Lecture 3: Equities: Characteristics and Markets

I. Reading.
   A. BKM Chapter 3: Sections 3.2-3.5 and 3.8 are the most closely related to the material covered here.

II. Terminology.
   A. Bid Price:
      1. Price at which an intermediary is ready to purchase the security.
      2. Price received by a seller.
   B. Asked Price:
      1. Price at which an intermediary is ready to sell the security.
      2. Price paid by a buyer.
   C. Spread:
      1. Difference between bid and asked prices.
      2. Bid price is lower than the asked price.
      3. Spread is the intermediary's profit.

Investor	Price	Intermediary
Buy	Asked	Sell
Sell	Bid	Buy

III. Secondary Stock Markets in the U.S..
- A. Exchanges.
  1. National:
     a. NYSE: largest.
     b. AMEX.
  2. Regional: several.
  3. Some stocks trade both on the NYSE and on regional exchanges.
  4. Most exchanges have listing requirements that a stock has to satisfy.
  5. Only members of an exchange can trade on the exchange.
  6. Exchange members execute trades for investors and receive commission.
- B. Over-the-Counter Market.
  1. National Association of Securities Dealers-National Market System (NASD-NMS)
     a. the major over-the-counter market.
     b. utilizes an automated quotations system (NASDAQ) which computer-links dealers (market makers).
     c. dealers:
        (1) maintain an inventory of selected stocks; and,
        (2) stand ready to buy a certain number of shares of stock at their stated *bid* prices and ready to sell at their stated *asked* prices.
           (a) pre-Jan 21, 1997, up to 1000 shares.
           (b) post-Jan 21, 1997, up to 100 shares.
     d. no centralized trading floor.
     e. individuals hire brokers to find the dealer offering the best deal.
  2. Third Market: refers to the trading of exchange-listed securities on the over-the-counter market.
- C. Fourth Market.
  1. This market refers to direct trading between investors in exchange-listed stocks without using a broker.
- D. Intermarket Trading.
  1. A “Consolidated Tape” reports trades on the NYSE, the AMEX, and the major regional exchanges as well as on NASDAQ stocks.
  2. The Intermarket Trading System links several exchanges by computer (NYSE, AMEX, Boston, Cincinnati, Midwest, Pacific and Philadelphia); brokers and market makers can thus display quotes on all markets and execute cross-market trades.

IV. Trading on the NYSE.

A. Participants: 4 types of members

1. Commission Brokers: execute orders that the public has placed with brokerage firms.
2. Floor Brokers: assist commission brokers when there are too many orders flowing into the market.
3. Floor Traders: trade solely for themselves.
4. Specialists: maintain a market in one or more listed stocks.

B. Types of Orders:

1. Market Orders: simple buy or sell orders that are to be executed immediately at current market prices.
2. Limit Orders
   a. A limit buy order says that if the price falls below a certain price then buy the stock.
   b. A limit sell order says that if the price goes above a certain price then sell the stock.
3. Stop-loss Orders
   a. A stop-loss buy order says that if the price goes above a certain price then buy the stock.
   b. A stop-loss sell order says that if the price falls below a certain price then sell the stock.

Example: The closing price for IBM on Monday 2/6/95 at 74.375. A limit order to buy IBM stock at 74 tells the broker to buy if the price of IBM falls to 74 or below. A stop-loss order to buy IBM stock at 75 tells the broker to buy if the price of IBM rises to 75 or above. A limit order to sell IBM stock at 75 tells the broker to sell if the price of IBM rises to 75 or above. A stop-loss order to sell IBM stock at 74 tells the broker to sell if the price of IBM falls to 74 or below.

C. Role of the Specialist

1. maintain a “book” of all unfilled limit orders entered by brokers on behalf of customers.
2. when the highest outstanding limit buy order exceeds the lowest outstanding limit sell order: execute or “cross” the trade.
3. be willing at any time to buy at her listed bid price and sell at her listed asked price.
4. maintain a “a fair and orderly market” by trading in the stock personally.

D. Effective Price
   1. bid price: the higher of the specialist's bid price and the highest unfilled limit buy order.
   2. asked price: the lower of the specialist's asked price and the lowest unfilled limit sell order.

E. Example.
   1. The specialist's book for a stock looks as follows:

Price	Limit Sell	Limit Buy	Specialist
$90\ ^{11}/_{16}$	100 sh		
$90\ ^{5}/_{8}$			
$90\ ^{9}/_{16}$	100 sh		asked
$90\ ^{1}/_{2}$	100 sh	100 sh	bid
$90\ ^{7}/_{16}$		100 sh	
$90\ ^{3}/_{8}$		100 sh	

Will any trades take place, given this book. Answer: Yes. The limit sell for 100 shares at $90^{1}/_{2}$ will cross with the limit buy for 100 shares at $90^{1}/_{2}$.

   2. The book now looks as follows:

Price	Limit Sell	Limit Buy	Specialist
$90\ ^{11}/_{16}$	100 sh		
$90\ ^{5}/_{8}$			
$90\ ^{9}/_{16}$	100sh		asked
$90\ ^{1}/_{2}$			bid
$90\ ^{7}/_{16}$		100 sh	
$90\ ^{3}/_{8}$		100 sh	

   a. If a market sell order for 100 shares comes in, at what price will it execute? Answer: The higher of the highest limit buy ($90^{7}/_{16}$) and the specialist's bid price ($90^{1}/_{2}$). So $90^{1}/_{2}$.
   b. If a market buy order for 100 shares comes in, at what price will it execute? Answer: The lower of the lowest limit sell ($90^{9}/_{16}$) and the specialist's asked price ($90^{9}/_{16}$). So $90^{9}/_{16}$.

F. Block Trades
   1. Definition: If an investor wishes to trade more than 10000 shares of a NYSE stock, it is known as a block trade.
   2. There are a number of ways such a trade can be executed.

G. The SuperDOT System
   1. SuperDOT enables exchange members to send orders directly to the specialist over computer lines.
   2. Most trades are executed and reported back to the originating member within 2 minutes.
   3. The largest market order that can be handled is 30099 shares and most orders handled are small; so although a large fraction of all orders are handles by SuperDOT, these only account for a small fraction of trading volume.

V. Discussion

A. NYSE vs OTC market

1. NYSE has higher fixed costs (due to the need for a central physical location), lower per-trade costs (since more likely to be trading with another investor and not a market maker) and greater structure (rules and regimentation).
2. The higher fixed costs for the NYSE means that a stock must have an active market to cover these costs; this is why the NYSE has stringent listing requirements.

B. Motivations for Trading.

1. Information: You believe that you have information about the asset that is not reflected in price.
2. Liquidity: You have surplus cash to invest (and you will buy securities) or you need to raise cash (and you will sell securities).
3. Rebalancing: The composition of your investment portfolio has changed due to differences in the performance of the assets currently in the portfolio. You want to readjust the composition to reflect your risk preferences.

VI. Return Calculation and Dividends.

A. Return Calculation

1. Return over a Period: Percentage change in the value of the investment over that period.
2. Formula to calculate Return: For an arbitrary asset i:

$$R^i(t,t+1) = \frac{p^i(t+1) + c^i(t+1) - p^i(t)}{p^i(t)}$$

$$= \frac{p^i(t+1) + c^i(t+1)}{p^i(t)} - 1$$

where $p^i(t+1)$ is the market price of asset i at time t+1;
$c^i(t+1)$ is the cash flow from the asset at time t+1;
$p^i(t)$ is the market price of asset i at time t; and,
$R^i(t,t+1)$ is the return on asset i over the period from t to t+1.

3. Example: The following price data is available for IBM:

What is the 1-day return on IBM stock for 8 /8/96? Answer:

Date	Dividend: IBM	Closing Price:IBM
8/7/96	0.35	112.625
8/8/96	0	113.5

So,

$$R^{IBM}(8/8/96) = \frac{p^{IBM}(8/8/96) - p^{IBM}(8/7/96)}{p^{IBM}(8/7/96)}$$

$$= \frac{113.5 - 112.625}{112.625} = 0.78\%$$

B. Return Calculation with Dividend.

1. Important Dates associated with a Dividend
   a. Declared Date: when the board formally approves the dividend.
   b. Ex-date: when the stock trades without its dividend.
2. Example (cont): The following price information is available for IBM:

What is the 1-day return on IBM stock for 8/7/96? Answer: Know 8/7/96 is the ex-date for IBM's dividend.

Date	Dividend: IBM	Closing Price:IBM
8/6/96	0	109.625
8/7/96	0.35	112.625

Thus,

$$R^{IBM}(8/7/96) = \frac{p^{IBM}(8/7/96) + Div^{IBM}(8/7/96) - p^{IBM}(8/6/96)}{p^{IBM}(8/6/96)}$$

$$= \frac{112.625 + 0.35 - 109.625}{109.625} = 3.06\%$$

VII. New NASDAQ Trading Rules

A. Effect of New Disclosure Rules

1. Market-makers order book:

Price	Limit Sell	Limit Buy	Market-maker
50.875	100 sh		
50.75	100 sh		asked
50.625	100 sh		
50.5		100 sh	bid
50.375		100 sh	
50.25		100 sh	

2. Market buy order for 200 shares arrives.
3. Pre-Jan 21, 1997: Market-maker executes at her asked price of 50.75.
4. Post-Jan 21,1997: Market-maker must inform customer of limit sells for 100 shares at 50.625 and 50.75.

B. SOES Trading.

1. Inventory = 3200 shares
2. Market-maker sells 3000 shares at 50.125
3. With Inventory = 200 shares, market-maker raises asked price to 50.25
4. Market-maker's order book looks as follows:

Price	Limit Sell	Limit Buy	Market-maker
50.375			
50.25			asked
50.125			
50		100 sh	bid

5. Pre-Jan 21:
   a. SOES trader buys 1000 shares at 50.25 and puts in a limit sell at 50.375.
   b. Market-maker is forced to execute at 50.25 even though she does not have the inventory.
   c. If no other sell orders come in, market-maker will have to take the other side of the limit sell for 50.375 to meet the SOES trader's buy.
   d. SOES trader makes (50.375-50.25)x1000=125
6. Post-Jan 21:
   a. SOES trader can only buy 100 at 50.25.
   b. Market maker has the inventory and does not have to turn to the SOES trader later in the day.
7. Discussion
   a. post-Jan 21, the market-maker may not need to increase the asked price after the 3000 share trade since she is not exposed to the same SOES manipulation as pre-Jan 21.
   b. the implication is lower spreads.
   c. so allowing market-makers to stand by bid and asked quotes for up to 100 rather than 1000 shares may in and of itself lower spreads.

Lectures 4-5: Stock Positions and Portfolio Return

I. Reading.
- A. BKM Chapter 3: Sections 3.6-3.7.
- B. BKM, Chapter 5: read Section 5.2.

II. Stock Transactions involving Credit
- A. Example:
  1. XYZ has the following price series

Date	Dividend: XYZ	Closing Price:XYZ
end 1/97	0	8
end 2/97	0	10
end 3/97	0	7

  2. Suppose you have $8000 cash at the end of 1/97. Your balance sheet at the end of 1/97 looks like:

Assets		Liabilities	
Cash	8000	Net Worth	8000
Total Asset	8000	Total Liab & Net W.	8000

  3. Assume your broker requires interest of 1% per month on any funds borrowed from her. Any funds placed with your broker earns 1% also. This rate (EAR=12.68%) can be thought of as the riskless rate.

B. Long the Stock.

1. Definition: Buying the stock with your own funds.
2. Example (cont):
   a. At the end of 1/97, you want to invest your $8000 in XYZ shares at the closing price; so buy 1000 shares.

Assets		Liabilities	
1000 XYZ sh @ $8	8000	Net Worth	8000
Total Asset	8000	Total Liab & Net W.	8000

   b. By the end of 2/97, XYZ's price has gone up.

Assets		Liabilities	
1000 XYZ sh @ $10	10000	Net Worth	10000
Total Asset	10000	Total Liab & Net W.	10000

   c. By the end of 3/97, XYZ's price has plunged.

Assets		Liabilities	
1000 XYZ sh @ $7	7000	Net Worth	7000
Total Asset	7000	Total Liab & Net W.	7000

C. Buying Stock on Margin.

1. Definition: Buying stock using funds borrowed from a broker; the client is charged the call money rate on the borrowed funds (plus a fee).
2. Percentage margin: refers to net worth (value of the stock less amount borrowed) as a percentage of the value of the stock:

$$Margin = \frac{Net\ Worth}{Value\ of\ Stock}$$

   a. In the U.S.,the Board of Governors of the Federal Reserve System has set the minimum initial margin at 50%; so the borrowed amount must be less than 50% of the value of the stock purchased.
   b. As the value of the stock decreases so does the percentage margin.
   c. If the percentage margin falls below the maintenance margin set by the broker, the customer has to put up enough collateral satisfy the maintenance margin.

3. Example (cont):

a. At the end of 1/97, you want to buy 1400 shares in XYZ; and so need to borrow 1400x$8 - $8000 = $3200 from your broker.

Percent Margin = 8000/11200 = 71.43%>50%.

Assets		Liabilities	
1400 XYZ sh @ $8	11200	Loan	3200
		Net Worth	8000
Total Asset	11200	Total Liab & Net W.	11200

b. By the end of 2/97, XYZ's price has gone up.

Percent Margin = 10768/14000 = 76.91%.

Assets		Liabilities	
1400 XYZ sh @ $10	14000	Loan ($3200@1%)	3232
		Net Worth	10768
Total Asset	14000	Total Liab & Net W.	14000

c. By the end of 3/97, XYZ's price has plunged.

Percent Margin = 6536/9800 = 66.69%.

Assets		Liabilities	
1400 XYZ sh @ $7	9800	Loan ($3232@1%)	3264
		Net Worth	6536
Total Asset	9800	Total Liab & Net W.	9800

D. Short Selling Stock

1. Definition: Borrowing the stock and selling it.
2. Proceeds from the sale must remain with the broker.
3. Percentage margin: refers to net worth as a percentage of the value of the stock borrowed:

$$Margin = \frac{Net\ Worth}{Value\ of\ Stock}$$

a. As the value of the stock increases, the percentage margin decreases.

b. If the percentage margin falls below the maintenance margin set by the broker, the customer has to put up enough collateral to satisfy the maintenance margin.

4. Example (cont):

a. At the end of 1/97, you have $8000 in cash with your broker.

(1) You borrow 1400 shares of XYZ. The loan is denominated in shares of XYZ not in dollars.

Assets		Liabilities	
1400 XYZ sh @ $8	11200	Loan (1400 sh @ $8)	11200
Cash	8000	Net Worth	8000
Total Asset	19200	Total Liab & Net W.	19200

(2) You sell the borrowed shares at the closing price at the end of 1/97.

Margin=8000/11200=71.43%

Assets		Liabilities	
Cash	19200	Loan (1400 sh @ $8)	11200
		Net Worth	8000
Total Asset	19200	Total Liab & Net W.	19200

b. By the end of 2/97, XYZ's price has gone up.

Margin=5392/14000=38.51%

Assets		Liabilities	
Cash ($19200@1%)	19392	Loan (1400 sh@$10)	14000
		Net Worth	5392
Total Asset	19392	Total Liab & Net W.	19392

c. By the end of 3/97, XYZ's price has plummeted.

Margin=9786/9800=99.86%

Assets		Liabilities	
Cash ($19392@1%)	19586	Loan (1400 sh@$7)	9800
		Net Worth	9786
Total Asset	19586	Total Liab & Net W.	19586

d. To close out the position at the end of 3/97, take the following steps:

(1) purchase 1400 shares of stock.

Assets		Liabilities	
Cash	9786	Loan (1400 sh@$7)	9800
1400 sh XYZ @$7	9800	Net Worth	9786
Total Asset	19586	Total Liab & Net W.	19586

(2) repay the stock loan.

Assets		Liabilities	
Cash	9786	Net Worth	9786
Total Asset	9786	Total Liab & Net W.	9786

5. Short Interest
   a. At the end of each month, all brokers report their customer's short positions in all stocks.
   b. Short Interest Ratio
      (1) Short Interest/Av Daily Trading Volume.
      (2) measures the number of days to close out the outstanding short position given the average daily trading volume for the stock.

E. Comparison

1. What is the monthly return each month for the three investments?

a. Recall that in the absence of any dividend payment:

Return = [Price (end) / Price (start)] - 1.

b. So

Portfolio Return = [Portfolio Value(end) / Portfolio Value(start)] -1

c. Note that Portfolio Value is given by Net Worth.

	Long 1000 XYZ sh		Buy 1400 XYZ sh on Margin		Short Sell 1400 XYZ sh	
Date	Net Worth	Return	Net Worth	Return	Net Worth	Return
1/97	8000		8000		8000	
2/97	10000	25%	10768	34.6%	5392	-32.6 %
3/97	7000	-30%	6536	-39.3%	9786	81.5%

2. Buying on Margin vs Going Long

a. Instead of using starting net worth to buy a firm's stock, the investor uses it to buy a larger number of the firm's shares on margin.

(1) A given price decline causes a larger reduction in net worth.

(2) A given price increase causes a larger increase in net worth.

(3) So the investor's net worth is more sensitive to changes in the stock price.

3. Short-selling vs Buying the Stock

a. Short-selling causes net worth to have a negative sensitivity to changes in the stock price.

(1) A price decline causes an increase in net worth.

(2) A price increase causes a decrease in net worth.

III. Portfolio Return.

A. Calculation

1. Example (cont):

a. Suppose I have $8000 to invest at the end of January 1997.

b. I decide to invest $6000 in XYZ and $2000 in the Riskless Asset.

c. I have invested:

(1) $6000/$8000=0.75 or 75% of my money in XYZ.

(2) $2000/$8000=0.25 or 25% in the riskless asset.

d. My portfolio:

(1) 750 shares in XYZ costing 750 x $8 = $6000.

(2) $2000 in the riskless asset.

Assets		Liabilities	
750 XYZ sh @ $8	6000	Net Worth	8000
Riskless	2000		
Total Asset	8000	Total Liab & Net W.	8000

e. What is the value of the portfolio at the end of February? Answer: By the end of 2/97, XYZ's price has gone up to $10 and the value of your investment in the riskless asset has increased by 1% of $2000 =$20:

Portfolio Value (2/97) = Net Worth (2/97)
= 750 x Price of XYZ(2/97) + $2000 x 1.01
= 750 x $10 + $2020
= $9520

Assets		Liabilities	
750 XYZ sh @ $10	7500	Net Worth	9520
Riskless	2020		
Total Asset	9520	Total Liab & Net W.	9520

2. What is the return on the portfolio?

Portfolio Return(2/97) = [Portfolio Value(2/97) / Portfolio Value(1/97)] -1
= 9520/8000 -1
= 19%.

B. Portfolio Return Formula

1. The following formula can be used to calculate the return on a portfolio given the returns on the assets that comprise the portfolio:

$$R_p(t) = \omega_{1,p} R_1(t) + \omega_{2,p} R_2(t) + ... + \omega_{N,p} R_N(t)$$

where

N is the number of assets in the portfolio;
$R_i(t)$ is the return on asset i in period t;
$\omega_{i,p}$ is the weight of asset i in portfolio p;
$R_p(t)$ is the return on portfolio p in period t.

2. Portfolio weights must sum to 1.
3. Example (cont): Your portfolio's return in February 1997 can be calculated using this formula:

$R_p(2/97) = \omega_{XYZ,p} R_{XYZ}(2/97) + \omega_{f,p} R_f(2/97)$
= 0.75 x 25% + 0.25 x 1%
= 19%.

C. Interpretation of the Portfolio Weighting ω

1. Buying a Stock on Margin: $\omega_{Stock}>1$ and $\omega_{Riskfree}<0$

a. Example (cont): When 1400 shares of XYZ were bought on margin at the end of January 1997, the weight on XYZ in the portfolio was >1.

(1) The value of the portfolio at the end of January 1997 was \$8000, of which 1400x\$8=\$11200 was invested in XYZ and -\$3200 was invested in the riskless asset.

(2) So,

$\omega_{XYZ,p}$ = \$11200/\$8000 = 1.4
$\omega_{f,p}$ = -\$3200/\$8000 = -0.4

(3) Note the weights sum to 1.

(4) Then can calculate the portfolio return for February 1997:

$R_p(2/97) = \omega_{XYZ,p} R_{XYZ}(2/97) + \omega_f R_f(2/97)$
$= 1.4 \times 25\% + -0.4 \times 1\%$
$= 34.6\%$

which agrees with the return calculated on page 10.

2. Short selling: $\omega_{Stock}<0$

a. Example (cont): When 1400 shares of XYZ were short sold at the end of January 1997, the weight on XYZ in the portfolio was <0.

(1) The value of the portfolio at the end of January 1997 was \$8000, of which -1400x\$8=-\$11200 was invested in XYZ and \$8000+\$11200=\$19200 was invested in the riskless asset.

(2) So,

$\omega_{XYZ,p}$ = -\$11200/\$8000 = -1.4
$\omega_{f,p}$ = \$19200/\$8000 = 2.4

(3) Note the weights sum to 1.

(4) Then can calculate the portfolio return for February 1997:

$R_p(2/97) = \omega_{XYZ,p} R_{XYZ}(2/97) + \omega_f R_f(2/97)$
$= -1.4 \times 25\% + 2.4 \times 1\%$
$= -32.6\%$

which agrees with the return calculated on page 10.