READING 19: EQUITY MARKET VALUATION

Introduction

Economic strength or weakness affects equity prices through its effect on risk-free rates, risk premiums, and corporate earnings. These economic drivers of security prices are often considered fundamental because they will affect security returns throughout most investment horizons. It is widely accepted that equity prices are negatively related to risk-free rates and risk premiums and positively related to earnings growth.

There are, of course, other drivers of equity returns and most of these can be considered behavioral. The cognitive and emotional factors experienced by investors can create both positive and negative feedback mechanisms. Market momentum may thus result in both bull market rallies and bear market declines lasting longer than may be justified by fundamental factors. This reading does not deal specifically with such behavioral drivers. Rather, this reading illustrates the application of economic forecasts to the valuation of equity markets. While many factors interact to determine whether equity prices are currently rising or falling, economic fundamentals will ultimately dictate secular equity market price trends.

A- Estimating a Justified P/E Ratio

1- Neoclassical Approach to Growth Accounting

Growth accounting is used in economics to measure the contribution of different factors—capital and labor—to economic growth and, indirectly, to compute the rate of an economy’s technological progress. The neoclassical approach to growth accounting uses the Cobb-Douglas production function. This approach can be useful to financial analysts because it gives insights into the long-term potential economic growth in individual countries, in larger regions, and for the world as a whole. The Cobb-Douglas estimate of the growth of total production can help to estimate corporate profit growth and develop corporate cash flow projections for stock market composites.

The basic form of the Cobb-Douglas production function is set forth as Equation 1, where \( Y \) represents total real economic output, \( A \) is total factor productivity, \( K \) is capital stock, \( \alpha \) is output elasticity of \( K \), \( L \) is labor input, and \( \beta \) is the output elasticity of \( L \). Total factor productivity (TFP) is a variable which accounts for that part of \( Y \) not directly accounted for by the levels of the production factors (\( K \) and \( L \)).

\[
Y = AK^\alpha L^\beta
\]  

Equation - 1

If we assume that the production function exhibits constant returns to scale (i.e., a given percentage increase in capital stock and labor input results in an equal percentage increase in output), we can substitute \( \beta = (1 - \alpha) \) into Equation 1. Taking the natural logarithm of both sides of the equation gives

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

Equation - 2
Taking first differences of Equation 2 and utilizing the fact that, for small changes in any variable \(x, \ln(x + \Delta x) - \ln(x) = \ln\left(\frac{x + \Delta x}{x}\right) \approx \frac{\Delta x}{x}\) we obtain the expression:

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

Equation 3 is the expression that we will employ in our analysis. In Equation 3, the percentage growth in real output (or gross domestic product, GDP) is shown as \(\frac{\Delta Y}{Y}\), and it is decomposed into its components: \(\frac{\Delta A}{A}\) is growth in TFP; \(\frac{\Delta K}{K}\) is the growth in the capital stock; \(\frac{\Delta L}{L}\) is the growth in the labor input; \(\alpha\) is the output elasticity of capital; and \(1 - \alpha\) is the output elasticity of labor where \(0 < \alpha < 1\).

In practice, all the variables in Equation 3, with the exception of the growth in TFP, are directly observable or can be derived from national income and product accounts. However, growth in TFP is determined using the other inputs as noted by Equation 3 and is commonly referred to as the Solow residual.

TFP growth means that aggregate output (i.e., GDP) can grow at a faster rate than would be predicted simply from growth in accumulated capital stock and the labor force. Interpreting TFP as a measure of the level of technology, growth in TFP is often described as a measure of “technical progress” and linked to innovation.

However, growth in TFP, as a residual in the sense described, can be driven by factors other than improvements in technology. These factors could be particularly significant in economies that are experiencing major changes in political and/or regulatory structures. As examples, liberalization of trade policies, abolition of restrictions on the movement and ownership of capital and labor, the establishment of peace and the predictable rule of law, and even the dismantling of punitive taxation policies would be expected to contribute to growth in TFP. Finally, growth in TFP can benefit from improvements in the division of labor that arise from the growth of the economy itself. By contrast, developments such as the depletion and degradation of natural resources would detract from growth in TFP.

Note: gross effective savings is loosely defined as investment in plant, property, equipment, and inventories divided by economic output.

**Case studies:**

- The savings rate for a national economy is comparatively stable. The economy faces a sharp uptick in energy prices and at the same time imposes stringent restrictions on environmental pollution. The combined impact of energy and environmental factors renders a large portion of the existing stock of manufacturing equipment and structures economically obsolescent. What is the impact on the economy according to Equation 3?
The sudden, unexpected obsolescence of a significant portion of the capital stock means that the percentage growth rate in capital stock in that period will be negative, that is, \(\Delta K/K < 0\). All other things being equal, this implies a one-time reduction in economic output. Assuming no change in technological innovation, savings rates, and labor force growth trends, the subsequent long-term growth rates should be relatively close to the previously prevailing growth rates, starting from the lower base value for \(Y\).

- A country experiences a sharp demographic rise in the divorce rate and single-parent households. Using the framework of Equations 1 and 3, what is likely to happen to total national production, total per capita income, and total income per household?

The change in demographics implies an increase in the aggregate labor force as stay-at-home parents and spouses re-enter the workforce. That is, the labor force will grow, for some period of time, at a pace faster than underlying population growth until a new steady-state labor force participation rate is attained. Total economic production (and income) will thus also rise at an above-trend rate during this adjustment period. Above-trend growth in national income, holding population trends constant, means that per capita income will also grow above trend during this period of demographic adjustment. Per-household income, by contrast, will grow at a below-trend rate (and may even decline) due to an uptick in new household formation during the shift in divorce and separation rates to ultimately prevailing steady-state levels.

2- Equity Market Valuation

In theory, we would like to be able to forecast, year by year, each of the underlying factors of production and the change in TFP. In practice, however, we recognize that a less complicated cash flow representation might be more suitable, because it lessens the possibility of compounding forecast errors. Fuller and Hsia (1984) developed a valuation model, known as the H-model, in which dividend growth rates are expected to decline in a linear fashion, over a finite horizon, towards an ultimately sustainable rate from the end of that horizon into perpetuity. It incorporates a growth rate in dividends that is expected to prevail in the initial period \(g_s\), a period of years, \(N\), where the dividend growth rate declines in a linear fashion, and a long-term dividend growth rate \(g_L\) that is expected to prevail to perpetuity beginning at the end of period \(N\). With an initial annualized dividend rate at time zero of \(D_0\) and a discount rate to perpetuity of \(r\), the H-model estimate of value, \(V_0\), is given by Equation 4:

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

Equation - 4

The H-model provides a convenient means for modeling initially high (“super-normal”) dividend growth rates that gradually transition to a lower, long-run growth at a constant mature-stage growth rate. The H-model involves an approximation to the value estimate that would result from period-by-period discounting of cash flows in the phase prior to the mature or terminal phase when a constant growth rate is assumed. In the case of valuation of mature developed equity markets, the Gordon (constant) growth dividend discount model would be more commonly used than the H-model because supernormal growth would not generally need to be modeled in such cases.
In our valuation analysis, we express the discount rate and both growth factors in real, that is, inflation-adjusted terms. A key to valuation is consistency: stating variables consistently on a nominal basis or consistently on a real basis are both feasible approaches. Economists, however, typically prefer to use real variables as they tend to be more stable and, therefore, easier to predict than their nominal counterparts.

In evaluating the investment attractiveness of a market index, we utilize a price–earnings ratio or P/E approach. Because of the behavioral factors mentioned in the introduction, prices of equities and equity market composites tend to vary more than underlying normalized earnings and growth prospects. P/E analysis permits us to make useful inter-temporal valuation comparisons and has the additional benefit of providing intuition when making comparisons across international borders.

In the following analysis, we estimate what justified P/E ratios should be under differing inflation-adjusted equity discount rates and for different estimates of the ultimately prevailing terminal inflation-adjusted dividend growth rate to perpetuity.

The (forward) justified P/E is the estimated intrinsic value divided by year-ahead expected earnings; in this case we are estimating intrinsic value using the H-model. Reflecting the meaning of justified here as warranted by fundamentals, price in the justified P/E ratio is assumed in this discussion to equal intrinsic value as estimated by the valuation model, i.e., \( P_0 (\text{or} P) = V_0 \).

A word on the Chinese Capital Market: In establishing a reasonable discount rate to apply to our cash flow forecasts, we should take into account the higher volatility of Chinese markets, which has arisen in part because of structural macroeconomic instabilities and the evolution of their legal and regulatory systems. The higher observed volatility also has arisen from behavioral shifts in P/E relationships that are more pronounced than those usually seen in U.S. and European markets.

The effect of higher volatility on required returns might be somewhat mitigated to the extent

1) Market returns are less than perfectly correlated with other international equity markets and
2) Cross-border investing and divesting of equities is freely achievable by investors both inside and outside of China.

On balance, the foregoing factors suggest that the required real equity discount rate be higher in China than, for example, in the United States. This naturally leads us to investigate both what the realized real equity discount rate has been in the United States and what real equity discount rates are predicted based on alternative theoretical models.

This is a necessarily judgmental adjustment but should

1) reflect an analyst’s view of differential riskiness (in the context of a well-diversified international portfolio) and
2) Reflect congruence with historical realized return differentials between markets that were then seasoned and those that were then developing.
Inherent in our analysis of equity composites is the difficulty of specifying precise price or P/E ratios at which a “buy” or “sell” recommendation is to be made. However, the strength of this kind of relative value approach is that, in a diversified portfolio context, investors can usually make reasonable decisions—at the margin—whether it is then appropriate to raise or lower market exposures relative to the investable universe in the aggregate. The price/value relationships prevailing at the date of the analysis were such that those investing on a fundamental basis should have a weighting in Chinese equities close to their baseline or normal-strategy allocation.

The possible criticisms of our approach should not be overlooked. From a practical perspective, there may be severe problems with the accuracy of data inputs.

- It is difficult enough to obtain macroeconomic data in developed countries with long-established methods and facilities. In developing markets or in economies experiencing profound governmental and structural change, such as the Eastern Bloc after the fall of the Berlin Wall, the problems of obtaining accurate and, more importantly, historically consistent, data are multiplied.

- The same fluidity in political and demographic fundamentals also calls into question whether companies’ growth rates will track GDP growth rates. In certain instances, there can be long departures between growth rates, meaning that for long periods of time the share of corporate profits may be rising or declining relative to GDP.

- The analysis in this reading has focused on inflation-adjusted income, cash flow, and discount rates. In a global economy with reasonably robust currency exchange markets and where monetary growth is targeted to keep inflation at manageable levels, this is probably appropriate. However, hyperinflation, currency instability, and other trade disequilibria have occurred far too frequently from a historical perspective to be overlooked. In the presence of such factors, the confidence of our model’s approach could be diminished.
B- Top-Down and Bottom-Up Forecasting

Top-Down Analysis

- Market analysis: Examine valuations in different equity markets to identify those with superior expected returns.
  - Compare relative value measures for each equity market to their historical values to identify those markets where equities are relatively cheap or expensive.
  - Examine the trends in relative value measures for each equity market to identify market momentum.
  - Compare the expected returns for those equity markets expected to provide superior performance to the expected returns for other asset classes, such as bonds, real estate, and commodities.
- Industry analysis: Evaluate domestic and global economic cycles to determine those industries expected to be top performers in the best-performing equity markets.
  - Compare relative growth rates and expected profit margins across industries.
  - Identify those industries that will be favorably impacted by expected trends in interest rates, exchange rates, and inflation.
- Company analysis: Identify the best stocks in those industries that are expected to be top performers in the best-performing equity markets.

Bottom-Up Analysis

- Company analysis: Identify a rationale for why certain stocks should be expected to outperform, without regard to the prevailing macroeconomic conditions.
  - Identify reasons why a company's products, technology, or services should be expected to be successful.
  - Evaluate the company's management, history, business model, and growth prospects.
  - Use discounted cash flow models to determine expected returns for individual securities.
- Industry analysis: Aggregate expected returns for stocks within an industry to identify the industries that are expected to be the best performers.
- Market analysis: Aggregate expected industry returns to identify the expected returns for every equity market.
1- Portfolio Suitability of Each Forecasting Type

In theory and practice, it is not necessary for either top-down or bottom-up forecasting to be carried to the final step shown for each method in Exhibit 7.

2- Using Both Forecasting Types

When engaged in fundamental securities analysis, it can be wise to use both top-down and bottom-up forecasting. It is frequently the case that top-down and bottom-up forecasts provide significantly different results. In such instances, the analyst should investigate the underlying data, assumptions, and forecast methods before employing them as a basis for investment decisions.

Most of the time, the aggregate market consensus will tend to be more accurate than the individual forecasts that comprise the consensus. The reconciling and revision process is therefore useful in helping us better understand the market consensus.

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

Two different methods are employed when estimating earnings for a market index, such as the S&P 500 Index. The first is to add up the individual estimates of the companies in the index. This is referred to as the bottom-up earnings estimate. The top-down estimate relies on forecasts for various macroeconomic variables and a model that fits these forecasts to past trends in aggregate earnings.

What considerations might encourage a market analyst to rely more on a top-down or bottom-up forecast of S&P 500 operating earnings?

Bottom-up forecasts are based on consensus earnings estimates from equity research analysts covering the S&P 500 stocks. Top-down estimates are often based on econometric methods rather than fundamental analysis of the companies comprising the index.

Analysts frequently wait for information from the companies they follow to change their forecasts. Thus, bottom-up estimates may be more optimistic than top-down heading into a recession, and more pessimistic than top-down coming out. If the belief exists that companies are reacting slowly to changes in economic conditions, then a market analyst may prefer a top-down forecast.

However, top-down earnings forecasting models also have limitations. Most such models rely on the extrapolation of past trends in economic data. As a result, the impact of a significant contemporaneous change in a key economic variable or variables on the stock market may not be accurately predicted by the model. If the belief exists that the economy is on the brink of a significant change, then a market analyst may prefer the bottom-up forecast.

C - Relative Value Models

Relative value investing is consistent with the popular trading maxim that investors should buy what is cheap and sell what is expensive. The relative value models presented in this section can be used to support the tactical asset allocation decision. They can help to identify times when investors would be...
well served switching from bonds to stocks, or vice-versa. As an investor, it is important to focus on the markets in a comparative fashion.

1. **Earnings-Based Models**

The **Fed model** is a theory of equity valuation that hypothesizes that the yield on long-term U.S. Treasury securities (usually defined as the 10-year T-note yield) should be equal to the S&P 500 earnings yield (usually defined as **forward operating earnings** divided by the index level) in equilibrium. Differences in these yields identify an overpriced or underpriced equity market. The model predicts:

- U.S. stocks are undervalued if the forward earnings yield on the S&P 500 is greater than the yield on U.S. Treasury bonds.
- U.S. stocks are overvalued if the forward earnings yield on the S&P 500 is less than the yield on U.S. Treasury bonds.

The **key criticism of the Fed model is that it ignores the equity risk premium**. Informally, the equity risk premium is the compensation demanded by investors for the greater risk of investing in equities compared to investing in default-risk-free debt. Equation 5 presents the Gordon growth model where $V_0$ is intrinsic value, $D_1$ is the dividend per share to be received one-year from today, $r$ is the required return, and the constant annual dividend growth rate is $g$:

$$V_0 = \frac{D_1}{r - g}$$

Equation - 5

Assuming markets correctly set price, $P_0$ equal to intrinsic value, then $P_0 = V_0$. The expected dividend, $D_1$ can be determined as the payout ratio, $p$, times expected earnings, $E_1$. Sustainable growth, $g$, can be estimated as return on equity, $ROE$, times the earnings retention rate, $(1 - p)$.

Substituting $D_1 = p E_1$ and $g = ROE (1 - p)$ into Equation 5 and noting that $P_0 = V_0$, we are able to derive Equation 6. Equation 6 provides a Gordon growth model estimate for the forward earnings yield, $E_1/P_0$:

$$\frac{E_1}{P_0} = \frac{r - ROE(1 - p)}{p}$$

Equation - 6

The Fed model hypothesizes that the earnings yield, $E_1/P_0$, and the yield on Treasury bonds, $y_T$, are equal in equilibrium. One way to produce this equilibrium using Equation 6 is to assume that the required return, $r$, and the return on equity, $ROE$, are equal to the Treasury bond yield, $y_T$. Making these substitutions in Equation 6 shows this result:

$$\frac{E_1}{P_0} = \frac{r - ROE(1 - p)}{p} = \frac{y_T - y_T(1 - p)}{p} = y_T$$

Equation - 7

Thus, implicit in the Fed model equilibrium are the assumptions 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, \( y_T \). Historical evidence and financial theory resoundingly reject the notion that either assumption is true. For example, the long-run average return on U.S. equities has exceeded the long-run average return on T-bonds by a significant amount. Because of this, many analysts consider the Fed model flawed.

**Two additional criticisms of the Fed model are**

- That it ignores inflation and earnings growth opportunities. Asness (2003) criticized the Fed model because it compares an arguably real variable, the earnings yield, to a nominal variable, the T-bond yield. According to this argument, the earnings yield is real because it is a ratio of current period prices. The T-bond yield is nominal because it is reflective of the expected rate of inflation. In the presence of inflation, investors should compare the earnings yield.

- That it ignores any earnings growth opportunities available to equity holders beyond those forecasted for the next year. In the United States, long-term compound average earnings growth has been 3–4 percent nominal and 1–2 percent real. Thus, the model ignores a significant portion of total equity return.

In spite of the several criticisms, the Fed model still can provide some useful insights. It does suggest that equities become more attractive as an asset class when interest rates decline. This is consistent with the predictions of any discounted cash flow model and is supported by market evidence. In practice, the model typically makes use of expected earnings (a future cash flow) as an input, which is again consistent with traditional discounted cash flow analysis.

Some analysts find a comparison of the earnings yield and Treasury bond yield to be most useful when the relationship is towards the extremes of its typical range. For example, some analysts compare the current difference between the earnings yield and the Treasury bond yield with the historical average difference. Stocks are viewed as more attractive as an investment when the current period difference significantly exceeds the historical average difference.

**The Yardeni model addresses some of the criticisms of the Fed model.** In creating the model, Yardeni assumed investors valued earnings rather than dividends. With the assumption that markets set price equal to intrinsic value, \( P_0 = V_0 \), a constant growth valuation model that values earnings is presented in Equation 8. \( E_1 \) is an estimate of next year’s earnings, \( r \) is the required return, and \( g \) is the earnings growth rate. Equation 8 shows that, given the assumptions of the model, the earnings yield, \( E_1/P_0 \), is equal to the required return, \( r \), minus the growth rate, \( g \).

\[
P_0 = \frac{E_1}{r - g} \Rightarrow \frac{E_1}{P_0} = r - g
\]

**Equation - 8**

As a data input for the required return, \( r \), Yardeni used the Moody’s A-rated corporate bond yield, \( y_B \) which allowed for risk to be incorporated into the model. The risk premium captured by the model, however, is largely a default risk premium (the credit spread between the A-rated bond, \( y_B \) and the yield on a Treasury bond, \( y_T \)), not the unobservable equity risk premium. **Thus, while an improvement over the Fed model, the Yardeni model still does not fully capture the risk of equities.**
As an input for the growth rate, \( g \), Yardeni used the consensus five-year earnings growth forecast for the S&P 500 from Thomson Financial, LTEG. Note that \( g \) is truly a perpetual or sustainable growth rate and that a five-year forecast for growth may not be sustainable.

The Yardeni model introduces an additional variable, the coefficient \( d \). It represents a weighting factor measuring the importance the market assigns to the earnings projections. The historical values for \( d \) averaged about 0.10. However, depending on market conditions, \( d \) can vary considerably from its historical average. Equation 9 presents the Yardeni model stated as the justified (forward) earnings yield on equities.

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

Equation - 9

A justified forward earnings yield that is below, equal to, or greater than the forward earnings yield value implied by current equity market index values (using consensus forward earnings estimates, for example) would indicate that equities are undervalued, fairly valued, or overvalued in the marketplace. A valuation judgment can also be made by using Equation 9 solved for \( P_0 \), which gives the Yardeni model expression for the fair value of the equity market: \( E1/(yB - d \times LTEG) \). The judgment would be that the equity market is undervalued, fairly valued, or overvalued if the fair value estimate is above, equal to, or below the current equity market level.

Note:
- Increases in \( y_B \) and decreases in \( d \) and LTEG produce higher fair value estimates of the earnings yield.
- Decreases in \( y_B \) and increases in \( d \) and LTEG produce higher fair value estimates of the P/E ratio.

Campbell and Shiller’s (1998, 2005) 10-year Moving Average Price/Earnings [\( P/10\)-year MA(E)] has become a popular measure of market valuation. The authors defined the numerator of \( P/10\)-year MA(E) as the real S&P 500 price index and the denominator as the moving average of the preceding 10 years of real reported earnings. “Real” denotes that the stock index and earnings are adjusted for inflation using the Consumer Price Index (CPI). The purpose of the 10-year moving average of real reported earnings is to control for business cycle effects on earnings.

Many analysts believe that \( P/10\)-year MA(E) should be considered a mean-reverting series.

For the purpose of illustrating the calculation of \( P/10\)-year MA(E) one can use data from any period.

- \( \text{Real stock price index}_{t} = \text{Nominal stock price index}_{t} \times \text{CPI}_{2009} \div \text{CPI}_{t} \)
- \( \text{Real earnings}_{t} = \text{Nominal earnings}_{t} \times \text{CPI}_{2009} \div \text{CPI}_{t+1} \)

What adjustments are made to earnings in determining \( P/10\)-year MA(E)?

Following Graham and Dodd, Campbell and Shiller averaged earnings over a 10-year time period. Their goal was to normalize earnings by providing an estimate of what earnings would be under mid-cyclical conditions. The implicit assumption is that the typical business cycle lasts 10 years.
Campbell and Shiller also control for inflation by adjusting past earnings to current period dollars using the Consumer Price Index.

2- Asset-Based Models

Tobin’s q ratio, is an asset-based valuation measure. Tobin’s q has been used for several purposes, including decision-making concerning physical capital investment and equity market valuation.

- The first application is the simplest: At the company level, Tobin’s q is calculated as the market value of a company divided by the replacement cost of its assets. According to economic theory, Tobin’s q is approximately equal to 1 in equilibrium. If it is greater than 1 for a company, the marketplace values the company’s assets at more than their replacement costs, so additional capital investment should be profitable for the company’s suppliers of financing. By contrast, a Tobin’s q below 1 indicates that further capital investment is unprofitable.

- Tobin’s q has also been calculated at an overall market level. In that case, the denominator involves an estimate of the replacement cost of aggregate corporate assets, and the numerator involves estimates of aggregate equity and debt market values. Some analysts have used a market-level Tobin’s q to judge whether an equity market is misvalued. This application involves a comparison of the current value of market-level Tobin’s q with its presumed equilibrium value of 1 or with its historical mean value. Assuming that Tobin’s q will revert to the comparison value, a Tobin’s q below, at, or above the comparison values is interpreted as the market being undervalued, fairly valued, or overvalued. Strong economic arguments exist that both Tobin’s q and equity q, discussed later, should be mean-reverting series.

The calculation of Tobin’s q often poses difficulties. At the company level, it is usually possible to get a fairly accurate estimate of market value (the numerator of Tobin’s q) by summing the values of the securities a company has issued, such as its stocks and bonds. It is much more difficult to obtain an accurate estimate of replacement costs of the company’s assets (the denominator of Tobin’s q). Liquid markets for many assets do not exist. Moreover, such items as human capital, trade secrets, copyrights and patents, and brand equity are intangible assets that are often difficult to value. Typically, researchers who try to construct Tobin’s q ignore the replacement cost of intangible assets in their calculations.

Smithers and Wright (2000) created an equity q that is the ratio of a company’s equity market capitalization divided by net worth measured at replacement cost. Their measure differs from the price-to-book value ratio because net worth is based on replacement cost rather than the historic or book value of equity.

Smithers and Wright suggest that readings below 1 are sometimes due to the true economic rate of depreciation being underestimated, which leads to the replacement cost of assets being overstated. Such overstatement means that the denominator in both formulations of the q ratio is too high and that the correctly measured ratios should be much higher.

Why should Tobin’s q be expected to mean revert?
If Tobin’s q is greater than 1.0, then the market is valuing a company at more than it costs to replace its assets. Either security prices must fall or the company should continue to invest in new assets until the ratio returns to its equilibrium. If Tobin’s q is below 1.0, then security prices are undervalued because new businesses cannot be created as cheaply as they can be bought in the open market. Either security prices must rise or the company should sell some of its assets until the ratio returns to its equilibrium.

How does equity q differ from the price-to-book ratio?

Book value in the price-to-book ratio reflects the value of equity that is reported on the company’s balance sheet. The denominator of equity q reflects the difference between the replacement cost of assets and the market value of liabilities. Most financial reporting standards require the use of acquisition cost as a measure of asset value. Thus, the book value of assets is typically less than their replacement cost, and this is particularly true during periods of rising prices.

Which of the models ignore the current level of market interest rates as determinants of equity market value?

In assessing equity market value, P/10-year MA(E), Tobin’s q, and equity q are typically compared to their long-term averages and not to market interest rates. While the Yardeni model compares the fair value earnings yield predicted by the model to the actual earnings yield, the A-rated corporate bond yield is an input to the model.

Under what conditions might the Fed model and Yardeni model provide a different assessment of the value of the equity market?

The Fed model compares the earnings yield to the Treasury bond yield. The Yardeni model uses the A-rated corporate bond yield and the consensus 5-year earnings growth forecast to determine a fair value earnings yield. One scenario in which the two models might differ in their predictions would be if the default risk premium on the A-rated corporate bond was currently high, the Treasury bond yield was currently low, and earnings were forecasted to grow at a slow rate. Given these assumptions, the Fed model might indicate that equities are undervalued while the Yardeni model indicates equities are overvalued.

Which of the models use some measure of earnings as an input? How might this lead to comparison issues?

The Fed model, Yardeni model, and P/10-year MA(E) all use some measure of earnings as a determinant of value. Time series comparisons will be problematic if the accounting methods used to determine earnings change over time.
## Exhibit 17 Summary of Relative Value Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictions of the Model</th>
<th>Strengths</th>
<th>Limitations</th>
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</thead>
</table>
| Fed model                       | The equity market is undervalued if its earnings yield exceeds the yield on government securities. | - Easy to understand and apply.  
- Consistent with discounted cash flow models that show an inverse relationship between value and the discount rate.                                                                                     | - Ignores the equity risk premium.  
- Compares a real variable to a nominal variable.  
- Ignores earnings growth.                                                                                                                                  |
| Yardeni model                   | Equities are overvalued if the fair value estimate of the earnings yield provided by the model exceeds the actual earnings yield for the market index. | - Improves on the Fed model by including the yield on risky debt and a measure of expected earnings growth as determinants of value.                                                                      | - Risk premium captured by the model is largely a default risk premium that does not accurately measure equity risk.  
- The forecast for earnings growth may not be accurate or sustainable.  
- The estimate of fair value assumes the discount factor investors apply to the earnings forecast remains constant over time.                                                                 |
| P/10-year MA(E)                 | Future equity returns will be higher when P/10-year MA(E) is low.                        | - Controls for inflation and business cycle effects by using a 10-year moving average of real earnings.  
- Historical data supports an inverse relationship between P/10-year MA(E) and future equity returns.                                                                                   | - Changes in the accounting methods used to determine reported earnings may lead to comparison problems.  
- Current period or other measures of earnings may provide a better estimate for equity prices than the 10-year moving average of real earnings.  
- Evidence suggests that both low and high levels of P/10-year MA(E) can persist for extended periods of time.                                                                 |
| Tobin’s q and equity q          | Future equity returns will be higher when Tobin’s q and equity q are low.                | - Both measures rely on a comparison of security values to asset replacement costs (minus the debt market value, in the case of equity q); economic theory suggests this relationship is mean-reverting.  
- Historical data supports an inverse relationship between both measures and future equity returns.                                                                               | - It is difficult to obtain an accurate measure of replacement cost for many assets because liquid markets for these assets do not exist and intangible assets are often difficult to value.  
- Evidence suggests that both low and high levels of Tobin’s q and equity q can persist for extended periods of time.                                                                 |