UNIVERSITY OF CALGARY
HASKAYNE SCHOOL OF BUSINESS

Investments & Portfolio Management

Trading Securities

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It is inefficient for buyers and sellers of securities to find each other on their own as it would require too much time and effort. Securities markets have evolved to support quick, easy, and secure buying and selling of standardized securities.

Centralized auction markets like modern stock exchanges provide anonymous trading between buyers and sellers for stocks and derivatives like options and futures. Historically, incumbents security exchanges like NYSE and CBOT had trading floors where security trading was carried out by human traders (the so-called 'open outcry' method). As new competitors successfully introduced trading using ECNs (electronic communication networks), trading floors declined and eventually centralized trading became automated and became electronic trading platforms.

Various securities like fixed income and currencies are still traded 'over-the-counter' (OTC) through dealers who maintain inventories of securities or through brokers who specialize in matching buyers and sellers. This is increasingly supported by partial or full automation.

How Securities are created

To raise capital private firms issue equity and fixed income securities, while public entities only issue fixed income securities (but a sovereign state can also issue its own currency.)

Issuance of securities by private firms typically involves the assistance of investment bankers to structure, price and distribute the said securities in what is called the primary market. Public entities often simply auction bills and bonds to banks. After the initial sale to investors, it is common that the security begins trading in secondary markets like previously described.

Other entities also raise funds by issuing securities. Securitization vehicles buy and pool financial assets like mortgages and then issue fixed-income securities to fund these pools. By doing such repackaging, the financial economy does not directly provide capital to the real economy, but it indirectly provides for a smooth flow of capital to the real economy over time.

Derivative contracts are created as agreed upon between parties. In an anonymous derivative market, fulfillment of the mutual obligations between the parties is guaranteed by a third party.

One trading mechanism has gained wide acceptance over the years: the open limit order book.

- Investors willing to trade submit their orders to buy or sell through an intermediary to a centralized organization (e.g. a stock exchange like the NYSE).
- The limit order book accumulates orders to buy and orders to sell for each security.
- The status of the book is information available to investors in real time, providing them with information to fine-tune their trading intent (e.g. best bid price and best ask price).
- According to pre-specified rules (e.g. price and time priority), a matching engine matches sell orders and buy orders resulting in a sequential series of trades.
- The trades are also information available to investors in real time, providing them with further information to fine-tune their trading intent (e.g. price and size of last trade).

Throughout the day trading is continuous. An auction starts (open) and terminates (close) the day, whereby all orders are accumulated for some time and then the price at which the most shares would be transacted is selected and a number of trades generated accordingly. At the open the leftover orders populate the order book while at the close the leftover trades die.

Isracann Biosciences Inc. (from thecse.com)

Depth Display By Price IPOT / Last Updated: 13:26:09 ET

Bid Count	Bid Size	Bid Price	Ask Price	Ask Size	Ask Count
2	15,000	0.57	0.58	11,000	1
2	75,500	0.55	0.59	35,500	4
1	5,000	0.54	0.60	113,500	9
3	13,500	0.53	0.61	10,000	1
2	15,000	0.52	0.62	10,000	1

Depth Display By Order

IPOT / Last Updated: 13:26:09 ET

Bid Broker	Bid Size	Bid Price	Ask Price	Ask Size	Ask Broker
Anonymous	10,000	0.57	0.58	11,000	Anonymous
Scotia Capital Inc.	5,000	0.57	0.59	5,500	Anonymous
Anonymous	70,000	0.55	0.59	7,000	Anonymous
RBC Capital Markets	5,500	0.55	0.59	20,000	Anonymous
TD Securities Inc.	5,000	0.54	0.59	3,000	TD Securities Inc.
BMO Nesbitt Burns Inc.	7,500	0.53	0.60	10,000	Anonymous
TD Securities Inc.	1,000	0.53	0.60	50,000	Anonymous
TD Securities Inc.	5,000	0.53	0.60	10,000	Anonymous
CIBC World Markets Inc.	5,000	0.52	0.60	3,000	Canaccord Capital Corporation
RBC Capital Markets	10,000	0.52	0.60	3,000	Canaccord Capital Corporation

Recent Trades IPOT / Last Updated: 13:15:15 ET

Last 5 Last 10 Last 25

Date/Time	Price	Change	Volume	Buyer	Seller
Dec 24, 10:59	0.57	0.075	10,000	Anonymous	Anonymous
Dec 24, 10:59	0.58	0.085	1,000	RBC Capital Markets	Anonymous
Dec 24, 10:59	0.58	0.085	1,000	RBC Capital Markets	Anonymous
Dec 24, 10:59	0.58	0.085	1,000	Scotia Capital Inc.	Anonymous
Dec 24, 10:59	0.58	0.085	1,000	RBC Capital Markets	Anonymous

Type of orders

There is really a wide variety of orders. But a trading intent to generate an order requires to decide what security to buy or sell in which quantity at what price, when, where and how.

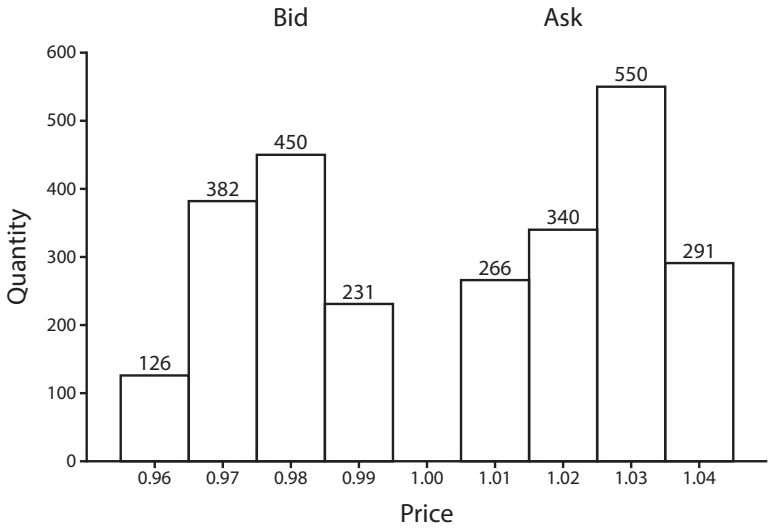
Market order

- A market order is an order to buy at the best ask price or sell at the best bid price.
- 'A market order may increase the likelihood of a fill and the speed of execution, but unlike the Limit order a Market order provides no price protection and may fill at a price far lower/higher than the current displayed bid/ask.'
- A market order prioritizes certainty and timeliness of execution over price.

Limit order

- A limit order is an order to buy or sell at a specified price or better.
- 'The Limit order ensures that if the order fills, it will not fill at a price less favorable than your limit price, but it does not guarantee a fill.'
- A limit order prioritizes price certainty over certainty and timeliness of execution.

A limit order book (as viewed by most traders)



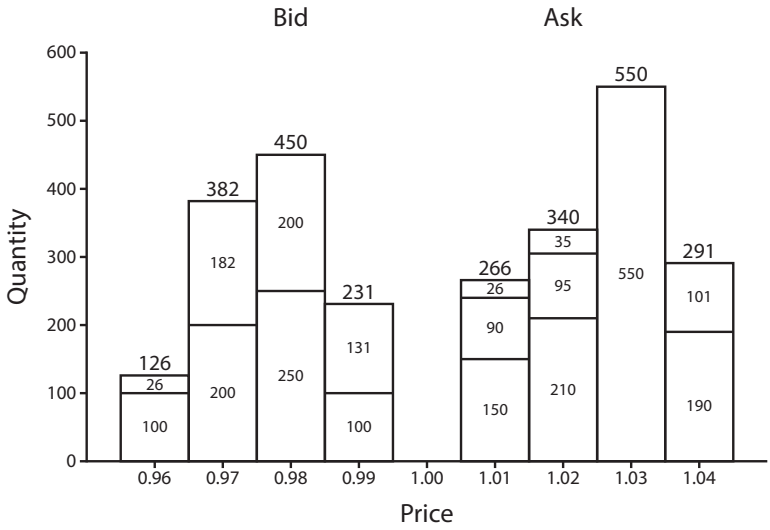
The price priority for the limit orders is from the most advantageous price to the least advantageous price as viewed by a market order.

The best price available for a seller is 0.99 for up to 231 shares (i.e. best bid).

The best price available for a buyer is 1.01 for up to 266 shares (i.e. best ask).

The 'bid-ask spread' is 0.02 (i.e. difference between the best bid and the best ask).

A limit order book (when viewing each limit order)



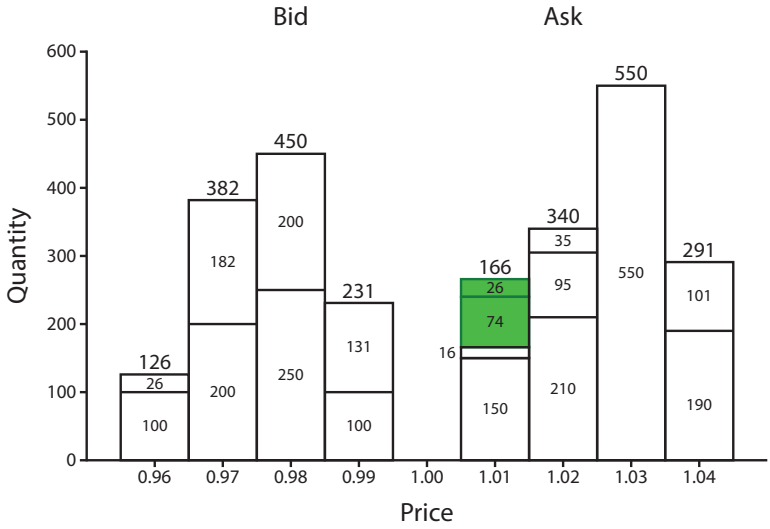
The time priority is from the oldest limit order to the newest per time of arrival (i.e. first come first served).

The oldest sell limit order at 0.99 is for 131 shares.

The oldest buy limit order at 1.01 is for 26 shares.

These two limit orders will be executed first on their respective side according to price time priority.

A limit order book (when viewing each limit order)

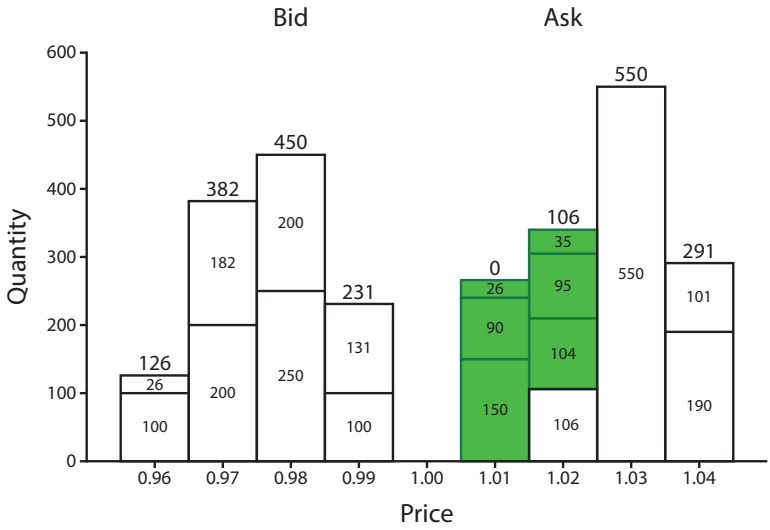


The arrival of a buy market order for 100 shares results in two trades (one of 26 shares and a second for 74 shares), both at 1.01.

Then, the oldest buy limit order at 1.01 is now for 16 shares (the remainder of the partially executed sell limit order for 90 shares at 1.01).

The total number of shares available at 1.01 has been decreased from 266 to 166.

A limit order book (when viewing each limit order)



Instead, the arrival of a buy market order for 500 shares results in six trades, three at 1.01 and then three at 1.02.

Such a trade did 'walk the book' and accordingly ended paying more that the initial best price since its size was larger than the quantity available at that price.

No shares are left at 1.01, the spread moved from 0.02 to 0.03, and the mid-quote from 1.00 to 1.005.

Traders active in an open limit order book

While an open limit order book centralizes the trading of various market participants, their trading intent often differs markedly, thus creating a sort of ecosystem.

Market makers (no intent to maintain a position)

- Some agents populate the order limit book with limit orders on both sides of the book.
- As trading goes on almost on a random basis they attempt to earn the spread.
- Such agents are somewhat paid to provide liquidity.

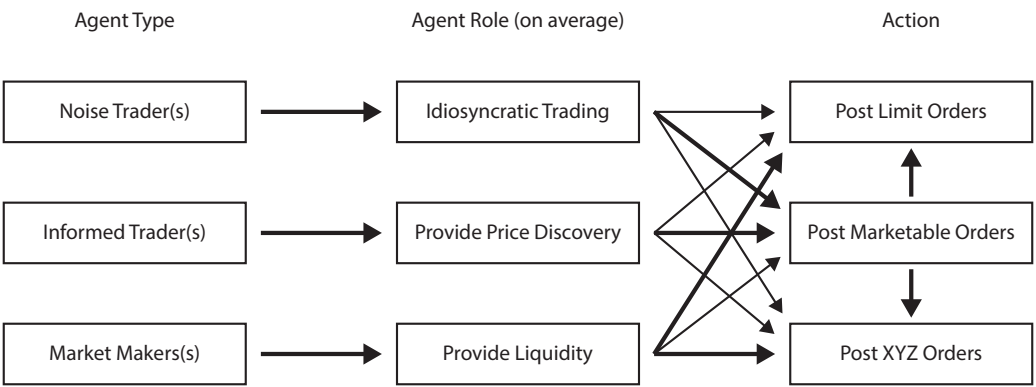
Informed traders (intent to maintain a position just long enough for short term gain)

- Some agents believe they have better information than others.
- They monetize their private information by buying low and selling high, embedding their information by moving the prices and contributing to price discovery.

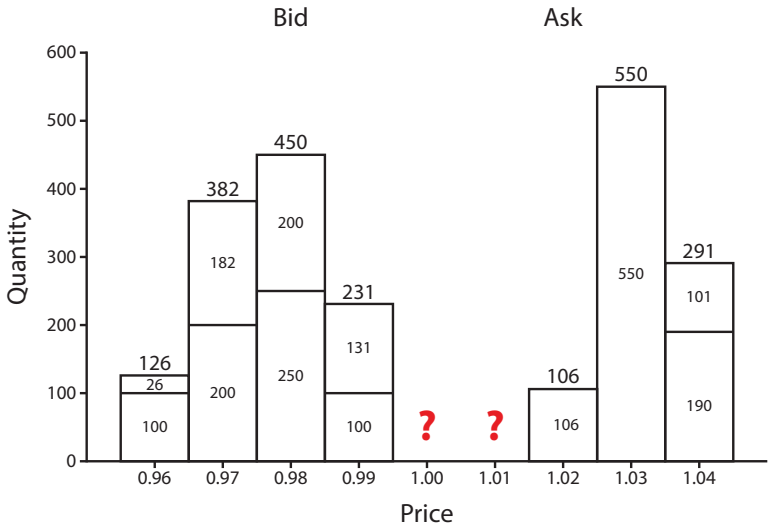
Uninformed traders (trade per portfolio objectives and liquidity needs, aka noise traders)

- Some agents trade for idiosyncratic motives according to their investment objectives.
- They pay marker makers for liquidity and informed traders for price efficiency.

Traders active in an open limit order book



Price discovery in action



If market makers believe the large 500 shares trade is from an informed trader, they will post new limit buy orders at 1.00, further moving the mid-quote from 1.005 to 1.01.

Otherwise, the market makers will replenish the book with sell limit orders at 1.01, moving the mid-quote back to 1.00.

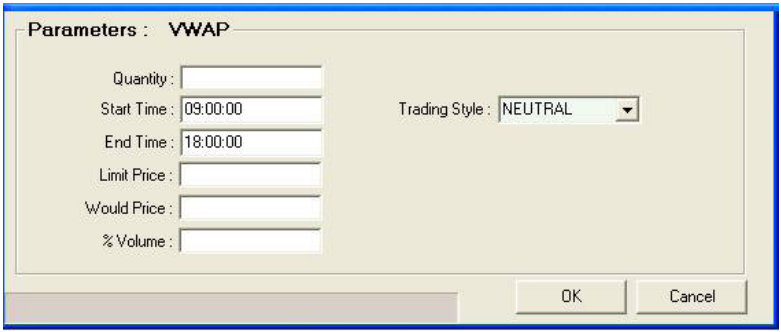
A trading algorithm consists in trading rules codified to deliver an expected outcome given a certain environment and inputs.

- e.g. a set of trading rules to split a (large) order into an optimal trading sequence according to market conditions and chosen constraints (time – impact)

Algorithmic Trading consists in implementing and operating a trading algorithm.

- This is also called automated trading when conducted on a computerized trading platform as initialized by and operated under the supervision of a human.
- This form of trading has become prevalent since, like in many fields, automation is increasing as labor is slow, expensive and behaviorally error-prone while computers are faster, more powerful and cheaper every year.

A VWAP algorithm consists in a set of trading rules to split large order into an optimal trading sequence according to market conditions with the objective of achieving an average buy or sell price close to or better than the market average price as weighted by volume within a time limit.



Using leverage: buying on margin

A long position in a given security can be established using only the investor's funds or by also using borrowed funds. Using such leverage magnifies the potential for gain, as well as losses. For such borrowing, the investor has to post collateral in support of the loan and such process is called a margin. The securities bought with borrowed funds are commonly used as collateral to support the loan. However, as the value of securities fluctuate while the money owed does not, the loan has to be overcollateralized (i.e. the value of the collateral has to exceed the loan).

The collateral value required in excess of the loan value is providing some margin of surety for the lender. That margin has to be provided by the investor using its own funds initially and thereafter to meet a minimum margin requirement at all time (which is typically set by the regulator to foster financial stability). If that minimum requirement is breached, the investor will be informed accordingly and asked through a margin call to provide additional collateral or funds to reestablish compliance. If the investor fails to comply, the lender would be within its right to sell a portion or even all the provided collateral to enforce its margin rules.

Calculating margin (textbook examples 3.1 and 3.2)

Buy 100 shares at \$100 for \$10,000 by using a loan of \$4,000 and own funds of \$6,000.

$$Margin = \frac{Equity}{Investment} = \frac{Investment - Loan}{Investment} = \frac{10{,}000 - 4{,}000}{10{,}000} = 0.6$$

What is the share price threshold for a margin call if the minimum margin requirement is 30%.

$$\frac{Qty \times Price - Loan}{Qty \times Price} = 0.3 \rightarrow Price = \frac{Loan}{0.7 \times Qty} = \frac{4{,}000}{0.7 \times 100} = 57.14$$

Selling a security you already own is trivial (if you own it you are said to be long). But it is also trivial to sell a security you do not own, you simply have to borrow it. However, in this case, you still owe the security you just sold, so you are short. The security lender can ask for its security back at any time of its own choosing. So, you can maintain your short position as long as you can continue to borrow the security on an on-going basis from the initial security lender or any subsequent one (i.e. if you do not want to close your short position, you simply have to find another security lender to lend you the security you need to return to the initial lender).

Again, collateral value is required in excess of the security value to provide some margin of surety against the possibility that the security will increase in value. The collateral is first provided from the funds generated by selling the borrowed security, and then the margin is provided by the investor using its own funds initially and thereafter to meet a minimum margin requirement at all time (which is typically set by the regulator to foster financial stability). If that minimum requirement is breached, the investor will be informed and asked through a margin call to provide additional funds to reestablish compliance. If the investor fails to comply, the lender would be within its right to close the short portion to enforce its margin rules.

Calculating margin for a short (textbook example 3.4)

Sell short 1,000 shares at $100 for $100,000, and provide additional cash collateral of $50,000 to meet an initial margin of 50%.

$$Margin = \frac{Cash\ in\ account}{Value\ of\ security\ owed} = \frac{150{,}000}{100{,}000} = 1.5$$

What is the share price threshold for a margin call if the minimum margin requirement is 30%.

$$\frac{Cash\ in\ account}{Qty \times Price} = 1.3 \rightarrow Price = \frac{Cash\ in\ account}{1.3 \times Qty} = \frac{150{,}000}{1.3 \times 1{,}000} = 115.38$$

Applications in chapter 3 of the textbook

Concept checks

- Suggest to do concept checks 1 to 6 (solutions provided at the end of the chapter).

Exercises

- Suggest 3-12 and 3-13.
- Solutions follow next slides, and Excel solution file in available in D2L.

3-12 Solution

Price	80	a.	New price	P&L	Gain
N	250	i	88	2,000	13.3%
Investment	20,000	iii	80	0	0.0%
Equity	15,000	iii	72	- 2,000	-13.3%
Loan	5,000	% gain = % change in price × Investment/Equity = % change in price × 1.333			
Interest rate	8%				

b. Investment = Quantity x Price and Equity = Investment - Loan
(250xP-5,000)/250xP = 0.3, then P = 28.57

c. (250xP-10,000)/250xP = 0.3, then P = 57.14

d.	New price	Interest	P&L	Gain
i	88	400	1,600	10.7%
iii	80	400	- 400	-2.7%
iii	72	400	- 2,400	-16.0%

e. (250xP-5,400)/250xP = 0.3, then P = 30.86

3-13 Solution

Price	80
N	250
Equity	15,000
Proceeds	20,000
Margin	30%

a.	New price	P&L	Gain
i	88	- 2,000	-13.3%
iii	80	0	0.0%
iii	72	2,000	13.3%

b. Account Balance = Quantity x Initial Price + Investment
Liabilities = Quantity x Current Price
(20,000 + 15,000 - 250xP)/250xP = 0.3, then P = 107.69

c.	New price	Dividend	P&L	Gain
i	88	500	- 2,500	-16.7%
iii	80	500	- 500	-3.3%
iii	72	500	1,500	10.0%

(20,000 + 15,000 - 500 - 250xP)/250xP = 0.3, then P = 106.15