



Module 4

Market indices

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1. Overview

Individual security prices are reported each day on the Internet, in local newspapers, and in the financial press. But individual stocks' prices may not be indicative of how a security market as a whole may be performing.

Why would you care how the market is faring? There are at least two reasons. First, the prices of securities tend to move together - not in perfect tandem, but most tend to move in the same general direction. Second, general movements of the market tend to precede economic developments. For example, an upward movement in the market during a recession usually tells us that the end of the recession is nearing. Both of these factors have consequences for investors and for corporations contemplating new equity issues.

In general, a **market indicator** is a summary measure of how a group of stocks and/or bonds performing. Indicators provide a means for us to gauge the movement of market prices over time. There are many uses of market indices. These include:

- As benchmarks to evaluate performance, such as comparisons for performance of mutual fund managers or as indicators of the performance of asset classes (e.g., stocks, bonds).
- To create and monitor an index fund. Indicators are often used as a basis for the construction of an indexed fund. Some **exchange traded funds** (ETFs) have been created to mimic indexes (for example, **SPDRs**).
- To forecast future market movements.
- To measure market rates of return. Understanding past returns help us predict future market movements (e.g., using technical analysis).
- As a proxy for the market portfolio in the calculating systematic risk of a stock.

An indicator may be calculated as an average of the prices of representative stocks, perhaps weighted in some way, or as an index -- a sum or average of representative prices reported as a ratio.

Factors important in constructing a market index include:

1. the sample of securities included,
2. the weights applied to the sample securities (that is, price-weighted, value-weighted, or un-weighted), and
3. the computational procedure (type of averaging; method of adjusting for splits)

As an example, the oldest and most watched stock market indicator is the **Dow Jones Industrial Average (DJIA)**, comprised of the stocks of thirty large, well-established and profitable firms (sometimes called "**blue chip**" firms) and weighted to reflect various events that have occurred during the histories of those firms. The DJIA is constructed as a price-weighted average of the thirty stocks.

A more representative indicator is the **Standard & Poor's 500 Stock Index (S&P 500)**, which includes 500 common stocks. The S&P 500 is a value-weighted index; that is, each stock's return is weighted by the market value of the company's outstanding stock. The S&P 500 is reported relative to the base years 1941-1943, which are arbitrarily given the index value 10. So, for example, when that index reached 900 in January 2003, we knew that stock prices were generally about ninety times as high as in 1943.

In addition to general stock market indicators such as the DJIA and the S&P 500, a number of industry-specific stock indicators are computed and published by financial services. These include the **Dow-Jones Transportation Average** and the **S&P 400 Utilities Stock Index**.

Global equity indexes include:

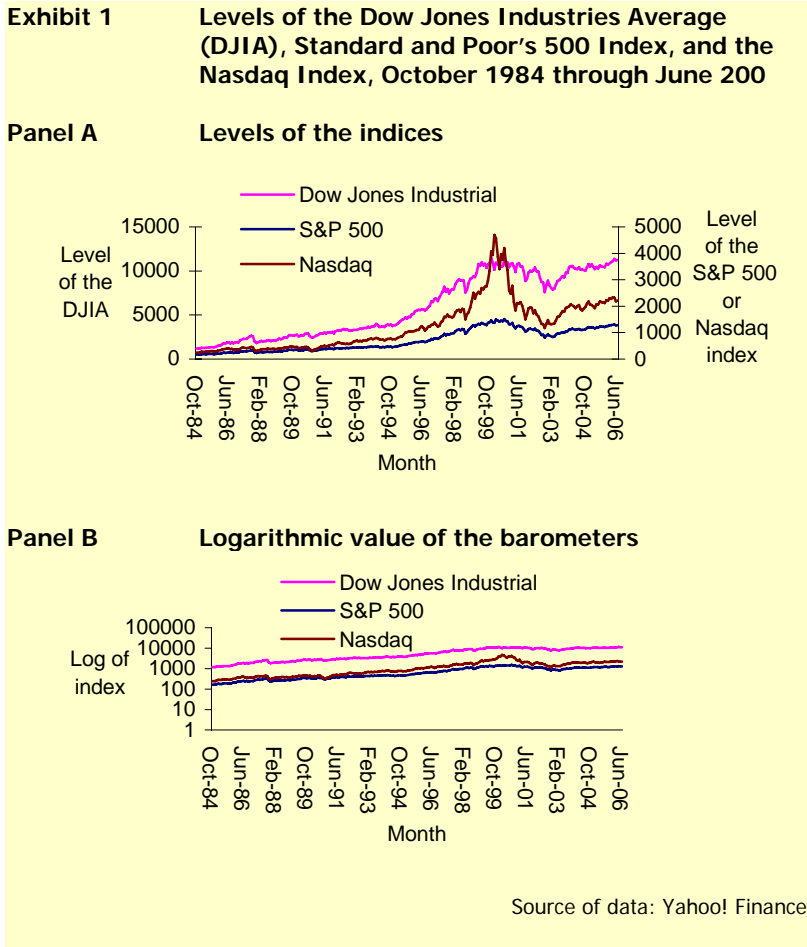
- the **FT/S&P Actuaries World Indexes** (thirty countries),
- the **Morgan Stanley Capital International Indexes (MSCI)**, a set of market-weighted indexes, and
- the **Dow Jones World Stock Index** (thirty-three countries), calculated using own-country currency as well as U. S. dollar.

In addition to stock indicators, there are a number of indicators that serve as barometers of the bond market. However, a bond market indicator series is more difficult to create than a stock market indicator because of a number of reasons:

- there is a larger number of bonds than stocks,
- there is more variety in features,
- the universe of bonds is constantly changing (bonds matures, stocks don't),
- a bond's value changes constantly as duration and interest rates change over the life of the bond, and
- there are difficulties in pricing some types of bonds (e.g., convertible, callable bonds).

The changes in the bond indexes over time are determined, in large part, by changes in interest rates. There are few well-developed corporate bond markets world-wide, including the Lehman Brothers Aggregate Bond Index, JP Morgan Government Bond Index, S&P/TSX Canadian Bond Index and the FTSE Global Bond Index Series.

We can see the similarities in the stock indexes over time comparing three different market barometers, as shown in Exhibit 1. As we see in Panel A of this exhibit, the trends among the three indices are similar. The stock market bubble in the 1999-2000 period is evident in all three barometers, though more pronounced in the Nasdaq indicator.



Because the barometers are different starting points and compositions, it's not easy to compare them without some type of adjustment. Remember from your basic math classes, by taking logs we are able to capture the percentage change in the index, hence we can better compare the barometers once we have transformed them using logs.

The different market barometers basically move together, but with minor exceptions – such as the Internet bubble years.

The three indicators track very closely until late 1998. The returns on these three indicators are highly correlated in the period from October 1984 through May, 2006 as indicated by the calculated correlation coefficients (for which 1 is perfect, positive correlation and 0 indicates no correlation):

	DJIA	S&P 500	Nasdaq
DJIA	1.0000		
S&P 500	0.9895	1.0000	
Nasdaq Composite	0.9082	0.9490	1.0000

If we isolate the Internet Bubble years, 1998 through 2002, however, we see a different picture of correlation among the markets, with less correlation between the blue-chips and the Nasdaq:

	DJIA	S&P 500	Nasdaq
DJIA	1.0000		
S&P 500	0.8628	1.0000	
Nasdaq Composite	0.7101	0.9065	1.0000

A bond market indicator may represent government bonds, such as Shearson Lehman Brothers' Long-term Treasury Index, or corporate bonds. Bond indexes for corporate bonds are generally created separately for **investment grade bonds** and **high-yield bonds**.

A note about correlation

The correlation between any two samples is a measure of association. When we refer to "correlation", we are referring to the correlation coefficient, which is the ratio of the covariance to the product of the standard deviations of the two samples. A correlation coefficient ranges from -1 (perfect negative correlation) to +1 (perfect positive correlation).

In the case of the correlation of an index, we are interested in the association between the time series of the two indices: Do these series move together? How closely do they move together? You tell both visually (in Exhibit 1) and statistically, that the major indices are closely, positively correlated.

bonds are those rated BBB (Baa) or higher. The four purveyors of investment grade bond indexes

are Merrill Lynch, Lehman Brothers, Salomon Brothers, and Ryan Treasury. High-yield bonds

(a.k.a. **junk bonds**) are those that are not investment grade (that is, they are rated as BB or lower). There is less correlation among high-yield bond indexes (compared to the investment grade

indexes).

We can make some general statements about how market indicators are related to one another over time:

- Broad U.S. stock market indicators, such as the DJIA, the S&P 500, and the Wilshire 5000, are correlated with one another.
- Correlations among countries' stock market indexes are significant, but not as high as within-country comparisons.
- There is a high degree of correlation among high-grade bond indexes.
- There is little correlation within high-yield bond indexes, and there is little correlation between high-yield bond indexes and high-grade indexes.

A. The price-weighted average

A **price-weighted average** is a simple, arithmetic average of the values of the stocks in the average. If there is a stock split or other adjustment (e.g., reverse stock split, stock dividend), the divisor is no longer the number of stocks in the average, but rather is adjusted appropriately.

An example of a price-weighted average is the Dow Jones Industrial Average (DJIA).

Consider an example of a price-weighted average comprised of three stocks, A, B and C, with the following share price and number of shares outstanding:

Stock	Price per share at time t	Price per share at time t+1	Number of shares outstanding at t	Number of shares outstanding at t+1
A	\$10	\$15	100	100
B	\$20	\$15	150	150
C	\$30	\$18	200	400

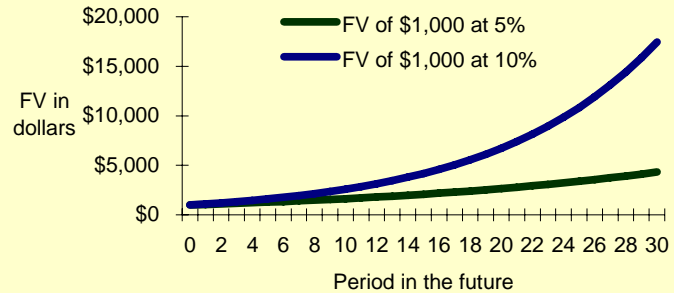
← 2:1 split between t and t+1¹

The price-weighted average at time t is:

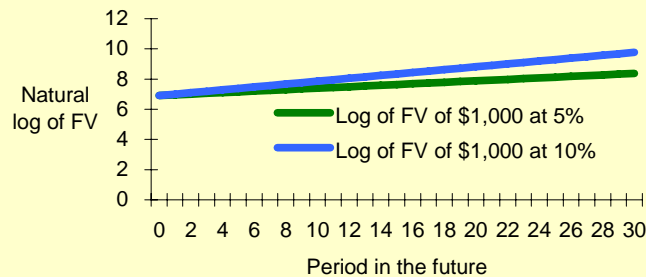
$$\text{price-weighted average at } t = (10 + 20 + 30) / 3 = 20$$

An aside about logs

Consider \$1,000 invested for 30 years at 5% and then at 10%. The growth of the value of \$1,000 follows the following paths:



If we take logs of the future values, we see that the constant growth in the above graph is transformed into straight lines:



¹ A stock split is a change in the number of shares outstanding. If you own 100 shares of stock and the stock has a 2:1 stock split, you have 200 shares after the split; if the stock had split 3.5:1, you own 350 shares after the split.

The price-weighted average at time t+1 is more challenging. First, the Note: The split changes the divisor. The divisor is revised so that the average (if prices change for no other reason than the split) is the same; that is:

$$[10 + 20 + (30/2)] / X = 20$$

$$\text{Solve for X: } 45 / X = 20 \rightarrow X = 2.25$$

The price-weighted average at time t+1 is:

$$\text{Price-weighted average}_{t+1} = (15 + 15 + 18) / 2.25 = 48 / 2.25 = 21.333$$

In a price-weighted series, the divisor is constantly changing to keep up with the stock dividends and stock splits of the components of the series.

The [Dow Jones Industrial Average](#), a price-weighted series, is comprised of thirty stocks. In 1928, it was decided that the divisor be altered to reflect stock dividends and splits, in the method we have just demonstrated. This means that the divisor today is quite small because of all that has happened in the [component stocks \(and their replacements\)](#) over the years. The divisor for the DJIA in September 2005 was 0.12560864.

B. Value-weighted series

A value-weighted series uses the market value of the series at a point in time as its base (usually scaled to 100).

$$\text{Index}_t = \frac{\sum_{i=1}^N P_{it} Q_{it}}{\sum_{i=1}^N P_{ib} Q_{ib}}$$

where

- P is the price of the stock;
- Q is the number of shares outstanding;
- t is the day for the index computation;
- b is the base day for the index; and
- N is the number of stocks in the index;

The index is automatically adjusted for stock splits and other capital changes by its construction.

Consider the same example as before, but calculate the value-weighted index comprised of three stocks, A, B and C, with the following share price and number of shares outstanding:

Stock	Price per share at time t	Price per share at time t+1	Number of shares outstanding at t	Number of shares outstanding at t+1	Market value of shares at t	Market value of shares at t+1
A	\$10	\$15	100	100	\$1,000	\$1,500
B	\$20	\$15	150	150	\$3,000	\$2,250
C	\$30	\$18	200	400	<u>\$6,000</u>	<u>\$7,200</u>
					\$10,000	\$10,950

Suppose the beginning value of the index is 100 and the base value is \$5,000.

The index value as of time t:

$$\text{Index}_t = \frac{(\$10 \times 100) + (\$20 \times 150) + (\$30 \times 200)}{\$5,000} \times 100$$

$$\text{Index}_t = \frac{\$1,000 + \$3,000 + \$6,000}{\$5,000} \times 100$$

$$\text{Index}_t = 200$$

The index value as of time t+1:

$$\text{Index}_{t+1} = \frac{(\$15 \times 100) + (\$15 \times 150) + (\$18 \times 400)}{\$5,000} \times 100$$

$$\text{Index}_{t+1} = \frac{\$1,500 + \$2,250 + \$7,200}{\$5,000} \times 100$$

$$\text{Index}_{t+1} = 219$$

Another way of looking at this calculation is to compare market values:

$$\text{Index}_t = 100 \times \frac{\$10,000}{\$5,000} = 200$$

$$\text{Index}_t = 100 \times \frac{\$10,950}{\$5,000} = 219$$

C. Un-weighted value series

In an un-weighted series (a.k.a. equal-weighted series), each security has an equal weight. The return on each stock, therefore, gets equal weight. Examples of an un-weighted value series include the Value Line averages and the Financial Times (FTSE) series. Instead of calculating the arithmetic average of the stocks' returns, most un-weighted series use the geometric average.

Consider the same example as before, but calculate the un-weighted index comprised of three stocks, A, B and C, with the following share price and number of shares outstanding:

Stock	Price per share at time t	Price per share at time t+1	Number of shares outstanding at t	Number of shares outstanding at t+1
A	\$10	\$15	100	100
B	\$20	\$15	150	150
C	\$30	\$18	200	400

← 2:1 split between t and t+1

The holding period yield (HPY) is calculated as:

$$\text{HPY} = \frac{\text{Price}_{t+1} - \text{Price}_t}{\text{Price}_t}$$

So, for Stock A,

$$HPY_A = \frac{(\$15-10)}{\$10} = 50\%$$

Therefore

Stock	Holding period yield
A	0.50 or 50%
B	-0.25 or -25%
C	0.20 or 20%

Note that the use of the geometric average instead of an arithmetic average makes a difference:

$$\text{arithmetic average} = (0.50 - 0.25 + 0.20) / 3 = 0.15 \text{ or } 15\%$$

$$\begin{aligned} \text{geometric average} &= [(1 + 0.50)(1 - 0.25)(1 + 0.20)]^{1/3} - 1 \\ &= [1.35]^{1/3} - 1 = 0.1052 \text{ or } 10.52\% \end{aligned}$$

Suppose the Index value at time t is 1000. The index value using an arithmetic average is 1,000 (1 + 0.15) = 1150 and using a geometric average is 1,000 (1 + 0.1052) = 1105.2.

D. Summary and comparisons

By understanding how an index is constructed, we get a better idea why these market barometers move as they do. Consider the three indices that we calculated earlier. Each is represented with different levels because of the way they are constructed. The levels of the three indices for periods t, t+1, and t+2 are as follows:

Average or index	Level		
	t	t+1	t+2
Price-weighted average	20	21.333	22.667
Value-weighted index	200	219.000	212.000
Un-weighted index	1000	1105.20	1306.68

We also see that the calculated returns based on the levels are different – again, because of the way in which the indices are constructed and calculated.

Average or index	Return	
	t to t+1	t+1 to t+2
Price-weighted average	6.665%	6.253%
Value-weighted index	9.500%	-3.196%
Un-weighted index	10.520%	18.230%

In the case of a value-weighted index, a small change in a large capitalization stock will result in a large change in the level of the index. In the case of a price-weighted series, a large movement in the price of a single component of the series can result in a major movement in the series. When we watch the day-to-day fluctuations in the DJIA and the S&P500, we should keep in mind the different stocks that these indicators represent and the different computational methods behind these indicators.

Consider the characteristics and differences among the leading market indicators:

- The DJIA is a price-weighted indicator that includes large capitalization, “blue chip” companies. But because it is limited to only thirty stocks, it is not often representative of the market’s movements as a whole. Further, because it is comprised of only U.S.

companies, it does not tell use much about how stocks markets in general are performing.

- The [S&P 500 index](#) is a value-weighted series that is comprised of stocks of 500 different large capitalization stocks that are widely-held. The stocks are drawn in a way to represent the different sectors in the economy and do include stocks of non-U.S. companies that are widely held in the U.S.
- The [Nasdaq 100](#) is a value-weighted series, but the precise calculation is not public information. As the name implies, the Nasdaq 100 is comprised of 100 different Nasdaq-listed companies. Because of the predominance of technology stocks listed on the Nasdaq, the index is heavily influenced by the price movements of technology stocks.
- The [Wilshire 5000 index](#) is a value-weighted index comprised of the stocks of over 6,000 companies, representing a broad spectrum of companies whose stocks are traded on the MYSE, AMSE, and Nasdaq markets. Like the S&P500, the Wilshire 5000 index is influenced by the movements of the larger capitalized stocks.
- The [Russell 2000](#) is a small-capitalization index, designed to represent the movements of the smaller stocks.

In addition to these U.S. market barometers, there are a number of non-U.S. and global indices. For example, the DAX is comprised of German companies' stocks, whereas the Hang Seng is comprised of stocks traded on the Hong Kong stock market.

Market indicators: Facts

Name	Date begun	Number of stocks	Method of weighting
DJIA	1884	30	Price weighted
S&P 500	1957	500	Value weighted
Wilshire 5000	1970	6,400+	Value weighted**
Nasdaq 100	1985	100	Value weighted*
Russell 2000	1984	2000	Value weighted
Nasdaq Composite	1971	4000+	Value weighted
FTSE 100	1984	100	Equal weighted
FTSE All World	1987	2,200+	Value weighted**
DAX	1987	30	Value weighted
Hang Seng	1969	33	Value weighted

* proprietary calculation method based on the value weighted method

** float-adjusted market capitalization

Check out:

- [List of stock market indices](#), by Wikipedia
- [Market Indices](#), quotes and descriptions from the Nasdaq

Example Calculating the value of an index

Problem

Consider the following:

Stock	P_t	P_{t+1}	Shares _t	Shares _{t+1}
M	\$10	\$12	1,000	1,000
N	\$20	\$22	2,000	2,000
O	\$60	\$20	1,000	3,000

O had a 3:1 split between t and t+1

Calculate, for t+1:

- the price-weighted average,
- the value-weighted index value (assuming a base of the index of 1000 and a base value of \$80,000), and
- the un-weighted index value using a geometric average (assuming index value at time t is 1000).

Which of the following indicates the price-weighted average, value-weighted index, and un-weighted (geometric) index, respectively for t+1?

- A. 32.4; 1450; 1097
- B. 27.33; 142.5; 1010
- C. 32.4; 1450; 1010
- D. 27.33; 145; 1097

Solution: A

At time t,

- Price-weighted average is 30
- Value weighted series is 1375
- Un-weighted series (geometric) is 1097

E. Returns on indexes

A return on an index is calculated using the same method as you would use in calculation the return on a stock:

$$r_t = \frac{P_t - P_{t-1} + D_t}{P_{t-1}}$$

where r_t is the return 1 period t, P_t is the closing stock price for period t, P_{t-1} is the closing stock price at the previous period, and D_t is the cash dividend on during period t.

What makes this a bit more challenging is including the cash dividends because these are not readily available. Simply calculating the percentage change in the index from day to day or from month to month ignores a substantial portion of the return on an index.

Consider the S&P 500 in 2006,

Quarter end	Level	Dividends
03/31/2006	1294.83	\$5.91
06/30/2006	1270.20	\$6.02
09/30/2006	1335.85	\$6.09
12/31/2006	1418.30	\$6.86

The level of the S&P 500 at the beginning of 2006 was 1248.83. Calculating the returns for each quarter in 2006 with and without dividends produces different returns:

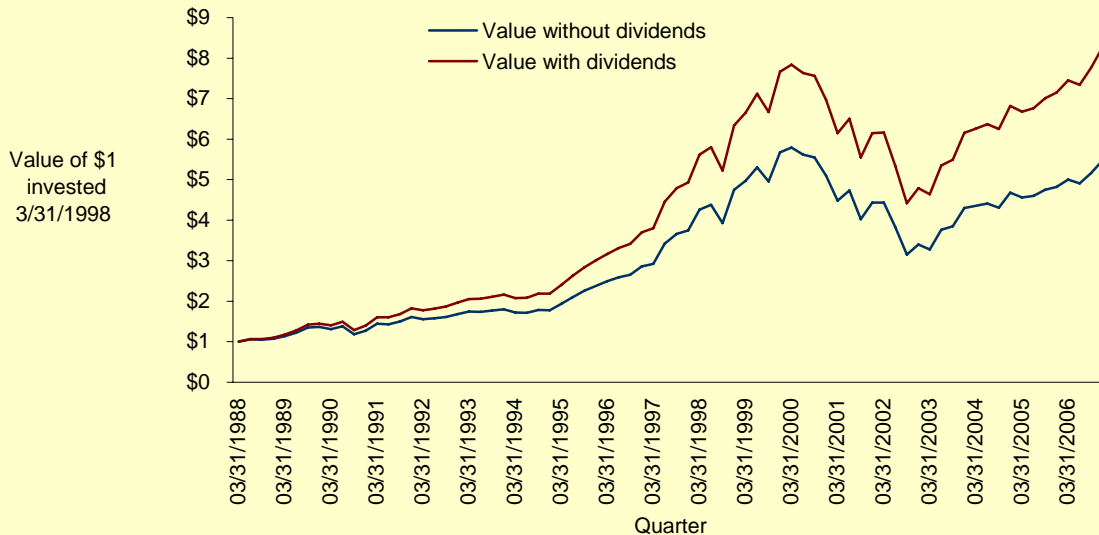
Quarter end	Return without dividends	Return with dividends
03/31/2006	3.728%	4.215%
06/30/2006	-1.902%	-1.446%
09/30/2006	5.168%	5.642%
12/31/2006	6.172%	6.628%

Does this make a difference? Yes. In much of the benchmarking that we do in analyzing returns on investments, we compare the returns on a stock with those of a benchmark, such as a stock index. A correct comparison requires that we calculate the returns with accuracy, which requires including dividends. For some stocks, dividends may be small or not at all, but for other stocks the dividends may be a large part of the return. This is also true with stock indexes: ignoring dividends is ignoring a portion of the return.

You can see the significance of ignoring dividends when you look at wealth relatives over time, as shown in Exhibit 2. The wealth relative used here is to consider an equal investment (in this case, \$1) in the index without and with returns. As you can see, ignoring dividends results in a significant difference in the performance of the index. In other words, if you calculate a return on an index without considering the dividends paid on the stocks comprising this index, you are ignoring a portion of the returns and are therefore incorrect.

Exhibit 2

The value of \$1 invested in the S&P 500 index, calculated with and without cash dividends considered, 1998-2006



Source of data: Standard & Poor's, www2.standardandpoors.com/spf/xls/index/SP500EPSEST.XLS

2. Learning outcomes

- LO4-1 Describe the uses of stock and bond market indices.
- LO4-2 List and briefly describe the major U.S. stock indicators.
- LO4-3 Calculate different indices, including a price-weighted average, a value-weighted index, and an equal-weighted index.
- LO4-4 List the reasons why a bond index is difficult to construct.
- LO4-5 Explain why the major market indicators of the DJIA and the S&P 500 may not move in perfect tandem with each other.

3. Module Tasks

A. Required readings

- "Indexes: The Good, The Bad and The Ugly," by Rick Wayman, *Investopedia*.
- [Market Indices](#), provided by the SEC

B. Optional readings

- Chapter 9 of the *Irwin Guide to Using the Wall Street Journal*, by Michael B. Lehman, available through the FAU Libraries' to netLibrary [Note: if you are accessing this from off-campus, you must use EZProxy to access this material. Process: FAU Libraries – EZProxy – Indexes and Databases -- netLibrary]

C. Practice problems sets

- [Market indices](#), prepared by Pamela Peterson Drake
- [StudyMate activity](#)

D. Project progress

- At this point in time, you should have completed the company description write-up and gathered the financial data that you'll need to analyze your company.
- Check out [Gathering Financial Information from Mergent Online](#) to learn how to get downloadable financial data on your company.

E. Module quiz

- Available at the [course Blackboard site](#). See the Course Schedule for the dates of the quiz availability.

4. What's next?

Up to this point, we have been focusing on the instruments and mechanics of the stock and bond markets. In Module 1 you were introduced to the concept of investments and investing. In Module 2, you were introduced to the different types of investments – direct and indirect – that are available to investors. You learned about the mechanics of trading in Module 3, where you learned how short selling and margin trading affect investors' returns. In this module, you learned about how the different indices are constructed and why they may not move quite in tandem.

In the next module, our focus is on fundamental analysis. The valuation of a stock requires understanding the financial condition and performance of company. Not just what has happened, but where the company is heading. You'll have to use your accounting background and financial ratio analysis tools to get an idea of the current situation and future of a company. You will be applying what you learn in this module to your course project.