Indexes and Trading

BKM Chapters 2.4 & 3

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Dow Jones

The Dow Jones Industrial Average (DJIA) is the oldest U.S. index, dating to 1896. Since 1926 it has included 30 large stocks.

- Originally a simple average of the prices.
- Percentage change in the Dow was the return (excluding dividends) on a portfolio consisting of one share invested in each of the stocks in the index.
  - The value of the portfolio is the sum of the prices.
  - The value of the index is the average of the prices.
- The percentage change in the index and portfolio are the same from day to day.
- The DJIA is a price-weighted average: the amount of money invested in each asset of the portfolio is proportional to the share price.
- Due to splits and changes in the composition of the index, the DJIA is no longer a simple weighted average of prices.

Price-Weighted Indexes

Consider a price-weighted index of two stocks, X and Y. Suppose the price of X is originally \$25 and increases to \$30, while the price of Y is originally \$100 and decreases to \$90. It's clear that

Portfolio:

$$\begin{aligned}
&\text{InitialValue} = \$25 + \$100 = \$125 \\
&\text{FinalValue} = \$30 + \$90 = \$120 \\
&\text{Percentage change} = -\$5/\$125 = -0.04 = -4\%
\end{aligned}$$

Index:

$$\begin{aligned}
&\text{InitialValue} = (\$25 + \$100)/2 = \$62.5 \\
&\text{FinalValue} = (\$30 + \$90)/2 = \$60 \\
&\text{Percentage change} = -\$2.5/\$62.5 = -0.04 = -4\%.
\end{aligned}$$

Price-Weighted Indexes (Cont.)

Note that price-weighted indexes give higher priced stocks more weight. The percentage change in stock X is

$$\frac{\$30 - \$25}{\$25} = 0.2 = 20\%$$

while the percentage change in stock Y is

$$\frac{\$90 - \$100}{\$100} = -0.1 = -10\%$$

The overall percentage change in the index is

$$\begin{aligned} \%\text{change in index} &= \frac{p_X^0}{p_X^0 + p_Y^0}\Delta_X + \frac{p_Y^0}{p_X^0 + p_Y^0}\Delta_Y \\ &= 0.2 * 0.2 + 0.8 * (-0.1) = -0.04, \end{aligned}$$

where p_i^0 is the initial price of stock i and Δ_i is the percentage change in the price of stock i.

Splits and Price-Weighted Averages

Continuing with the previous example, suppose that stock Y split, causing its price to fall to \$50. This would cause a large fall in the value of the index, unless an adjustment is made to the divisor. That is, if the index value before the split was

$$\frac{\$25 + \$100}{2} = \$62.5,$$

the post-split divisor, d, should be the value such that

$$\frac{\$25 + \$50}{d} = \$62.5,$$

Hence, d falls from 2 to 1.2. Notice that since the split causes the price of Y to fall, it's relative weight in the portfolio will fall, and movements in the price of Y will have a smaller impact on the index.

Standard and Poor's Composite 500

The S&P 500 stock index has two advantages over the Dow:

- It is comprised of 500 large stocks, and hence is more broadly based and a better indicator of the market as a whole;
- It is a value-weighted, rather than price-weighted, index.

The market value or market capitalization of a firm is simply its total value on the market: price per share times the number of shares outstanding. A value-weighted index weights each stock in the index according to its market cap.

Value-Weighted Indexes

Consider the previous example for price-weighted indexes. If stock X currently has 20 shares trading in the market and stock Y only has 1 share, then the original market caps for X and Y are

$$MC_X^0 = 20 * \$25 = \$500,$$
$$MC_Y^0 = 1 * \$100 = \$100.$$

So, a value-weighted index of two stocks would give X five times the weight as Y (compare to the price-weighted index which gave Y four times the weight). Initially, the total stock on the market is equal to $\$500 + \$100 = \$600$.

Value-Weighted Indexes (Cont.)

After the price changes, market caps become

$$MC_X^1 = 20 * \$30 = \$600,$$
$$MC_Y^1 = 1 * \$90 = \$90,$$

leaving the value of all stock equal to \$690. Thus if the initial value of the value weighted index was \$100, after the price changes it would be $\$100 * \frac{\$690}{\$600} = \$115$. In this case the value of the index rises since it gives a relatively higher weight to X. Now,

$$\%\text{change in index} = \frac{MC_X^0}{MC_X^0 + MC_Y^0}\Delta_X + \frac{MC_Y^0}{MC_X^0 + MC_Y^0}\Delta_Y$$
$$= \frac{5}{6} * 0.2 + \frac{1}{6} * (-0.1) = 0.15.$$

Equally-Weighted Indexes

One of the advantages of price-weighted and value-weighted indexes is that they correspond to buy-and-hold portfolio strategies:

- A price-weighted index is equivalent to buying and holding one share (or an equal number of shares) of each stock in the index;
- A value-weighted index is equivalent to buying and holding each share of the index in proportion to its market cap.

Equally-Weighted Indexes (Cont.)

In contrast, one could form an equally-weighted index, where all stocks receive the exact same weight. This does not correspond to a buy-and-hold strategy.

- Consider starting with with equal amounts of money invested in stocks X and Y.
- If (as in the example above) the price of X increases by 20% and the price of Y falls by 10%, the dollar amount invested in each stock is no longer equal. To keep the investment equally weighted, the investor would have to sell some shares of X and buy shares of Y.

Other Indexes

There are a wide number of published indexes:

- NYSE
- NASDAQ
- Wilshire 5000
- Sub-indexes of the S&P 500 and others above.

To hold these as part of a portfolio one could

- Buy shares of a mutual fund that tracks the index.
- Buy shares of an Exchange Traded Fund (ETF) which is a portfolio of the shares in the index.

How Firms Issue Securities

The market can be divided into two broad categories:

- The primary market, where new shares are sold to the public
  - Initial Public Offerings (IPOs).
  - Seasoned new issues are new shares sold by firms that already have shares outstanding.
- The secondary market, where outstanding shares can be traded. Note that the secondary market doesn't alter the number of shares outstanding, whereas the primary market does.

Stocks on the primary market are generally purchased by an investment bank (or a syndicate of investment banks) at a slightly discounted price, and then are marketed by the investment banks at the agreed offering price.

Markets

We can rank types of markets by their organization and volume of trading.

- Direct Search (Craigslist), where buyers and sellers find each other directly.
- Brokered (real estate), where trading of an asset is high and requires specialized knowledge.
- Dealer (OTC - NASDAQ), where dealers buy assets in their own accounts and sell for a slightly higher price (the bid-ask spread).
- Auction (NYSE), where buyers and sellers all converge at one place.

Buying on Margin

When investors borrow money from a broker to purchase an asset, they are buying on margin.

- The margin is the proportion of the purchase price provided by the investor.
- The purchased securities are maintained in an account by the broker and are monitored.
- The Board of Governors has limited initial margins to be 50% of the initial purchase (i.e. investors must provide at least half of the funds for asset purchase).

Margin Example

Suppose an investor has \$6000 and would like to buy 100 shares of asset W, currently selling for \$100. Since \$10,000 is required for the purchase, the investor must borrow \$4000 from a broker. The initial balance sheet would be

Assets	Liabilities and Owners' Equity
Value of Stock: \$10000	Loan from broker: \$4000
	Equity: \$6000

Thus, the initial margin is $\frac{\$6000}{\$10000} = 0.6$.

Margin Example (Cont.)

If the stock price falls to \$70 per share, the balance sheet becomes

Assets	Liabilities and Owners' Equity
Value of Stock: \$7000	Loan from broker: \$4000
	Equity: \$3000

The resulting margin is $\frac{\$3000}{\$7000} = 0.43$.

Maintenance Margin

Brokers can set minimal margin requirements, known as maintenance margins.

- If the asset value in the account falls too low, relative to the loan from the broker, the broker can issue a margin call, requiring the investor to add cash to the account or liquidate some the stock.
- If the investor doesn't act accordingly, the broker then has the right to sell some of the stock to pay off enough of the loan to restore the margin to an acceptable level.

For example, if a broker has a maintenance margin of 30%, the lowest the price could fall before a margin call is

$$\frac{100P - 4000}{100P} = 0.3,$$

or P = \$57.14.

Why Margins?

Margins have the ability to magnify upside returns.

- Suppose asset W is selling for \$100 and an investor believes its price will increase to \$120 next period.
- If the investor buys \$10,000 worth of stock, she will realize a return of 20% on her money (after one period her net worth will be \$12,000).
- However, if the investor borrows an additional \$10,000 at 5% interest, then she will earn a gross return of \$4000 on the \$20,000 invested.
- After repaying \$10,500 (loan plus interest), her net return will be

$$\frac{(\$24,000 - \$10,500) - \$10,000}{\$10,000} = 0.35.$$

- So the investor was able to increase her return from 20% to 35% by earning a return on borrowed money.

Why Margins? (Cont.)

While margins provide the ability to magnify returns, they also increase downside risk exposure.

- Suppose that after borrowing \$10,000 from the broker, the price of asset W fell from \$100 to \$80.
- The investor's gross return would be -\$4000 on the \$20,000 invested.
- After repayment of the loan, the investor's net return would be

$$\frac{(\$16,000 - \$10,500) - \$10,000}{\$10,000} = -0.45.$$

If the investor hadn't borrowed money, she would have realized a net return of -0.2. So, by borrowing on margin she has magnified her loss from -20% to -45%.

Short Sales

Short sales allow investors to profit from declines in stock prices.

- To engage in a short sale, an investor borrows a share of a stock from a broker and sells it on the market.
- The investor is then obligated to replace the share at a later date.
- If the stock price falls, the investor benefits from selling at a high price and repurchasing at a low price.
- In between, the investor is responsible for paying the broker any dividends that are realized (since the broker would have received these if it hadn't lent the stock).

When an investor engages in a short sale, we say that they are 'short' the stock, or have taken the 'short position'. Conversely, if an investor buys a stock (the usual transaction), we say they are 'long', or have taken the 'long position'.

Short Sale Example

Suppose asset W is selling for \$100 and you think its price will fall.

- You decide to borrow 1000 shares, selling them for \$100 a piece, yielding a total sale value of \$100,000.
- If the stock price falls to \$80 per share next period, you can repurchase the 1000 shares for \$80,000 and return them to the lender.
- You earn a total of \$20,000 in the process.