limit order thus raises the dealer's costs.