

1. INTRODUCTION

Following are the three fundamental economic drivers of equity prices:

1) *Risk-free rate*: The equity prices have a negative relation with risk-free rate.

2) *Risk premiums*: The equity prices have a negative relation with risk premiums.

3) *Corporate earnings growth*: The equity prices have a positive relation with corporate earnings growth.

2. ESTIMATING A JUSTIFIED P/E RATIO

2.1 Neoclassical Approach to Growth Accounting

The Cobb-Douglas Production Function or Model: It is a model used for estimating economic growth, which in turn helps to determine the dividend growth rate, corporate profit growth, and equity prices. This model is relatively more appropriate to use for developing markets than for developed markets with stable growth rates.

The Cobb-Douglas Production Function can be stated as:

$$Y = A \times K^\alpha \times L^\beta$$

Where,

- Y = Total real economic output
- A = Total factor productivity (TFP)
- K = capital stock
- α = Output elasticity of K
- L = Labor input
- β = Output elasticity of L

- Real economic output, capital stock and labor input are either directly observable or can be derived from national income and product accounts.
- However, TFP is not directly observable and estimated as residual, referred to as the "**Solow Residual**".

Assuming **Constant Returns to Scale** (i.e. an X% increase in capital stock and labor input will result in an equal (i.e. X%) increase in output*), the Cobb-Douglas Production Function can be stated as:

$$\ln(Y) = \ln(A) + \alpha \ln(K) + (1 - \alpha) \ln(L)$$

Or

$$\frac{\Delta Y}{Y} \approx \frac{\Delta A}{A} + \alpha \frac{\Delta K}{K} + (1 - \alpha) \frac{\Delta L}{L}$$

Where,

- $\frac{\Delta Y}{Y}$ = % growth in real output (or gross domestic product, GDP)
- $\frac{\Delta A}{A}$ = % Growth in TFP
- $\frac{\Delta K}{K}$ = % Growth in capital stock
- $\frac{\Delta L}{L}$ = % Growth in labor input

- α = Output elasticity of capital stock
- $1 - \alpha$ = Output elasticity of labor input → Where $0 < \alpha < 1$

***NOTE:**

Constant returns to scale implies $\% \Delta A = 0$.

Solow Residual = $\% \Delta TFP = \% \Delta Y - \alpha (\% \Delta K) - (1 - \alpha) \% \Delta L$

Total Factor Productivity (TFP): Growth in TFP represents that part of total economic growth which is not explained by capital accumulation and growth in labor force. In other words, growth in TFP implies that growth in aggregate output/GDP can be greater than predicted by growth in accumulated capital stock and the labor force.

Factors that positively impact growth in TFP include:

- Technical progress (improvements in technology) or innovation;
- Liberalization of trade policies;
- Elimination of restrictions on the movement and ownership of capital and labor;
- The establishment of peace and the predictable rule of law;
- Use of efficient taxation policies;
- Improvements in the division of labor;

Factors that negatively impact growth in TFP include depletion and degradation of natural resources.

Example of Factors affecting Economic Growth:

Reform measures (i.e. liberalization of trade policies, free flow of capital etc.) tend to have positive effect on TFP and consequently, the economic growth rate. However, such policies are considered as a one-time event. In order to achieve sustainable economic growth, an economy needs to have sustained increases in productivity.

Sudden, unexpected changes in capital stock are considered as a one-time event e.g. unexpected decrease in the capital stock tends to reduce economic output, but only in the short-run.

Changes in demographics i.e.

- Increase in the number of women entering into the

workforce leads to increase in the aggregate labor force participation rate. Initially, these changes tend to increase economic output at a higher rate until a new steady-state labor force participation rate is achieved.

- *Increase in the retirement age* leads to increase in the aggregate labor force participation rate. Initially, these changes tend to increase economic output at a higher rate until a new steady-state labor force participation rate is achieved.
- *Increase in children per household* increases economic growth via increase in labor force growth rate.
- *Increase in number of "two-wage-earner households"* increases economic growth via increase in labor force growth rate.
 - It is important to note that in the short-run, as labor force participation rates increase, the growth in labor force will be greater than population growth; however, in the long-run, labor force growth is constrained by population growth.

Savings: Increase in savings leads to increase in capital stock, which in turn tends to increase economic growth.

Health: Improvements in health tend to positively affect economic growth via increase in human capital and productivity.

Education: Education tends to have a positive impact on economic growth. Increase in subsidies to higher education results in increase in future technical innovation; as a result human capital increases and labor productivity increases, leading to an increase in economic growth.

Environmental and pollution controls: Increase in environmental and pollution controls tend to decrease economic growth due to higher costs associated with meeting environmental protection standards. However, this decrease in economic output will only be short-term.

IMPORTANT TO NOTE:

- A **large developed economy** tends to have lower growth rates in capital, labor, TFP and economic output.
- **Relatively small economy** (i.e. in the early stages of development) tends to have considerably higher workforce growth rate and a modest capital stock growth rate.
- A **larger, more developed and faster growing economy** tends to have a considerably higher growth rate of capital stock combined with greater ability to translate capital growth into increased economic output.

Practice: Example 1,
Volume 3, Reading 16.



2.4

Equity Market Valuation

In the long-run, the growth rate of corporate earnings and inflation-adjusted dividend cash flow tend to have a positive relationship with real GDP growth. However, in the short-run, (since the sector of publicly traded companies is a subset of overall economy) the growth in publicly traded companies is somewhat greater or lower than the overall growth rate of GDP.

H-Model: In the H-model, initially the dividends grow at a high, extraordinary growth rate that last for N years and then declines linearly over time to reach a lower, normal/sustainable rate at the end of the investment horizon that is expected to last into perpetuity.

It is stated as:

$$V_0 = \frac{D_0}{r - g_L} \left[(1 + g_L) + \frac{N}{2} (g_S - g_L) \right]$$

Where,

V_0 = Value per share at time zero

D_0 = Annualized dividend rate at time zero

r = Discount rate → It depends on expected volatility of the markets.

- The higher the volatility on required returns (e.g. due to greater structural and regulatory changes, behavioral factors, significant government equity holdings etc.), the higher the equity discount rate.
- The lower the correlation between developing economy and developed world, the higher the diversification benefits from including developing market equities in global portfolio and thus the lower the required rate of return demanded by global investors.

g_S = short-term, higher dividend growth rate in the initial period

g_L = long-term, sustainable dividend growth rate

N = Super-normal growth period

$N/2$ = Half-life of the high growth period

The H-Model is not appropriate to use for valuing mature developed equity markets. In this case, it is preferred to use the Gordon (constant) growth dividend discount model.

The Gordon (constant) growth dividend discount model is stated as:

$$V_0 = \frac{D_0(1 + g)}{r - g}$$

It must be stressed that variables used in valuation should be consistent i.e. either all variables must be on a nominal basis or all variables must be on a real basis. Typically, analysts prefer to use real variables because

they are relatively more stable and easier to predict than the nominal variables.

The forward justified P/E: It is estimated as follows.

Forward justified P/E = Intrinsic value (e.g. from H-model or Gordon growth model) / Year-ahead expected Earnings

Sensitivity of Intrinsic Value to different Input Variables:

- Intrinsic value has **positive (but < +1.00)** correlation with length of period of Growth decline (i.e. N). For example, 1% increase in N tends to increase intrinsic value by < 1%.
- Intrinsic value has **negative (but > -1.00)** correlation with required return (r). For example, 1% increase in " r " tends to decrease intrinsic value by > 1%.
- Intrinsic value has **positive (but < +1.00)** correlation with Sustainable Growth Rate (i.e. g_L). For example, 1% increase in " g_L " tends to increase intrinsic value by < 1%.
- Intrinsic value has **positive (but < +1.00)** correlation with Supernormal Growth Rate (i.e. g_S). For example, 1% increase in " g_S " tends to increase intrinsic value by < 1%.

Issues related with accuracy of data inputs in Equity Valuation:

- It is difficult to obtain macroeconomic data in developed markets or economies.
- It is relatively more difficult to obtain accurate and historically consistent macroeconomic data in developing market or economies compared to developed markets due to significant governmental and structural changes in developing economies.
- In some cases, the corporate earnings growth rate may significantly deviate from GDP growth rates.
- Inflation-adjusted income, cash flow, and discount rates are not appropriate to use in economies with hyperinflation, currency instability etc.

Practice: Example 2 & 3, Volume 3, Reading 16.



1. TOP-DOWN AND BOTTOM-UP FORECASTING

Top-down forecasting: The top-down forecasting starts with macroeconomic and industry analysis and ends with company analysis.

1) Market analysis: Market analysis refers to macroeconomic analysis. It involves identifying broader economy or equity markets (i.e. S&P 500, FTSE 100 or Nikkei 225) that are expected to offer attractive/superior returns. It involves the following steps.

- Identifying undervalued/overvalued equity markets using relative value measures:* Relative value measures for each equity market are compared to their historical values to identify undervalued or overvalued equity markets.
- Identifying market momentum:* The market momentum is identified by analyzing trends in relative value measures for each equity market.
- Comparing performance of selected equity markets to those of other asset classes:* The expected returns for selected, best-performing equity markets are compared against the performance of other asset classes (i.e. bonds, real estate, commodities etc.).

2) Industry analysis: It involves identifying best-performing market sectors and industry groups within the best-performing equity markets or broader economy. It involves following two steps:

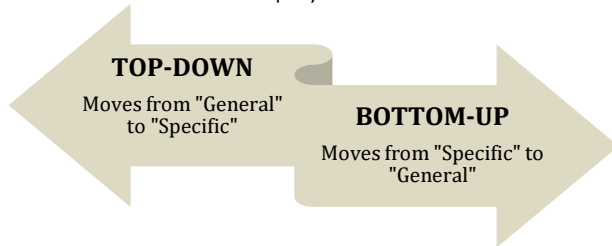
- The relative growth rates and expected profit margins are compared across different industries.
- Afterwards, an analyst analyzes and identifies which industries will benefit and which will suffer from expected changes in interest rates, exchange rates, and inflation.

3) Company analysis: It involves identifying best-performing companies or individual securities within the best-performing industries or sectors.

Bottom-up forecasting: The bottom-up forecasting starts with company analysis and ends with market/macroeconomic analysis.

- 1) Company analysis:** It involves identifying companies or individual securities that are likely to offer superior returns. It involves the following steps:
- Analyzing each company's products/services, management, and business model.
 - Comparing each company's past performance.
 - Forecasting each company's future growth prospects.
 - Based on the above steps, determining each company's intrinsic value (e.g. using DCF models).
 - Comparing each company's intrinsic value against its market price to identify undervalued or overvalued securities irrespective of prospects for the industry or the broader economy.

- 2) Industry analysis:** It involves identifying best-performing industries by aggregating expected returns for stocks within each industry.
- 3) Market analysis:** It involves identifying best-performing equity markets by aggregating expected returns for industries within each equity market.



3.1 Portfolio Suitability of Each Forecasting Type

The type of forecasting that is more appropriate to use depends on the investment strategy and portfolio context.

Top-down forecasting approach is appropriate to use when:

- A portfolio focuses primarily on tactical asset allocation among different equity markets and/or different industry groups within such markets or composites.
- A portfolio investment is only limited to futures and options on exchange-traded equity indexes.
- A portfolio primarily employs global macro-hedge fund investment strategy.

Bottom-up forecasting approach is appropriate to use when:

- A portfolio or investment strategy focuses primarily on individual security returns e.g. long-short, market neutral strategy.
- A portfolio focuses primarily on generating alpha returns through stock selection.

In some cases, both types of forecasting may be useful. For example, analysts can use a top-down approach to determine best-performing industry sectors in the current macroeconomic environment and then use a bottom-up approach to identify best-performing and attractive securities in these sectors.

Practice: Example 4,
Volume 3, Reading 16.



3.2 Using Both Forecasting Types

When top-down and bottom-up forecasting provide contradictory and inconsistent results, it is recommended that the analysts should reconcile top-down and bottom-up forecasts by examining the underlying data,

assumptions, and forecast methods in order to avoid making inappropriate investment decisions and to better understand the market consensus.

NOTE:

Typically, the aggregate market consensus tends to be more accurate than the individual forecasts.

3.3 Top-Down and Bottom-Up Forecasting of Market Earnings per Share

Two different methods used for estimating earnings for a market index (e.g. S&P 500 Index) include:

- 1) The top-down earnings estimate method:** In a top-down estimate method, forecasts for various macroeconomic variables are made and then the aggregate earnings and trends in aggregate earnings are identified using econometric models.
- 2) The bottom-up earnings estimate method:** In a bottom-up estimate method, the individual estimates of each company in the index are determined using fundamental analysis and the aggregate earnings estimates are obtained by adding estimates of each company comprising the index.

Limitations of Top-down Forecasting approach:

- Since top-down approach is based on historical relationships among various economic variables, it may provide inaccurate and unreliable results if current statistical relationships between economic variables are significantly different from historical statistical relationships.
- The bottom-up approach may correctly and timely detect signs of a cyclical economic and profit upturn because unlike top-down approach, it is not based on econometric models and historical relationships.
- The econometric models used in Top-down approach may be inaccurately specified.
- Unlike Top-down approach, a bottom-up forecasting approach facilitates investors/analysts to identify companies with weak fundamentals irrespective of prospects for the industry or the broader economy.

Limitations of Bottom-up Forecasting approach:

- The bottom-up earnings estimates may suffer from overly optimistic views of company's management regarding company's earnings prospects. E.g., management may believe that growth in company's earnings will be greater than that of overall economy (GDP growth).
- The bottom-up estimates tend to be more optimistic than top-down with respect to an economy heading into a recession and more pessimistic than top-down with respect to an economy coming out of a recession.
 - This implies that when companies are believed to

react slowly to changes in economic conditions, then it is more appropriate to use top-down approach.

- Bottom-up approach is relatively more time-consuming as it requires analyzing several securities.

Practice: Example 5 & 6, Volume 3, Reading 16.



4. RELATIVE VALUE MODELS

4.1 Earnings-Based Models

There are three earnings-based models.

A. The Fed Model: The Fed model can be used to identify an overpriced or underpriced equity market. According to Fed Model, the forward earnings yield on the S&P 500 must be equal to the yield on long-term U.S. Treasury bond (usually 10-year T-note yield) i.e.

$$\frac{\text{Forward Operating Earnings}}{\text{Index Level}} = 10 - \text{Year Treasury Note Yield}$$

Or

$$\frac{E_1}{P_0} = y_T$$

- When forward earnings yield on the S&P 500 > yield on U.S. Treasury bonds → U.S. stocks are undervalued and relatively more attractive because it indicates that stocks yield more return than bonds.
- When forward earnings yield on the S&P 500 < yield on U.S. Treasury bonds → U.S. stocks are overvalued and relatively less attractive because it indicates stocks yield less return than bonds.
- When forward earnings yield on the S&P 500 = yield on U.S. Treasury bonds → U.S. stocks are fairly valued, implying that investors will be indifferent between investing in equities and investing in government bonds.

Strengths of Fed Model:

- 1) The Fed Model is easy to understand and apply.
- 2) Like discounted cash flow models, the Fed Model reflects an inverse relationship between equity value and discount rate.
- 3) In addition, the Fed model is consistent with discounted cash flow models as it uses expected earnings as an input to represent future cash flows.

Criticisms of Fed Model:

- 1) **If ignores the equity risk premium** which is the compensation demanded by investors for assuming greater risk associated with investing in equities compared to investing in default-risk free debt.
- 2) The Fed Model is based on the assumption that the required return (r) and the accounting rate of return

on equity (ROE) for risky equity securities are equal to the Treasury bond yield (y_T). However, due to different growth and risk characteristics of stocks and bonds, it is inappropriate to view stocks and bonds as comparable assets.

3) It ignores inflation because it compares real variable (i.e. Earnings yield = Forward operating earnings / Current period equity prices) to a nominal variable (i.e. T-bond yield).

4) It ignores any earnings growth opportunities as it only considers expected earnings growth for the next year (i.e. E_1). Although dividend yield is an important determinant of long-term equity returns but the earnings growth should not be ignored.

NOTE:

For no-growth company (i.e. with zero retention or payout ratio of 100%), the required return on equity = Earnings yield.

Comparison between the current period difference between the earnings yield and the Treasury bond yield with the historical average difference: Another way to identify an overpriced or underpriced equity market is to compare the current difference between the earnings yield and the Treasury bond yield with the historical average difference i.e.

- When the current period difference between the earnings yield and the Treasury bond yield is significantly > historical average difference → stocks are undervalued and relatively more attractive.
- When the current period difference between the earnings yield and the Treasury bond yield is significantly < historical average difference → stocks are overvalued and relatively less attractive.

Practice: Example 10, Volume 3, Reading 16.



B. Yardeni Model: The Yardeni Model is stated as follows:

$$\frac{E_1}{P_0} = y_B - d \times LTEG$$

Where,

E_1/P_0 = Justified (forward) earnings yield on equities
 y_B = Moody's A-rated corporate bond yield

LTEG = Consensus 5-year earnings growth forecast for the S&P 500

d = Discount or Weighting factor that represents the weight assigned by the market to the earnings projections

- Note that the fair value estimates of the earnings yield are **positively** related with y_B and **negatively** related with d and LTEG.

Interpretation:

- When justified forward earnings yield (implied by Yardeni model) < Current forward earnings yield →

$$\frac{E_1}{P_0} - [y_B - (d \times LTEG)] > 0 \rightarrow \text{it indicates that}$$

equities are undervalued.

- When justified forward earnings yield (implied by Yardeni model) = Current forward earnings yield →

$$\frac{E_1}{P_0} - [y_B - (d \times LTEG)] = 0 \rightarrow \text{it indicates that}$$

equities are fairly valued.

- When justified forward earnings yield (implied by Yardeni model) > Current forward earnings yield →

$$\frac{E_1}{P_0} - [y_B - (d \times LTEG)] < 0 \rightarrow \text{it indicates that}$$

equities are overvalued.

In terms of ratio, it can be stated as follows:

$$\frac{\text{Earnings Yield}}{[y_B - (d \times LTEG)]} > 1.00 \Rightarrow \text{Equity market is under-valued}$$

$$\frac{\text{Earnings Yield}}{[y_B - (d \times LTEG)]} < 1.00 \Rightarrow \text{Equity market is over-valued}$$

$$\frac{\text{Earnings Yield}}{[y_B - (d \times LTEG)]} = 1.00 \Rightarrow \text{Equity market is fairly valued}$$

Yardeni estimated fair value of P/E ratio is computed as follows:

$$\frac{P_0}{E_1} = \frac{1}{y_B - d \times LTEG}$$

- When the actual P/E ratio for the S&P 500 < Yardeni estimated fair value of P/E ratio → it indicates that stocks are undervalued.
- When the actual P/E ratio for the S&P 500 > Yardeni estimated fair value of P/E ratio → it indicates that stocks are overvalued.
- When the actual P/E ratio for the S&P 500 = Yardeni estimated fair value of P/E ratio → it indicates that

stocks are fairly valued.

Note that fair value estimates of the P/E ratio are **negatively** related with y_B and **positively** related with d and LTEG.

Under the Yardeni Model, the fair value of the equity market can be stated as:

$$P_0 = \frac{E_1}{y_B - d \times LTEG}$$

Interpretation:

- When the estimated fair value > Current equity market price → it indicates that equity market is undervalued.
- When the estimated fair value = Current equity market price → it indicates that equity market is fairly valued.
- When the estimated fair value < Current equity market price → it indicates that equity market is overvalued.

The discount/weighting factor can be estimated as:

$$d = \frac{y_B - \frac{E_1}{P_0}}{LTEG}$$

Limitations:

- The Yardeni model does not fully capture the risk of equities because it uses yield on Moody's A-rated corporate bond, which only represents **default risk premium** (the credit spread between the A-rated bond and the yield on a Treasury bond) not the equity risk premium.
- The 5-year earnings growth forecast used in the Yardeni model may not represent the sustainable growth rate.
- The Yardeni model assumes that the discount factor (i.e. d) remains constant over time. However, it is not constant and may vary depending on market conditions.

IMPORTANT TO NOTE:

The Fed and Yardeni model might provide contradictory predictions. For example, the Fed model may predict that equities are overvalued (undervalued) but the Yardeni model predicts that equities are undervalued (overvalued) if:

- Default risk premium on the A-rated corporate bond < (>) the Treasury bond yield; and
- Earnings were forecasted to grow at a high (slow) rate.

Practice: Example 12,
Volume 3, Reading 16.



C. 10-year Moving Average Price/Earnings (P / 10-year MA (E)):

$$\frac{P / 10\text{-year MA (E)} = \frac{\text{Real (or Inflation-adjusted)*S\&P 500 Price Index}}{\text{Moving Average of preceding 10 years of Real (or Inflation-adjusted)Reported Earnings}}}$$

*The stock index and reported earnings are adjusted for inflation using the Consumer Price Index (CPI).

Where,

$$\text{Real Stock Price Index}_t = (\text{Nominal Stock Price Index}_t \times \text{CPI}_{\text{base year}}) \div \text{CPI}_t$$

$$\text{Real Earnings}_{t+1} = (\text{Nominal Earnings}_{t+1} \times \text{CPI}_{\text{base year}}) \div \text{CPI}_{t+1}$$

- When P/10-year MA (E) is low → it indicates attractive future equity returns.
- When P/10-year MA (E) is high → it indicates poor future equity returns.

Strengths:

- P / 10-year MA (E) controls for the impact of business cycles on earnings as it uses the 10-year moving average of real reported earnings which helps to normalize earnings.
- P / 10-year MA (E) controls for inflation as it uses the **real** stock index and **real** reported earnings.
- It has been evidenced that an inverse relationship exists between P/10-year MA (E) and future equity returns.

Limitations:

- Changes in accounting rules used to determine reported earnings may make it difficult to make time series comparison of values of P/10-year MA (E).
- The 10-year moving average of real earnings represents historical prices and thus may not provide a better estimate for equity prices; rather, it is more appropriate to use current period prices or other measures of earnings.
- It is evidenced that both low and high levels of P/10-year MA (E) may persist for extended periods of time and may not revert to its justified values (or comparison values).

Practice: Example 13 & 14,
Volume 3, Reading 16.



4.2 Asset-Based Models

There are two asset-based valuation measures:

1) Tobin's q ratio: It is calculated as:

$$\text{Tobin's } q = \frac{\text{Market value of debt} + \text{Market value of equity}}{\text{Replacement cost of assets}}$$

- In equilibrium, it is equal to 1.00.
- It is assumed that in the long-run, the Tobin's q value reverts to its equilibrium value i.e. 1.00.

At the Company Level:

- If Tobin's q > 1.00 → it indicates that the market value of company's assets is greater than the replacement costs which implies that additional capital investment into the company is profitable for the company's suppliers of financing.
- If Tobin's q < 1.00 → it indicates that the market value of company's assets is lower than the replacement costs which implies that additional capital investment into the company is NOT profitable for the company's suppliers of financing.

At the Overall Equity Market Level:

- If Tobin's q < 1.00 → it indicates that the current market value of company's assets is lower than the replacement costs which implies that equity market is undervalued.
 - In order to bring the ratio at its equilibrium value either security prices must rise or company should sell some of its assets.
- If Tobin's q > 1.00 → it indicates that the current market value of company's assets is greater than the replacement costs which implies that equity market is overvalued.
 - In order to bring the ratio at its equilibrium value either security prices must decline or company should make additional capital investments.

In summary:

Future equity returns are inversely related with Tobin's q ratio i.e. the higher (lower) the value of Tobin's q ratio, the lower (higher) the future equity returns.

2) Equity q ratio: It is calculated as:

$$\text{Equity } q = \frac{\text{Equity Market Capitalization}}{\text{Net Worth}} = \frac{\text{Price per share} \times \text{Number of Shares outstanding}}{\text{Replacement cost of assets} - \text{Market value of liabilities}}$$

- In equilibrium, it is equal to 1.00.
- It is assumed that in the long-run, the Equity q value reverts to its equilibrium value i.e. 1.00.
- Note that unlike Price-to-book value ratio, equity q ratio is based on replacement cost, not historic or book value of equity.
- Commonly (especially during rising prices), replacement cost of assets > book value of assets.

In summary:

Future equity returns are inversely related with Equity q ratio i.e. the higher (lower) the value of Equity q ratio, the lower (higher) the future equity returns.

IMPORTANT TO NOTE:

The Replacement cost of company's assets is overstated when a company underestimates the true economic rate of depreciation of its assets.

Strength:

- It is evidenced that both Tobin's q and Equity q ratios are mean-reverting.
- The inverse relationship between future equity returns and Tobin's q and Equity q ratios is consistent with the historical data.

Limitations:

- It is quite difficult to accurately estimate the replacement costs of the company's assets because many assets do not trade in liquid markets.
- It is difficult to estimate value of intangibles assets i.e. human capital, trade secrets, copyrights and patents, and brand equity etc.
- It is evidenced that both low and high levels of Tobin's q and equity q may persist for extended periods of time and may not revert to mean value.

**Practice: Example 15,
Volume 3, Reading 16.**

