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Securities Trading: Procedures and Principles

Problems, Exercises, and Sample Exam Questions

Draft Teaching Notes

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Supplementary material for Securities Trading Principles and Protocols version 8.

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Chapter 9. Public information and trading halts

Readings (links on web page)

Fischel, Daniel R. (1982). Use of modern finance theory in securities fraud cases involving actively traded securities. Business Lawyer, 38(1), 1-20.

Partial list of concepts and terms

Market efficiency (weak-, semi-strong-, strong-); limit-up/limit-down; circuit breakers; timing of public announcements; trading halts; re-openings; forecasting the forecasts of others (the Keynesian "beauty contest"); Reg FD

Rule 10b-5 (not exact wording, but the content); material fact/materiality; reliance; causation; damages under the "traditional" view; material … damages under the market-efficiency view; fraud on the market; of materiality and reliance; corrective disclosure; the single-index stock return model and its use in damage calculation; identification of injured buyers and sellers. Most of these concepts were identified and/or analyzed in the Roka, Sanofi, and "ChunkyChocolates" cases.

Problems

9.1. It is 1pm. After the market close, Briarthorne is planning to announce an accounting irregularity that calls last quarter's financial statements into question. Briarthorne might move the announcement earlier, and during trading hours, if

a. The primary listing exchange believes that the announcement would increase trading volume.
b. A hurricane has hit Florida, and Briarthorne believes that this news would distract attention from their announcement.
c. There is evidence that the news may already have been leaked.
d. Briarthorne wants to discourage traders from selling the stock short.

9.2. U.S. government economic statistics are often announced when the market is open. Immediately prior to an announcement, the bid-ask spread usually ___ and trading volume ___.

a. Widens; rises
b. Widens; drops
c. Narrows; drops
d. Narrows; rises

9.3. Limit-up/limit-down procedures in US equity markets ____.

a. Set price limits for individual stocks. These limits can trigger trading halts.
b. Govern when a market center can accept limit buy and sell orders.
c. Limit retail investors' profits and losses over the day to ±5% of the prior day's closing price.
d. Specify limits such that all trades occurring outside of those limits can be broken (cancelled) by either the buyer or the seller.

9.4. Circuit breakers in US equity markets.

a. Force orders to be routed from dark to lit markets.
b. Are triggered only when the S&P index declines by a pre-set amount.
c. Are triggered when the S&P index declines or increases by pre-set amounts.
d. Are pre-emptively used in advance of US Presidential news conferences.

The next two questions refer to the following situation.

- APX first reported its 2013 IV (fourth quarter) earnings on January 29, 2014.
- On Monday, March 3, 2014, APX closed down 2% from the previous Friday. After the market close, APX discloses that previously reported 2013 IV results can't be relied upon and are likely to be revised.
- On Tuesday, March 4, APX closes down 18% from the previous day. Also on Tuesday, after the market close, APX discloses that 2013 IV earnings were overstated by $0.30 per share.
- On Wednesday, March 5, APX closes down 8% from the March 4 close.

9.5. Randolph and Mortimer Duke immediately file a law suit alleging that the accounting fraud cost them 28% of their investment in APX (the sum of the Monday, Tuesday and Wednesday declines). APX hires an expert. Using market data prior to June, 2014, the single-index model is specified for daily returns as $r_{APX} = \alpha_{APX} + \beta_{APX} r_M + e$ where the expert's estimated parameters are $\alpha_{APX} = 0$; $\beta_{APX} = 1.3$. The daily returns on APX and the market ("M") during the week are:

Date	r_{APX}	r_M
Monday, March 3	-2.0%	-4.0%
Tuesday, March 4	-18.0%	-5.0%
Wednesday, March 5	-8.0%	-1.0%
Thursday, March 6	+3.0%	-1.0%
Friday, March 7	6.0%	5.0%

What case could the expert make to refute the Duke claim? What number might she suggest as an alternative to the 28% loss?

9.6. The Dukes also present the following records of their purchases and sales:

Date	Shares bought (sold)	Net holdings
September 1, 2013	10,000	10,000
December 29, 2013	(9,000)	1,000
January 5, 2014	5,000	6,000
February 1, 2014	2,000	8,000
March 7, 2014	(8,000)	0

On the basis of these records, they claim that their 28% loss applies to the 17,000 shares they purchased before or during the period affected by the alleged fraud. What alternative number might APX's expert suggest?

Answers

9.1. c There is evidence that the news may already have been leaked. (If the news is leaking, there is a danger of increased information asymmetries.)

9.2. b Widens; drops (Over the period of the announcement, volatility is higher.)

9.3. a Set price limits for individual stocks. These limits can trigger trading halts.

9.4. b (only on declines)

9.5. The corrective disclosures did not occur before the market close on Monday, so Monday's return is not relevant. APX declined on Tuesday and Wednesday, but so did the market. To isolate the part of the return that might be due to company-specific news, we focus on the residuals in the regression (the company-specific components of the return).

Date	r_{APX}	r_M	$e = r_{APX} - \beta_{APX} \times r_M$
Monday, March 3	-2.0%	-4.0%	…
Tuesday, March 4	-18.0%	-5.0%	$-18 - 1.3 \times (-5) = -11.5\%$
Wednesday, March 5	-8.0%	-1.0%	$-8 - 1.3 \times (-1) = -6.7\%$
Thursday, March 6	+3.0%	-1.0%	$3 - 1.3 \times (-1) = 4.3\%$
Friday, March 7	6.0%	5.0%	…

If the company-specific returns on Tuesday and Wednesday are attributed to the corrective disclosures, the damages would be based on return of $-11.5\% - 6.7\% = -18.2\%$. But the following day (Thursday), the stock recovered on a day when the market was down. So the expert might also argue that there were over-reactions on Tuesday and Wednesday. Including Thursday's gain, the damages would be calculated on a return of -13.9% $(= -18.2 + 4.3)$.

9.6. The period over which the earnings accrued (in an accounting sense) isn't relevant here. What matters is the information that management reported (or mis-reported) to the market. Since they first reported 2013 IV earnings on January 29, what matters is the net number of shares that were purchased during the period covered by the mis-information, that is January 29 to March 6. This is 2,000 shares.

Chapter 10. Private information

Readings (links on web site)

Bagehot, W., 1971. The Only Game in Town. Financial Analysts Journal 27, no. 2 (March-April), 12-22, (pseudonym for Jack Treynor).

Partial list of concepts and terms.

Private vs. common values; symmetric and asymmetric information; Treynor/"Bagehot" analysis of the bid-ask spread. The sequential trade model of the bid-ask spread and price impact; market failure;

Problems

10.1. Retail order flow is more desirable *to a market maker* because, relative to institutions/institutional orders, ____.

a. Retail traders are less likely to be informed (in possession of non-public information).
b. Retail traders are more likely to use order splitting strategies.
c. Retail traders are more likely to direct their orders to specific trading venues.
d. Retail orders are usually subject to payment for order flow arrangements.

10.2. At the end of the day, SLK stock will be worth 100 (an 80% probability) or 110 (a 20% probability). A market-maker believes that 90% of her incoming traders are uninformed, and equally likely to buy or sell; the remaining 10% know SLK's end-of-day value. The market maker is trying to set his ask price. At what value of the ask does she just break even?

10.3. Before posting her ask price, the market maker notices that the date is April 15. Uninformed traders are more likely to be selling stock to pay their taxes. She now figures that there is only a 30% probability that an uninformed trader will be buying. What is her revised ask price?

[See also the embedded problems in the class overheads.]

Answers

10.1. A. Retail traders are less likely to be informed (in possession of non-public information). *Market makers lose to informed traders. (Informed traders always trade in the direction of their information, buying if they have positive non-public news; selling on negative non-public news.) Market makers profit (on average) from uninformed traders. An uninformed trader is just as likely to buy as to sell; the dealer earns the spread from each pair of uninformed traders who come by. Informed traders never come by in pairs; they are always on one side of the market. Answer b is irrelevant; answer c states something that is incorrect (retail traders are less likely to know or care where their orders were sent. As for answer d, the statement is true, but it does not describe why a market maker would prefer a retail order.*

10.2. The market considers the following possibilities (the full table is given, but only the numbers in bold are actually needed):

End-of-day value	Trader type	Trader …	Probability
100	Uninformed	Buys	$\mathbf{0.8 \times 0.9 \times \frac{1}{2} = 0.36}$
		Sells	same
	Informed	Buys	$\mathbf{0}$
		Sells	$0.8 \times 0.1 = 0.08$
110	Uninformed	Buys	$\mathbf{0.2 \times 0.9 \times \frac{1}{2} = 0.09}$
		Sells	same
	Informed	Buys	$\mathbf{0.2 \times 0.1 = 0.02}$
		Sells	0

The probability of a buy order from the first incoming trader is

$$P(buy) = 0.36 + 0 + 0.09 + 0.02 = 0.47$$

The probability of a buy order *and* a low end-of-day value is

$$P(buy, 100) = 0.36$$

The probability of a low end-of-day value *given* a buy order is

$$P(100|buy) = \frac{P(buy, 100)}{P(buy)} = \frac{0.36}{0.47} = 0.766$$

The expected end-of-day value *given* a buy order is $0.766 \times 100 + 0.234 \times 110 = 102.34$. This is the break-even ask price.

10.3. The new probabilities are:

End-of-day value	Trader type	Trader …	Probability
100	Uninformed	Buys	$\mathbf{0.8 \times 0.9 \times 0.3 = 0.216}$
		Sells	$0.8 \times 0.9 \times 0.7 = 0.504$
	Informed	Buys	$\mathbf{0}$
		Sells	$0.8 \times 0.1 = 0.08$
110	Uninformed	Buys	$\mathbf{0.2 \times 0.9 \times 0.3 = 0.054}$
		Sells	$0.2 \times 0.9 \times 0.7 = 0.126$
	Informed	Buys	$\mathbf{0.2 \times 0.1 = 0.02}$
		Sells	0

Then:

$$P(buy) = 0.216 + 0 + 0.054 + 0.02 = 0.290$$

$$P(buy, 100) = 0.216$$

$$P(100|buy) = \frac{P(buy, 100)}{P(buy)} = \frac{0.216}{0.290} = 0.745$$

The expected end-of-day value *given* a buy order is $0.745 \times 100 + 0.265 \times 110 = 102.55$. This is the break-even ask price. (A buy order is more informative than in the last case because it is more surprising.)

Chapter 11. Insider trading

Readings (links on web site)

Bainbridge, Stephen M. (2000). Insider trading: an overview.

Pages 1-(top of) p. 5. Morrison-Foerster, LLP. (2015). 2014 Insider Trading Annual Review. Morrison-Foerster, LLP.

Partial list of concepts and terms

Disclose or abstain (Texas Gulf Sulfur); fiduciary duty of confidentiality (Chiarella); misappropriation of information (O'Hagan); tipper-tipee liability (Dirks); short-swing profits; 10b5-1 plans and the criticisms; economic arguments and counter-arguments in favor of insider trading.

Problems

11.1. In support of the idea that insider trading laws should be abolished, all of the following arguments are advanced, except ____.

a. Insider trading increases the informational efficiency of stock prices.
b. Insider trading is simply a way of compensating managers.
c. Insider trading will encourage managers to quickly publicize specific corporate developments.
d. Any limits to insider trading by managers are best addressed in their employment contracts.

11.2. Chiarella was a financial printer who learned the identities of target firms and bought their stock before the announcement of the takeover bid. He was ultimately _____, on the grounds that _____.

a. Convicted; he misappropriated information from his employer (the printing company).
b. Found innocent; he had no fiduciary responsibility to the target companies.
c. Convicted; he was simply trading on the basis of material non-public information.
d. Found innocent; his trades had no material impact on the bidding company.

11.3. "Insider trading increases the informational efficiency of stock prices." Why was this argument advanced? What are the counter-arguments (that insider trading *doesn't* increase the information efficiency of stock prices)?

11.4. Does the following situation constitute illegal insider trading?

- IceMountain (ICE) and SlipperySlope (SSL) are both publicly-traded companies that manufacture snowboards.
- ICE has done extensive tests of both firms' products; this testing clearly indicates that ICE boards are better.
- Next week, Downhill Magazine will release its annual review of snowboards.
- Mike, the president of ICE, is certain that Downhill's review will confirm the ICE tests, and the price of SSL will drop. He sees an opportunity.
- He plans to sell short, in his personal account, 10,000 shares of his competitor, SSL, just before the review is released.

Discuss whether this would constitute illegal insider trading from the perspectives of the disclose-or-abstain, fiduciary duty, and misappropriation principles.

Answers

11.1. c. Managers might actually have an incentive to delay, so they can make their trades.

11.2. b. Found innocent; he had no fiduciary responsibility to the target companies. Note: it might have been argued that he had misappropriated information from his employer (the printing company), as in the O'Hagan case. But this argument was not originally presented to the jury.

11.3. See class notes and Bainbridge article.

11.4. By strict disclose or abstain, Mike can't trade (he has material non-public information); it doesn't matter that it's not about *his* company. He has no fiduciary duty to SSL, but he does have a fiduciary duty to ICE. ICE produced the information that he's planning to trade on the basis of; the information properly belongs to ICE shareholders. In using the info to trade, he is misappropriating the info from the shareholders.

Chapter 12. Conditional orders / Complex orders

Partial list of concepts and terms

Stop orders; trailing stops; pegged orders; discretionary orders; reserve/iceberg orders

Problems

12.1. When the last sale price of PQR is $42, I enter a stop loss order trailing by $3. In which of the following situations does my order get triggered? Circle all that apply.

a. The trade at $42 is followed by trades at $40, $41 and $39.
b. The trade at $42 is followed by trades at $40, $43 and $41.
c. The trade at $42 is followed by trades at $40, $44 and $41.
d. The trade at $42 is followed by trades at $40, $44, $43, $44, $43 and $41.

12.2. "This year's volatile stock market is driving investors to a trading technique designed to trim their losses. Yet it can also backfire on those who are in the market for the long term. The practice -- known as a "stop-loss order" -- calls for an individual stock to be automatically sold when its share price falls by a certain percentage or hits a designated price. [But] consider what happened to the Stockbusters investment club, a group of about 25 Dallas women that has been meeting and picking stocks together for two decades. Earlier this year, the club members studied and then agreed to buy two energy company stocks, XTO Energy Inc. and Chesapeake Energy Corp. [The] members put in a stop-loss order calling for the shares to be automatically sold if the prices dropped by 10%. Before the next monthly meeting, both stocks had been sold. Both then rebounded within weeks and continued to gain. "That didn't go well," says Nanci Roberts, the club's treasurer. Jeremy Siegel, finance professor at the Wharton School … thinks long-term investors should avoid stop-losses altogether. Instead, he recommends a different tack: buying a 'put,' an option to sell the stock at a certain price on a certain date." When protecting an investment raises risks (Karen Blumenthal. Wall Street Journal. (Eastern edition). New York, N.Y.: Jun 18, 2008. pg. D.1)
What is the equivalent option strategy for a stop-buy order? What are the pros and cons of using options instead of a stop orders?

12.3. Why can't a visible limit order be pegged to or more aggressively than the same-side quote? (Consider, for example, a buy order pegged to the bid plus a penny.)

12.4. David enters an order to buy XYZ limit 50, with a discretionary price of 50.10. (That is, if the market offer drops to 50.10, David would like to buy at that price, canceling the original $50.00 limit order.) If David is willing to buy at 50.10, why doesn't he simply post this as his visible limit price?

12.5. With ABC trading around $55, an investor enters a stop loss order: "sell 200 shares stop $52, limit $50." This is equivalent to _____.
a. "Sell 200 shares limit $50."
b. "Sell 200 shares limit $52."
c. "Sell 200 shares at the market."
d. None of the above.

12.6. Stock XYZ is 20.10 bid, offered at 20.18. At 10:00am I enter an order to buy, undisplayed, pegged to the midpoint, with a discretionary offset of $0.03. In the following sequence of quotes, when does my order first execute (if at all)?

	Time	Bid	Offer	*Mid*	*Distance to Offer*
a.	10:01	20.10	20.29	*20.195*	*0.095*
b.	10:02	20.18	20.29	*20.235*	*0.055*
c.	10:03	20.19	20.29	*20.240*	*0.050*
d.	10:04	20.20	20.29	*20.245*	*0.045*
e.	10:05	20.21	20.29	*20.250*	*0.040*
f.	10:06	20.22	20.29	*20.255*	*0.035*
g.	10:07	20.23	20.29	*20.260*	*0.030*
h.	10:08	20.24	20.29	*20.265*	*0.025*
i.	10:09	20.25	20.29	*20.270*	*0.020*
j.	10:10	20.26	20.29	*20.275*	*0.015*
k.	*None of these situations would lead to an execution.*				

Answers

12.1.

a. The trade at $42 is followed by trades at $40, $41 and $39.
The stop prices set by these trades are 39, 39, 39, Triggered at 39.

b. The trade at $42 is followed by trades at $40, $43 and $41.
39, 39, 40, 40 (Not triggered)

c. The trade at $42 is followed by trades at $40, $44 and $41.
39, 39, 41, Triggered at 41.

d. The trade at $42 is followed by trades at $40, $44, $43, $44, $43 and $41.
39, 39, 41, 41, 41, Triggered at 41.

12.2. A stock buy order is used to purchase stock when the price has increased to a certain level. This could also be accomplished by the purchase of a call option.
Puts and calls are better than stop orders because they avoid the problem of regret (a stock that rebounds after triggering a stop-loss sale, or a stock that falls back after triggering a stop-buy purchase). Puts and calls are, however, costly. They also expire: if you're planning on using one to provide on-going insurance, new options must be purchased to replace expiring ones.

12.3. Once the pegged buy order becomes the visible bid, it tries to better itself. This is unstable, and ends only when the buy limit price reaches the offer (and achieves execution).

12.4. Posting a visible bid of $50.10 may encourage other buyers to match that price. These buyers may end up purchasing while David's order goes unexecuted. Even worse, a showing of visible interest at $50.10 might induce sellers to reprice their orders higher.

12.5. d.

12.6. g. (10:07) At this point, the offer is within $0.03 of the midpoint price, and the pegged limit order is replaced with a marketable order (buy limit $20.29).

Chapter 13. Statistical models of order-price dynamics [and]

Chapter 14. Order splitting

Partial list of concepts and terms

Random-walk; alpha; order impact; efficient trading frontier; manipulations

Problems

14.1. In typical order splitting models of trading strategy, whenever the trading horizon lengthens, the expected execution cost ____ and the variance of the execution cost _____.

a. rises; rises
b. falls; falls
c. rise; falls
d. falls; rises

14.2. In the typical order splitting models of trading strategy, an increase in short-term alpha causes optimal purchases to be made ____ and sales to be made _____.
a. Earlier; earlier
b. Later; later
c. Earlier; later
d. Later; earlier

14.3. Suppose that expected stock price dynamics are described by $p_t = p_{t-1} + 0.001 \times S_t$, where S_t is the number of shares bought (or, if negative, sold), and the current price is \$20. What is the total cost of 600 shares purchased in trades of 100, 200, and 300 shares? What is the total cost if the three trades are optimally sized?

14.4. (Difficult) Suppose that the stock price dynamics are described by $p_t = p_{t-1} + 0.1 \times S_t^2$ (if S_t shares are being actively bought, that is, if $S_t > 0$) and $p_t = p_{t-1} - 0.1 \times S_t^2$ (if S_t shares are being actively sold, that is, if $S_t < 0$). The current price is \$10. Describe a round-trip sequence of trades that would result in a profit. (That is, a manipulation.)

Answers

14.1. d. (This is the risk-return trade-off in order placement decisions.)

14.2. c.

14.3. The first 100 shares are purchased at $\$20 + 0.001 \times 100 = \$20.10$;
the next 200 shares are purchased at $20.10 + 0.001 \times 200 = \$20.30$;
the final 300 shares are purchased at $20.30 + 0.001 \times 300 = 20.60$.
The total cost is $100 \times 20.10 + 200 \times 20.30 + 300 \times 20.60 = 12{,}250$.
With a linear price impact, the cost is minimized by doing the trades evenly: 3 trades of 200 shares.
Under this schedule:
The first 200 shares are purchased at $\$20 + 0.001 \times 200 = \$20.20$;
the next 200 shares are purchased at $20.20 + 0.001 \times 200 = \$20.40$;
the final 300 shares are purchased at $20.40 + 0.001 \times 200 = 20.60$.
The total cost is $200 \times 20.20 + 200 \times 20.40 + 300 \times 20.60 = 12{,}240$.

14.4. Larger trades have a disproportionate impact. Suppose that we buy a total of ten shares as five trades of two shares each. The prices are 10.40, 10.80, 11.20, 11.60, and 12.00. At each of these prices we buy two shares: the total outlay is $112, and the price is at $12. Now we sell the shares, one at a time. The prices are 11.90, 11.80, 11.70, 11.60, 11.50, 11.40, 11.30, 11.20, 11.10, and 11. The total receipts are $114.50.

Chapter 15. Hedging

Terms and Concepts

Static hedging; the market model/single index model; setting up a hedge to capture a return differential; setting up a hedge to remove market risk; dynamic hedging; delta of an option; implementation of delta hedges; direction of trades. You won't need to do a Black-Scholes valuation or compute a Black-Scholes delta.

Problems

15.1. (Static hedging) The Privet hedge fund analyst has determined that LMN stock is likely to outperform the market ("SPY") over the near horizon. The fund wants to establish a $20 million position that will earn the return differential $r_{LMN} - r_{SPY}$. LMN stock is currently priced at $28 per share; the SPY is currently priced at $204 per share. How many shares of each security should Privet be long and/or short?

15.2. (Static hedging) DBQ stock is currently priced around $12 per share. The president and founder of the firm owns two million shares. She doesn't want to sell the stock outright: the market for DBQ has little depth, and she wants to avoid any suspicion that she is pessimistic on the company's outlook. She would like to at least partially hedge her position against market risk. Her broker has estimated the following regression relation between one-month returns on DBY and the SPY (the market): $r_{DBQ} = 0.001 + 1.2 \times r_{SPY} + e$. With the SPY at $204 per share, what position (how many shares? long or short?) should she establish in SPY?

15.3. With DEF stock trading at $21, a call option with an exercise price of $20 and a one-year maturity has a Black-Scholes value of $2.18 and a delta of 0.63. The derivatives desk sells this call, on 5,000 shares, to a customer at $2.75. What position should the desk establish in DEF stock to be hedged (number of shares, long or short)? If the price of DEF rises, will the hedge require stock to be bought or sold?

15.4. With ABC stock trading at $80, the derivatives desk at EastNational has just sold a customer a *put* option on 8,000 shares with an exercise price of $75. The Black-Scholes value for the put is $3.99 and its delta is −0.34. The desk sells the put to the customer at $5.00. How should the desk hedge the position? If the price of ABC rises, how will it change this position?

(Difficult) If the desk does not adjust the hedge after it is initially set up, what are worst and best possible outcomes, ignoring the time value of money? (Assume that ABC expires somewhere in the range of $0 to $100, inclusive.)

Answers

15.1. Long \$20,000,000 worth of LMN, $\frac{20,000,000}{28} = 714,286$ shares; Short \$20,000,000 worth of SPY, $\frac{20,000,000}{204} = 98,039$.

15.2. $2,000,000 \times 12 = \$24,000,000$ worth of stock. She needs to short $1.2 \times \frac{24,000,000}{204} = 141,176$ shares of SPY.
The value of her short position in SPY is 1.2 x \$24 Million = \$28.8 Million. If the market drops by 10%, her gain on this short position will be 10% x 28.8 = \$2.88 Million.
But if the market drops by 10%, her holdings in DBQ will drop (on average) by 12% (= 1.2 x 10%). A 12% drop on her \$24 Million DBQ position is a loss of 12% x \$24 Million = \$2.88Million. This loss is exactly offset by her gain on the SPY: the market risk has been correctly offset.

15.3. $0.63 \times 5,000 = 3,150$ (a long position). If the price of DEF rises, the call is more valuable; since the firm is short, their exposure also rises. More stock will be bought.

15.4. $-0.34 \times 8,000 = -2,720$, that is, short 2,720 shares. If the price rises, the put option becomes less valuable, and the exposure drops. The short position will be reduced, implying that stock will be bought.

The receipts from selling the put are $8,000 \times \$5 = \$40,000$.

If ABC goes to zero, each put is worth \$75; the loss on 8,000 puts is \$600,000. The gain on the 2,720-share short position is $2,720 \times \$80 = 217,600$. Our net profit is $\$40,000 - \$600,000 + \$217,600 = -\$342,400$ (a loss). This is the worst possible outcome.

If the price of ABC is above \$75 at expiration, the put option expires worthless, but we might also have a profit or loss on our short position. If ABC expires exactly at \$75, the put is worthless and we have a gain of $(\$80 - \$75) \times 2,720 = 13,600$. Our net profit is $\$40,000 + \$13,600 = \$53,600$. This is the best possible outcome.

If ABC is \$100 at expiration, the put is worthless; we have a gain of $(\$80 - \$100) \times 2,720 = -54,400$. We have, net, $\$40,000 - \$54,400 = -\$14,400$. This is not good, but it's not as bad as our loss if the stock price goes to zero.

Chapter 16. Fees, rebates and other inducements

Partial list of concepts and terms

Taker fees (also called liquidity removal, liquidity access); rebates for adding liquidity (also called maker rebates); inverted ("taker/maker") pricing and the logic behind it; payment for order flow; [SEC] Rule 606 information.

Problems

16.1. The PAX Exchange charges a $0.003 per share access ("taker") fee and pays a ("maker") liquidity rebate of $0.002 per share. How do these fees/rebates apply to an execution in which Tae's limit order (Sell 100 shares, limit $25.00) is lifted by Sam's order (Buy 100 shares, limit $25.00)?

16.2. (Continuation) For each execution, the ZAP Exchange *charges* a per share maker fee of $0.0029, and *rebates* $0.0018 to the active (marketable) order. On PAX, the bid is $25.00 for 10,000 shares, and the book at ZAP is empty. Vanessa enters an order on ZAP to sell 100 shares, limit 25.00. How do ZAP's fees/rebates apply if Sam's buy order is directed to ZAP instead of PAX?

16.3. DirectBook advertises a liquidity rebate of $0.0025 per share and an access fee of $0.0030 per share. The top of the bid book is a limit order to buy at $10.10 (Beth's); the top of the offer book is a limit order to sell at $10.20 (Sam's). If Charlie submits an order to sell limit $10.10, what are the total fees/rebates; who pays/receives them? *Assume all orders are for 100 shares.*

16.4. DirectBook advertises a liquidity rebate of $0.0025 per share and an access fee of $0.0030 per share. The market in XYZ is $10.10 bid; offered at $10.20. Briefly explain what this means to someone who's sending in a limit order to sell 100 shares limit $10.20.

16.5. A comment letter received by the SEC reads, "… I also encourage the Commission to give careful consideration to the issue of payment for order flow, which, in the opinion of many, can only be considered commercial bribery." What is payment for order flow, and why does the letter writer draw the comparison?

Answers

16.1. Tae receives the rebate, $100 \times 0.002 = \$0.20$, which brings the amount she receives from the sale to $2,500.20. Sam pays the access fee, bringing his net payment to $2,500.30. PAX keeps the $0.10.

16.2. Since Vanessa's order is the first in an empty book, she's at the front of ZAP's offer queue. Sam's order executes against Vanessa's. Vanessa pays maker fee, so the net amount she receives from the sale is $\$2{,}500 - 0.29 = 2{,}499.71$; Sam pays $\$2{,}500 - 0.18 = 2{,}499.82$. ZAP keeps $0.11.

16.3. The resting bid is Beth's. She receives a rebate of $0.25.; The taker is Charlie; he pays $0.30.

16.4. The order is at the offer, so it might not execute, but if it does, they will receive (in addition to the $10.20 per share) a liquidity rebate of 0.0025 per share (an extra $0.25)

Note: The *maker* is the *passive* side of the trade, the *resting* limit order, the bid that is hit or the offer that is lifted. The taker is the person who is actively executing against the maker ("taking liquidity").

- In question 16.3, the resting order is Beth's: she is sitting at the bid. Charlie's order is priced to be marketable: when his order arrives, there is an execution. So he is the taker.

- In question 16.4, the incoming sell order goes on to the book behind the order that is already there. the arrival of the new incoming sell order does not trigger an immediate trade. It will be passive, resting in the book until some marketable incoming buy order causes it to execute. It is therefore a "maker".

16.5. Payment for order flow is money paid by a dealer or market center to a broker to encourage the broker to send retail customer orders. Since the broker is supposed to be the agent for the customer, this gives the broker an incentive to act in a way that might not be in the customer's interest. See class notes.

Chapter 17. Regulation of US equity markets

Readings (links on the web page)

Discussion of "spoofing" in the Complaint for US v. Navinder Singh Sarao. (This was discussed in the class session on Pricing.)

Introduction to Reg NMS (from the final version of the rule).

Partial list of concepts and terms

Market competition; order competition; alternative trading system (ATS); electronic communications network (ECN); order handling rule; Reg NMS; order protection rule; access rule; subpenny pricing rule; protected quotes; intermarket sweep orders (ISOs); tick size; The Common Cents Pricing Act of 1997; Small Cap Liquidity Reform Act of 2014; Tick size pilot program. Trade-at rule. *Some of the material on protected quotes and intermarket sweep orders is discussed in Chapter 4.*

Problems

17.1. For stock *XYZ* markets AX and BX are the only two market centers bidding. Their bid books look like this:

Price	AX		BX	
$10.10	100 sh	*Hidden*		
$10.09	200	Visible	100 sh	Visible
$10.08			300	Visible
$10.07	300	Visible	500	Visible

a. What is the National Best Bid?

b. Market BX receives an order to sell 400 shares limit 10.08 (not marked "sweep"). It executes 100 shares at 10.09 and 300 more shares at 10.08. Does this constitute a trade-through from the perspective of Reg NMS? Explain.

c. Suppose the seller divides her orders:

- Sell 200 shares limit 10.08 (marked sweep) to AX
- Sell 200 shares limit 10.08 (marked sweep) to BX.

Is this consistent with the Reg NMS trade-through policy? Explain. What executions will result?

17.2. ISOs. Protected quotes. The bid sides of the books at three market centers are as follows. There are no hidden orders.

Price	*Exchange A shares*	*Exchange B shares*	*Exchange C shares*
50.49	300	200	
50.48	100	800	
50.47	100	300	400
50.46		900	600
50.45	2,000	2,000	2,000

a. For each exchange, what are the protected bids (prices and quantities)?
b. A trader wants to sell 1,000 shares limit 50.45 using ISOs. What is the minimum quantity that must be submitted to *A*? to *B*? to *C*?
c. A trader wants to sell 6,000 shares limit 10.48 using ISOs. What is the minimum quantity that must be submitted to *A*? to *B*? to *C*?
d. If the trader submits sell 2,000 shares limit 10.45 to each exchange using ISOs, are there any trade-throughs of displayed bids that aren't protected.

17.3. ISOs. Protected quotes with undisplayed orders. The bid sides of the books at three market centers are:

	Exchange A		*Exchange B*		*Exchange C*	
Price	*Shares (Displayed)*	*Shares (Undisplayed)*	*Shares (Displayed)*	*Shares (Undisplayed)*	*Shares (Displayed)*	*Shares (Undisplayed)*
10.49	100	900	800	2,000		
10.48	300	100	200	200		
10.47	400		500		200	400
10.46			700		1,000	
10.45	800		200		2,000	

a. For each exchange, what are the protected bids (prices and quantities)?
b. A trader simultaneously sends the following sell orders, all with limit prices of 10.46, all marked ISO: sell 800 to A, sell 2,000 to B, sell 500 to C. What executions occur?

Answers

17.1.

a. 10.09
b. This is a trade-through. AX is posting a visible quantity of 200 shares; BX trades at an inferior price without executing AX's shares.
c. At AX, 100 sh trade at 10.10; 100 sh trade at 10.09. At BX, 100 sh trade at 10.09, and 100 more trade at 10.08. Although AX still has 100 shares left at 10.09, this does not constitute a trade-through because the trader's order was sufficient to execute all of AX's protected quantity. AX's hidden quantities are not protected.

17.2.

a. *A*'s protected bid is 300 sh @ 50.49; *B*'s is 200 sh @ 50.49; *C*'s is 400 @ 50.47. It is not necessary for a protected quote to match the market-wide best bid or offer.
b. The limit price of 50.45 is below all of the protected bids, so the trader must send 300 to *A*, 200 to *B*, and 400 to *C*.
c. Only *A*'s and *B*'s protected bids are better than the limit price, so the trader must send at least 300 to *A* and 200 to *B*. There is no need to send anything to *C*.
d. On exchanges *A* and *C*, the final executions will occur at 50.45. But *B* will still have 200 shares left at 50.46 (a better price).

17.3.

a. Only the top of the visible book is protected. A's protected quote is 10.49 bid for 100; B's is 10.49 bid for 800; C's is 10.47 bid for 200.
b. On exchange A, 800 shares @ 10.49; on B, ***2,000*** shares @ 10.49; on C, 500 shares @ 10.47. Based on what was displayed, the trader would have expected that the orders would take out all of the displayed interest on A and B above 10.46. In fact, due to the hidden executions, everything executed at each markets best bid. In retrospect, the executions on exchange C could have been filled at better prices on the other exchanges.

FAQ

Why do all 500 shares get sold on market C at 10.47? Wouldn't the only protected orders be the 200 visible orders? And if that is the case then the ISO wouldn't require the remaining 300 shares to be sold from the hidden quantity at 10.47?

And isn't it the case that all orders that are better than the ISO order must be executed in a market before they can move to the next market? – I was under the impression that just the protected order at the top of the book needed to be filled first. Is that incorrect?

The answer to both questions arises in the distinction between *routing* and *execution*. The trade-through rule only dictates what quantities must be routed (sent) to a market. The executions those orders actually receive depends on the state of the order books at those markets. Sweep orders are sent simultaneously, not sequentially. Each receiving market handles its own portion of the ISO independently of what other markets are doing.

Relative to what is on the books at A and B, the entire execution of 500 shares at 10.47 at C could be judged a trade-through. That is, both A and B are holding buy orders at prices

better than 10.47. But these orders aren't protected unless they're visible and at the top of the book. C will execute the incoming 500 share sell order instantly: once C's front end sees that the order is marked "ISO", C is relieved of the responsibility of checking other markets protect bids.