Dividends and Stock Valuation: A Study From the Nineteenth to the Twenty-First Century

By:
Stephen R. Foerster and Stephen G. Sapp*
Richard Ivey School of Business
The University of Western Ontario
London, Ontario, Canada, N6A 3K7

First Version: February 26, 2004
Current Version: February 15, 2006

Abstract

Using a comprehensive database of monthly U.S. economic and price-based factors from 1871 to 2005 (to the best of our knowledge, the longest such monthly database), we investigate and provide a new perspective for how changing economic conditions have impacted the relationship between the actual and intrinsic values of firms in the S&P Composite Index. We estimate the intrinsic value of equity using the most fundamental valuation technique, the dividend discount model and compare this series to actual prices in order to estimate "pricing errors." Based on a 30-year rolling cost of equity estimate and perfect foresight of dividends, we find that stocks were undervalued, on average, by approximately 26% over the entire sample. Prior to 1945, stocks were consistently undervalued and displayed more bond-like characteristics. Since 1945, stocks were, on average, fairly valued but with long periods of under- and over-valuation. We show that well-known economic and price-based factors can explain much of both the level and changes in pricing errors. We find that equities were under-valued using the well-known Fed Model, but this undervaluation has decreased over time and the predictive ability of the Fed Model decreases when one considers other factors. We also compare estimated measures of the cost of equity (based on the CAPM) with implied measures from the actual price and dividend series and are able to explain much of the differences as relating to economic conditions.

JEL Codes: G21, G35
Keywords: Asset pricing, valuation, dividend discount model, multi-factor models

---

* Paul Desmarais/London Life Faculty Fellowship in Finance (Foerster) and MBA Class of 1989 Faculty Fellowship (Sapp). We thank Laurence Booth, Bernard Dumas, Ming Dong, Kai Li, Jerry Mulcahy, Rick Robertson, Sergei Sarkissian, Ken Snowden and seminar participants at McGill University, the University of Western Ontario and the Northern Finance Association meetings for useful comments, and the Social Sciences and Humanities Research Council for financial support. Please address all correspondence to Steve Foerster: Richard Ivey School of Business, The University of Western Ontario, London, Ontario, Canada, N6A 3K7; Phone: 1-519-661-3726; Fax: 1-519-661-3485; E-mail: sfoerster@ivey.uwo.ca.

1. Introduction

Long horizon historical studies of equity prices allow researchers to examine how firm and investor behaviors have changed over time and across economic conditions in order to better understand what factors drive value. In this study, we compile what may be the longest U.S. monthly time-series of stock, bond and economic data to investigate the changing role of dividends in how investors value equity from the 1870s to 2005. This period allows us to consider how the role of dividends has changed in the valuation of equity as equity markets in the U.S. have matured and economic conditions changed. Since firms typically pay dividends as a means of returning profits to their providers of equity capital, the fundamental value of a firm's equity should be related to its expected future dividend payments. The motivation for this is well-expressed in the following quote from Williams (1938):

> *"... A stock is worth the present value of all the dividends ever to be paid upon it, no more, no less... Present earnings, outlook, financial condition, and capitalization should bear upon the price of a stock only as they assist buyers and sellers in estimating future dividends."*

Building on this concept, several studies have investigated the ability of changes in dividends to explain changes in asset prices (e.g., Shiller (1979 and 1981) and LeRoy and Porter (1981)). Because the results of such tests have been mixed, researchers have proposed a wide variety of asset pricing models to empirically characterize how different factors influence equity prices.

The goal of this study is to investigate the way that investors' valuation of equity has changed over time and explain differences between actual and intrinsic stock values. Existing research suggests that there have been differences in how equity has been valued since the Great Depression of the 1930s and thus within the period covered by the majority of research in financial economics. In this study we extend this research to cover the period from the 1870s to 2005 and therefore we are able to put these changes into a broader context. Our approach diverges from many of the standard approaches used in asset pricing which focus on the ability of different economic risk factors to explain the changes in observed prices (i.e., returns) for various financial securities. Because the intrinsic (fundamental) value of equities depends on the expected or required return and growth of dividends paid to investors, we are able to provide a new perspective into how investors value assets and how this depends on economic conditions. This complements the standard asset pricing tests which focus on what factors influence the changes in the *actual* price and ignore what factors may influence the *fundamental* price – arguably the more important price in the long-term.

Our study makes two main contributions to the literature. First, we provide a detailed comparison of the relationship between the valuation one would have obtained using fundamental valuation methods and the actual price for equity over a long period of time. We begin with the most commonly used fundamental valuation method – the basic dividend discount model (DDM). We also consider the relationship of earnings and prices using the Fed Model. The Fed Model compares the earnings yield (earnings per share divided by current prices) to the yield on long-term government bonds.

We consider the actual prices and dividend payments for the S&P Composite Index over the period from 1871 to 2005. Using these data, we calculate the prices that one would have rationally expected using fundamental valuation methods relying on the expected future dividend payments. Using some of the economic factors and price-related factors most commonly considered in empirical asset pricing (but generally considered over much shorter time periods) such as the default premium, term structure of interest rates, changes in inflation, earnings yield, and price momentum at each point in time, we determine the conditions under which the valuation models can best explain observed prices. We find that stocks have been, on average, undervalued by roughly 26% over the period from 1871 to 2005. However, we find that in the early period (pre-World War II), stocks were valued more like bonds and were correspondingly undervalued using our models. Since the end of World War II, stocks have been more fairly priced even though there have been long periods of over- and underpricing. We recognize that any model of intrinsic value may be misrepresented. Thus in addition to attempting to explain pricing error *levels* we also use our economic and price-base factors to explain *changes* in pricing errors.

Second, we investigate how the estimated cost of equity one would use in the fundamental valuation methods (based on information at any particular point in time) and the implied cost of equity from the actual prices (based on current prices and ex post dividend streams) have changed over time and across economic conditions. This allows our study to provide new insights into the time-varying characteristics of the required rates of return which are at the heart of research in empirical asset pricing and complement existing work in this area such as Pastor and Stambaugh (2000). We find that much of the apparent mis-valuation of equity is related to differences between the discount rate that investors could have estimated using information available at the time and the implied discount rate actually used to obtain the current price. As with the pricing errors, we find systematic relationships between the standard economic factors and both our estimated and implied costs of equity. Although our estimated cost of equity is determined using the CAPM and the implied cost of equity is backed out from the current price and the DDM, we find that both values are impacted by economic conditions. We find that increasing uncertainty regarding the economy and therefore firms' future prospects impact the required rate of return, especially the value implied from our fundamental valuation which is much more sensitive to changing economic conditions.

The paper is organized as follows. Section 2 provides a review of the dividend-related literature relevant for our study. Section 3 presents our models and describes our hypotheses. Our data are described in section 4. Results are presented in section 5 and conclusions are presented in section 6.

2. Background

In this section we discuss some of the literature regarding how investors value assets. We start by focusing on the literature considering two of the key inputs into the valuation of firms: dividends and earnings. Since another key factor related to the valuation of equity is the discount rate, we also review the literature on the market or equity premium and its relationship to asset pricing.

2.1 Fundamental Valuation of Firms

The most intuitive value for the equity of a firm is the discounted value of all of the future expected dividend payments. Since these types of fundamental valuation models are based on the intuitively appealing idea that an asset is worth the discounted value of all of the future cash flows it can generate (i.e., Gordon and Shapiro (1956), Gordon (1962)), they are the most commonly used by both academics and practitioners.

In the dividend-based models, we assume that changes in dividends should explain changes in asset prices. Several studies have built on the intuition that asset prices are determined by the discounted value of future dividends to investigate how well changes in dividends can explain changes in the volatility of asset prices (e.g., Shiller (1979 and 1981) and LeRoy and Porter (1981)). Because the analyses find that the actual prices are excessively volatile relative to the expected prices based on dividends, these tests have cast doubt on the role of dividends in explaining the value of equity. However, the results from subsequent studies (e.g., Bollerslev and Hodrick (1995)) which have relaxed several of the assumptions used in the original tests have been more favorable and suggest that dividends do play a significant role in determining the value of equity. Poterba and Summers (1988) find that the magnitudes and variability in the implied risk premiums necessary for prices to be related to dividends are too large to be consistent with any rational, fundamental asset pricing model. On the other side of the debate, Fama and French (1988) find that the variation in dividend yields explains a large proportion of multi-year return predictability. Although many subsequent studies continue to find evidence in support of the predictive ability of dividends for equity returns, studies using longer time series of data bring the generalizability of these results into question – the predictive ability of the dividend ratio appears to be specific to a few time periods (e.g., Goyal and Welch (2003)). As a result, there is uncertainty regarding the importance one should give to dividends in the valuation of equities over time.

Similar to the mixed evidence regarding the predictive power for the dividend yield, researchers have struggled to estimate the growth rate of dividends. Arnott and Bernstein (2002), for example, provide an interesting historical perspective on the differences in how investors in the early 1900s viewed dividends as compared to how they are viewed today. To handle some of these differences, dividend growth rates have been modeled using a variety of different econometric models. For example, Bollerslev and Hodrick (1995) and Donaldson and Kamstra (1996) use time-series models to predict dividend behavior and find that a number of models do a reasonable job of explaining both changes in dividends and changes in prices.

Moving beyond the role of dividends in prices, the role of earnings have been viewed as an increasingly important source of information regarding the fundamental value of equity. This has led to the increased popularity of the Fed Model. Although the Federal Reserve (i.e., the Fed) has not officially endorsed this model, in the 1980s and 1990s it was believed that Fed chairman Alan Greenspan supported the argument that falling interest rates justified higher equity values; this notion subsequently became known as the Fed Model (see also Yardeni (1997, 1999)). Formally, this model hypothesizes that the yield on ten-year Treasury bonds should be similar to the earnings yield of the S&P 500 firms (the inverse of the price-earnings ratio), so differences in these yields identify over- or under-priced securities markets. If, for example, the earnings yield on equity is greater than the yield on ten-year Treasury bonds, then equities are under-valued and equity prices should rise.

A number of researchers have examined the Fed Model. Feinman (2005) argues that although inflation clearly affects bond yields, it should not affect earnings yields – earnings should increase with inflation so the increase in earnings should be offset by the increase in the cost of equity (arguments that had been previously advanced by Modigliani and Cohn (1979)). Estrada (2005) shows that from 1968 to 2005 there is a strong relationship between (trailing) E/P and the long-term government bond yield in the U.S., but we show below that this is not the case over the much longer 1871-2005 period. Lander, Orphanides, and Douvogiannis (1997) and Jansen and Wang (2004), however, do find some support for the Fed model. The former find that deviations from this model help predict the month-ahead returns of the S&P 500. The latter find that the earnings yields on the S&P 500 and the yield on the 10-year bond are cointegrated, as the Fed model would predict. On the other hand, Asness (2000, 2003) and Salomons (2005) find that earnings yields and bond yields in the U.S. are correlated but only after adjusting for the (time-varying) differential risk of stocks and bonds.

Though the Fed Model is easy to use, it is frequently criticized for omitting too many important factors. For example, it assumes that the earnings yield for firms is a function of only the ten-year bond yield; thus, the model ignores important considerations such as earnings growth or the sustainability of current earnings. It also fails to take into account the impact of possible changes in the equity risk premium. Since these factors are at the heart of the dividend-based valuation models, our study provides a valuable opportunity to investigate the importance of some of these factors on the performance of various valuation techniques.

2.2 Discount Rates and the Equity Premium

Previous studies have proposed a series of explanations for the relatively poor ability of asset pricing models to explain the expected returns for equities. One of the most commonly proposed reasons is the possible presence of a time-varying risk premium in the equities markets. To address this concern, studies have employed a wide variety of different approaches. The approaches range from using GARCH models to capture the time varying conditional volatility in betas within a CAPM framework (e.g., Bollerslev, Engle and Wooldridge (1988)) to using conditioning information to scale the estimated betas in a multi-factor asset pricing model (e.g., Cochrane (1996 and 2001)). Studies using these methods have provided evidence that the expected return for an asset changes over time as a result of changes in the market risk premium and/or changes in the sensitivity of the asset to systematic risk.

We approach this issue from a slightly different perspective. Since the fundamental valuation techniques require one to discount future expected dividends, we use the actual prices and ex-post dividends to derive the implied discount rate used by investors. We therefore study how the implied discount rate has changed over time and how this compares to what investors might have rationally expected at each point in time. Studies such as Jagannathan, McGratten and Scherbina (2000), Pastor and Stambaugh (2000), Welch (2000), Claus and Thomas (2001), Arnott and Bernstein (2002) and Fama and French (2002) use various techniques to estimate the expected cost of equity and suggest the cost of equity has changed over time. The results all suggest that it is unlikely that one could have used information available at the beginning of the twentieth century to predict how large the equity premium turned out to be throughout the latter part of the century. Consistent with this, Welch (2000) provides interesting evidence suggesting that many financial economists currently believe the cost of equity is even larger than empirical evidence suggests. This discrepancy could have a significant impact on valuation (for an interesting discussion see Arnott and Bernstein (2002)).

Consistent with the apparent over-estimation of the equity premium, long-run historical studies of equity markets have suggested that there have been significant changes in how investors have valued equity over the past century (e.g., Smith (2001 and 2003), Arnott and Bernstein (2002) and Siegel (2002)). Before 1900 equities were frequently valued based on the book-value of equity (i.e., Smith (2001) Chapter 1). This changed as it became clear that there were other sources of value in corporations and these other sources should be captured in the value of the equity. As a result the focus switched more to the value of the dividends that the firm could pay, and not just the value of the firm's assets. This led to the valuation of stocks in a fashion more similar to bonds with the main difference that the return on stocks had to be higher since equities were riskier than bonds. The next fundamental shift occurred around 1958 when investors appeared to recognize the value of the capital gains one could obtain from stocks (the significance of this particular date is described below in more detail). During the 1950s, persistent inflation in the U.S. started to become a problem and investors realized that the capital gains from equities could provide a long-term hedge against inflation. Consequently the value of equity was derived both from the dividends as well as the anticipated capital gains. This shift in the 1950s resulted in investors becoming more willing to accept risks. Further the increased presence of institutional investors in the stock market led to an increase in the risk tolerance of investors, because of their long-term perspective and willingness to accept the risk of the stock market. This implied that the risk premium (the extra return required to hold equity) had been changing .

3. Empirical Models and Hypotheses

In this section we discuss the techniques to investigate how different factors influence investors' valuation of equity over time. We compare the results from the overall period from 1871 to 2005 to three arbitrary periods: 1871-1913 (to the start of World War I), 1914-1944 (to the end of World War II) and 1945-2005.[1] This leads to our first hypothesis:

Hypothesis 1: There is no difference in firms' dividend policies and the impact of dividends on equity valuation across the pre- and post-World War II periods.

3.1 Fundamental Value of Dividends

To formally investigate how investors use the cash flow obtained from dividends to determine the price at which they are willing to buy or sell shares, we assume investors use fundamental analysis. The first model we consider is the DDM which is based on the standard relationship in financial economics:

$$E_t[P_t] = \sum_{i=t+1}^{\infty} E_t[D_i]/(1+r_t)^{i-t} \tag{1}$$

where $E_t[P_t]$ is the expected, intrinsic (fundamental) value or price that one would expect to pay for the asset in a given year t based on information available in year t, D_i is the nominal annual dividend paid on the stock in year i, and r_t is the discount rate or the rate of return required by investors[2] at time t. Investors are concerned with total returns and we only have a finite time series of data (to 2005), so we decompose the total returns into the returns from dividends and the capital gains portion to implement this model:

$$E_t[P_t] = \sum_{i=t+1}^{T} E_t[D_i]/(1+r_t)^{i-t} + E_t[P_T]/(1+r_t)^{T-t} \tag{2}$$

This representation explicitly shows how the price depends on the expectation for the future dividends as well as the capital gains through the value from selling/liquidating the asset at the terminal date of our study, P_T, where T is 2005. In an efficient market, this fundamental or intrinsic value should equal the current price.

Since we have the actual dividend payments and terminal price, we start by assuming our investors have rational expectations and therefore have perfect foresight of both future dividends and the

[1] These three sub-periods are chosen to correspond with the two World Wars. Since we know that the economy in the U.S. changed after each of the World Wars these provide reasonable cut-offs. This is consistent with the periods studied in other work considering long time series of financial data (e.g., Skinner (2004)).

[2] Note that throughout the paper we interchangeably refer to this discount rate as the required return or the cost of equity.

terminal price. Under the assumption of perfect foresight, the only remaining input we need is the discount rate, r_t. We estimate the discount rate (or cost of equity) using a simple version of the CAPM:

$$r_t = r_{f,t} + ß\ (MRP_t) \tag{3}$$

where $r_{f,t}$ is the yield on a long-term U.S. government bond at time t, ß is assumed to be 1.0 since we are considering a measure of the overall market, and MRP_t is the estimated market risk premium at time t calculated as the U.S. market return less the yield on a long-term U.S. government bond on a rolling 30-year basis (note that it is on a cumulative basis for the first 30 years). This ensures that we are estimating the market risk premium using only information that would have been available to the investors at time t.

We compare the theoretical prices obtained using equations (2) and (3) to the actual price at each time t to get a "pricing error" or the unexpected portion of the current price as a fraction of the current price:

$$UP_t \equiv (E_t[P_t] - P_t) / P_t \tag{4}$$

where UP_t is the unexpected portion of the price in period t, P_t is the actual price and $E_t[P_t]$ is the expected valuation based on *perfect foresight of future dividends and the terminal price*. Since UP represents the percent difference between the expected value of shares using "perfect foresight" dividends (e.g., the *actual* dividends) discounted at the *estimated* cost of equity, one interpretation of the deviation is the magnitude of mis-estimation of the cost of equity which we discuss further below. This gives rise to the following:

Hypothesis 2: There is no difference in the actual price series, P_t, and the estimated price series based on the dividend discount model, $E_t[P_t]$.

3.2 Cost of Equity

The DDM requires certain assumptions to estimate the value of equity, so we need to consider the quality of our estimate for this crucial input. The future dividends and terminal value we use in our valuation model are the actual dividends between time t and the end of our sample, T or 2005. The assumption of perfect foresight means that we assume investors are able to rationally forecast what actually happened. Assuming investors use the CAPM over the entire period, our method provides us with estimates for the cost of equity based on historical information that would have been available to investors at a given point in time. As a source of comparison we use the observed prices to back out the implied discount rate being used by investors. Specifically, the implied cost of equity is obtained as the discount rate that equates the actual current price with the discounted value of the actual future dividends from that time until the end of the sample plus the terminal price (e.g., equation (2)). The implied discount rates are determined assuming our investors are perfectly rational and therefore would have accurately forecasted the future dividends and terminal price.

To determine how well our methods perform at predicting the discount rate, we compare the implied discount rates at each period, K_eimp_t, to the estimated discount rate obtained using the historical data, K_eest_t. The unexpected part of the current discount rate is therefore defined as:

$$UR_t \equiv (K_eest_t - K_eimp_t)/ K_eimp_t \quad (5)$$

3.3 The Role of Economic and Price-Based Factors

The final stage of our study considers how a number of key economic and price-related factors influence the differences between our expected and actual values. We start by studying how our observed pricing deviations or errors (the differences between the actual prices and the prices we would have expected using the DDM) are impacted by changing economic conditions:

$$UP_t = a + \Sigma b_j{*}F_{jt} + e_t \quad (6)$$

Where "UP_t" is defined as above, "F_{jt}" is the value of economic factor j in period t, "b_j" is the sensitivity of the pricing errors to factor j, "a" is the intercept term, and "e_t" is the error term.[3]

We also recognize a potential criticism of any such study as ours, that we can never be sure of what the true intrinsic value of the stock market is since we can only observe actual prices. However, we can mitigate this concern by also examining pricing error *changes*. As such, we also examine a modified version of equation (6) whereby the dependent variable is UP_t - UP_{t-1}.

[3] We run regressions based on a "centered" version of equation (6) (see Morrison (1983)). The value of each factor j in period t is subtracted from its mean value over the entire period of interest. This procedure has no impact on the estimated betas but it allows us to test our hypotheses directly since the intercept is interpreted as the average "pricing error."

The economic and price-related factors we consider were selected to capture the current economic conditions as well as the market's expectations for the future economic conditions. To facilitate comparison between our results and those of standard asset pricing tests, we consider some of the most commonly used factors. These factors have been argued to capture how investors are currently valuing equity investments over different economic conditions. Specifically, we examine the impact of expected changes in economic conditions using the default premium, PREM, and the term structure of interest rates, TERM. To compensate for differences which may occur as a result of changes in inflation over time, we include the change in the level of the consumer price index, DCPI. We also consider measures related to trends in market valuation: the earnings/price ratio, EP, and a momentum factor, MOM. We provide further intuition related to these various factor below. Most of these factors are assumed to be related to changes in stock prices because of their relationship to the business cycle. Although there are many occasions on which the stock market does not react to the business cycle, the stock market is known to generally react quite powerfully to changes in economic activity. Specifically, stocks almost always fall preceding a recession and increase rapidly as the recovery arrives. Siegel (2002) states that out of the 41 recessions from 1802 to 1993, 38 of them (93%) have been preceded or accompanied by declines of 8% or more in the stock returns index. The only exceptions were of timing (slightly delayed) or magnitude (not quite 8%).

Overall, the unexplained portion of the actual prices, UP, should be zero in an efficient market. Since we expect there to be periods of sustained over- and under-valuation in the market (i.e., the Tech bubble in the late 1990s), we anticipate periods when investors are systematically over-estimating the future dividend growth rate or under-estimating the required return on equity. These periods will result in the actual price, P_t, being greater than the expected price, $E[P_t]$ so the unexplained pricing error, UP, would be negative. The reverse would hold when UP is positive. The relationship between UP and our economic factors are hypothesized to depend on the information in these factors with respect to future dividend growth and the required return on equity. Since the changes in price will be larger on the current or actual price than on the expected or intrinsic price, we focus our hypotheses development on how changes in the economic factors are related to changes in the actual price and consequently on the UP's.

PREM is estimated as the yield on a long-term BAA corporate bond less the yield on a long-term AAA corporate bond. This measure should capture changes in the business cycle. The default premium should increase as the economy is slowing down because the slowdown results in an increase in the risk premium for firms, especially for lower rated BAA firms. Concurrent with the increase in the risk premium on bonds, we expect the same to be occurring with the cost of equity at these times. Similarly an increase in the default premium would suggest that investors would anticipate a decrease in future dividends. We therefore expect the actual price to decrease more than the expected price as the default premium increases. This decrease in the actual price, P_t, when the expected price, $E[P_t]$, remains relatively stable would result in the value of UP increasing, $(E[P_t] – P_t)/P_t$, and thus it would leave us with a positive relationship between the pricing errors and the default premium.

The term structure is similar to the default premium in providing insight into how the economy is developing over time. TERM is defined as the yield on long-term government bonds less the yield on short-term government bonds. This measure is also designed to capture business cycle effects. A positive TERM or upward-sloping yield curve is generally associated with economic expansion. The slope of the yield curve is frequently viewed as a leading economic indicator. For example, an inverted yield curve is viewed as a leading indicator that the business climate is deteriorating, since the associated tightening of monetary policy which increases short rates is believed to indicate a future recession. Using the term structure measure, we expect that the economy will improve as the term structure increases – for example, as the slope goes from being negative to positive we expect the economy to be improving. As the economy is improving, investors would not require as large a return on their equity and would have more optimistic forecasts for future dividend payments by firms. Therefore we expect the actual price to be increasing as the term structure increases and therefore state of the economy are improving. This would leave us with a negative relationship between term structure and our pricing errors.

Because of the potential impact that changes in inflation can have on stock prices, we also consider a measure of the year-over-year changes in consumer prices. Current conventional wisdom is that stocks provide a long-term hedge against inflation although, in the short-term, stock price changes are frequently observed to be negatively related to inflation changes. The view of the relationship between stock price and inflation has evolved through time. A turning point in the view of the impact of inflation on equity values occurred in the summer of 1958. Standard investment wisdom prior to 1958 required stock dividend yields to be higher than bond yields to compensate investors for the higher risk of stocks. In the summer of 1958, however, the average dividend yield on stocks fell below the yield on long-term government bonds for the first time in decades (and has remained below ever since). At that time Business Week (August 1958) referred to the lower dividend yields as "An Evil Omen Returns" since the last time this occurred had been in 1929, just before the market crash. The shift in how stocks were valued was purported to be a result of changes in investors' expectations regarding inflation. Though stocks are now viewed as a means of compensating for inflation, many investors were hesitant to accept this until the late 1950s. This view lasted until the 1970s when the oil crisis destroyed much of the value of stocks while inflation was rampant. Thus the importance of inflation to help explain the prices of shares appears to have changed significantly over time.

We measure changes in inflation, DCPI, using differences in the Consumer Price Index (CPI) with a 12 month moving average to deseasonalize the monthly values. If we assume that inflation is a lagging indicator, this means we observe that inflation is falling (rising) as the economy is coming out of (going into) a recession. If this is the case, we therefore expect, in general, a negative relationship between the DCPI variable and economic conditions. We expect the actual price to increase more than the expected price as the inflation decreases because the actual cost of equity for the market should be decreasing as inflation is decreasing (economic conditions are improving) and/or the market is expecting dividends to be increasing more rapidly. As a consequence the pricing errors would be expected to have a positive relationship with the rate of inflation.

Historically one of the most important financial metrics has been the earnings yield (earnings per share divided by the price per share) denoted EP (or the inverse of the price/earnings ratio). Our measure is the 10-year moving average of earnings per share compared to the average price per share for the S&P Composite Index at each point over our sample. One of the major reasons for changes in the value of the equity premium is changes in how investors value and anticipate future earnings (e.g., Arnott and Bernstein (2002)). We expect that the price investors are willing to pay for each dollar of earnings increases as the economy is improving since those earnings are expected to increase more rapidly. This means that we would expect the EP ratio to fall as the economy is improving because we expect the actual price to decrease more than the expected price as the EP ratio increases. An explanation for this is that an increase in the EP means the economy is doing worse, so the cost of equity for the market should be increasing and/or the market is expecting dividends to be decreasing. We therefore expect the pricing errors to have a positive relationship with the EP ratio.

The final factor we consider is price momentum, MOM. This is measured using the cumulative change in equity prices over the past 36 months. If we assume that an increase in momentum indicates an improvement in the economy (actual prices have been rising indicating an increase in the expected level of future dividends and/or a decrease in the cost of equity), we would expect there to be a positive relationship between momentum and economic conditions. We therefore expect the cost of equity to be decreasing and correspondingly the actual price to increase more than the expected price as the momentum increases. This means that we would expect the pricing errors to have a negative relationship with momentum.

As with the pricing errors, we also investigate how these economic factors are able to capture the differences between the estimated cost of equity and the implied cost of equity (UR):

$$UR_t = a + \Sigma b_j * F_{jt} + e_t \qquad (7)$$

Previous studies which have calculated implied equity premiums (e.g. Jagannathan, McGratten and Scherbina (2000), Pastor and Stambaugh (2000)) suggest a possible role for economic factors in the apparent deviations between the implied and the estimated costs of equity. Specifically, we expect that the implied cost of equity will be greater than the historically calculated cost of equity when our economic factors suggest a future upswing in economic performance. The forward looking implied cost of equity will capture the investors' perception that future conditions are improving and thus that equity prices should be improving in the future.

As with our previous discussion above, we also consider a modified version of equation (7) whereby the dependent variable is $UR_t - UR_{t-1}$, focusing on *changes* in the differences in addition to an examination of the *level* of differences.

4. Data

Our main data series is the monthly data on the S&P Composite Index obtained from Robert Shiller's website for the period from 1871 to 2005.[4] These data include information on the monthly price level of the index as well as the corresponding dividend payments and earnings for each month back to 1871. We chose this series because the S&P Composite Index (S&P stocks) is the most commonly used benchmark portfolio. Before 1957, this index covered 90 companies; since March 1957, it has covered 500. The S&P Index is a market-value weighted index designed to provide a benchmark for total U.S. equity market performance.[5] This data series is similar to the data series used in Schwert (1990) and Siegel (2002). We use the S&P data because it is the longest comprehensive series of equity prices that also have the corresponding dividend payments.

---

[4] http://aida.econ.yale.edu/~shiller/data.htm

[5] Naturally there are several issues with such a long historical data series. There have been documented concerns associated with the Standard and Poor's data before 1926. Specifically, S&P does not publish dividend or earnings series before 1926 so Shiller uses information from the Cowles Report (Cowles (1939)) to supplement the S&P data. Because Cowles does not have earnings data for many of the stocks in the S&P Index, this may influence the accuracy of the earnings series with the largest discrepancies occurring in the earliest years of the sample. Wilson and Jones (1987) examine the Cowles data for accuracy and find some apparent errors in the earnings and dividend series but they conclude that the overall impact should be minimal. Detailed discussions about some of the other concerns with this data and data series going back further can be found in Schwert (1990). Because of our interest in the role of dividends in the fundamental valuation of equity, we do not go back before 1871 when the dividends paid by firms must be estimated rather than actual values (e.g., Schwert (1990)).

To measure the changes in economic conditions between 1871 and 2005, we collect data from a number of different sources. The majority of our interest rate data was obtained from MacAulay (1938) and supplemented with more recent data from the Federal Reserve.[6] For the AAA interest rates, we use the AAA data from Moody's obtained from the Federal Reserve from 1919 onward which we supplement with the yields on the highest grade corporate bonds before this date – railway bonds. Since there was a high degree of variability in the quality of railway bonds with some being considered similar in quality to government bonds, we use the yields for the bonds in the top 25th percentile of railway bonds in each month.[7] For the BAA interest rates, we, once again, use the data from Moody's obtained from the Federal Reserve from 1919 onward, but we supplement this with the interest rate for the railway bonds listed in MacAulay (1938). The BAA yields were most similar to the yields for the bonds in the bottom 25th percentile. To obtain the default premium, the values from both sources were spliced together and the difference between the BAA and AAA bonds used.[8]

For the long-term government interest rates, we use the quarterly yields on New England municipal bonds from 1871 until 1915, the highest quality railway bonds from 1915 to 1925 (both from MacAulay (1938)) and the Federal Reserve ten year yields since 1925.[9] For the short-term low risk bonds, we use the Call Money data for the period until 1931 from MacAulay (1938), the Call Money data

---

6 http://www.federalreserve.gov/releases/h15/data.htm

7 This ranged from a low of roughly 12 bonds listed in the early sample to more than 50 later in the sample. Note that the 25 percentile was chosen because it matched very well to the AAA bonds in the period between 1919 and 1937 for which we have both data series.

8 To ensure the robustness of the default premium, this value was verified by estimating a regression model for the data available from both data series covering the period from 1919 to 1937. The R-square for the regression was over 90% suggesting a very good matching of both data series.

9 This is similar to the data proposed by Shiller except that we use a slightly different interpolation technique. We interpolate from quarterly data for the New England municipal bonds until 1915, from annual U.S. government bonds until 1925 and we use actual monthly data for bonds with a minimum ten years until maturity from 1925 until 1951 and the constant maturity ten year bond afterward. Shiller interpolates using the average annual yields on New England municipal bonds and then annual yields on U.S. government bonds until 1951. Although U.S. government bonds were traded at this time, we use the New England municipal bonds because U.S. government bonds were not considered a reliable measure of interest rates between 1880 and 1910 – they traded at a premium as they were required for banks to be able to issue currency (Homer (1963)).

from the Federal Reserve until 1953, and the T-Bill rate since 1953. To estimate the term structure, we consider the difference between the yields of bonds with low risk but different times to maturity.[10]

5. Results

We begin with a descriptive analysis of our data to provide some insight into how different market features have changed over the period from 1871 to 2005. Next we more formally investigate how investors' valuation of equity has changed over time.

5.1 Preliminary Investigation

If dividends are valued by investors as hypothesized in our discounted cash flow based models (equation (2)), we should find a relationship between changes in the levels of dividends and the current value of the index. Examining how the prices and dividends change over our sample period (Figure 1a) we see the dividends and prices move in a very similar manner. As a result, it is not unreasonable for us to assume that the dividend discount model, or versions of it, may describe how investors value equity.

Looking more carefully at dividend payments, we see that the dividend yield over the entire period is, on average, about 4.5%, but there are several trends over time (Figure 1b). The yields were higher over the initial part of the sample, decreasing during the poor economic times in the late 1800s, increasing as the economy improved in the early part of the 1900s, highly volatile during the 1920s and 1930s, increasing immediately after World War II and falling gradually since 1955, especially since the early 1980s. In Figure 1b we also see the previously noted change in the relationship between the dividend yield and the long-term government rates with the clear crossing of these two series in the late 1950s. These findings are consistent with past evidence as well as the more recent evidence of a changing role of dividends in studies such as Fama and French (2001) who assert that dividends have decreased in importance over time. Studies such as Allen and Michaely (2002) and Brav et al. (2005) suggest that,

[10] We used the spliced series, but verified that they were capturing the standard term structure measures by running regressions on the periods during which we had an overlap between the standard term structure measures and our proxy series. The R-square values for these regressions were almost 90% in each case.

more recently, managers use a wider range of tools to return profits to shareholders. Despite the most commonly used of these, share repurchases, being the subject of a large amount of research since repurchases became more common in the mid-1980s, we do not explicitly include them in our analysis for several reasons. First, most recent studies suggest that a significant portion of the repurchases are performed to cover the use of stock options so they do not change the quantity of shares outstanding. Second, the dividend value for the S&P Index is determined on a per-share basis, so the dividend value grows as shares are repurchased and therefore it should already capture the impact of net share repurchases.

The dividend payout ratios in Figure 1c also demonstrate some interesting changes over time. We see that the payout ratios were consistently above 60% and highly variable until around 1945. The payout ratio stabilized after World War II and the level has gradually decreased afterward, especially in the early 1970s. This suggests that dividend policies have changed significantly over time, especially since the end of World War II. It appears that managers are now more focused on maintaining a stable but lower dividend payout ratio (i.e., Brav et al. (2005)). Since the return to investors depends on the payout ratio, we expect changes in the payout ratio to impact the valuation of equities.

Because there have been many changes in the U.S. tax code over this period, it is important to understand how they may have impacted the motivation for managers to pay dividends. Federal income tax in the U.S. was first collected under the Revenue Act of 1913 and there was no tax preference given to either dividends or capital gains income with both taxed as regular income. Because of the dramatic increase in the personal tax rates during World War I, investors refrained from realizing the gains on their equity investments thereby decreasing the liquidity of the equity market. Since U.S. Congress was persuaded that such frozen portfolios were detrimental to the efficient allocation of capital, in 1922 capital gains were given beneficial tax treatment. This preferential treatment for capital gains persisted until the tax reforms in 1988 when the marginal tax rate on dividends was brought down to the same level as on capital gains (see Figure 7-1 in Siegel (2002)).

To more clearly understand the relationship between the size of dividends paid out to investors and earnings retained to re-invest in the company and therefore improve capital gains, Figure 1d compares the level of dividends per share to the earnings per share. The series move closely together with earnings appearing to be more volatile and leading dividends until the end of World War II. Not surprisingly earnings are the most volatile between about 1916 and 1942 with very large earnings declines in 1921 and the early 1930s. There is a clear covariation between and similarity in the levels of dividends and earnings before World War II, but the dividend series becomes much smoother, both in absolute terms and relative to earnings, after World War II. We also see a consistent increase in the separation between dividends and earnings over this period. These results provide part of the motivation for our definition of the three sub-periods we consider in our analysis. Before World War II changes in dividends were more common and in both directions whereas after World War II dividend policy appeared to become increasingly smooth and conservative – evidenced by the gradual widening of the gap between dividends and earnings per share.

To formally characterize our data series, we present summary statistics and tests in Table 1. The values are similar to those obtained by studies also using similar historical data series (e.g., Schwert (1990), Siegel (2002) and more recently Skinner (2004)). Each row presents the means and standard deviations for changes in dividends, changes in earnings, dividend payouts, dividend yields, capital gains, total returns, and price-earnings ratios, respectively. The columns present the values over different sub-periods. To investigate how these values change over time we consider the overall period 1871-2005, as well as the three sub-periods: 1871-1913, 1914-1944 and 1945-2005. The final portion of the table presents p-values for tests of equality of the values across adjacent sub-periods.

Examining the mean annual changes in dividends over our different sample periods we see that since 1871 the annual growth rate in dividends has averaged around 4%. We find that there is a small growth in dividends over period 1 (1871-1913); a slightly smaller growth rate in period 2 (1914-1944) but a much higher growth in dividends in period 3 (1945-2005). The differences are not significant across periods 1 and 2 but they are across periods 2 and 3. This is likely due to the high variability in the growth rates in the first two periods observed in Figures 1a and 1b and not in period 3. The decline in the standard deviation of the growth rates across periods clearly demonstrates how the volatility of dividends has changed over time, particularly the decrease in the post World War II period where we see more persistent, yet smaller increases.

We also see that earnings generally grew at a slightly faster rate of around 6% and were much more variable than dividends . The lower growth in dividends than in earnings suggests a reluctance of managers to change dividends in response to changes in earnings; in other words, a stickiness in dividend policy. This is consistent with our observations from Figure 1 – the changes in the dividends are much smaller but coincided with changes in earnings before 1900; post-World War II the changes in dividends are smaller and more frequent but no longer appear to follow the changes in earnings. The dividend payout ratios are high in both periods 1 and 2 (about 70% in both periods) but decrease significantly in the period 3 (50%). A t-test rejects the null hypothesis of the equivalence of the means between periods 2 and 3 (the p-value is less than 0.001) but not between periods 1 and 2.

From an investor's perspective, we see that the dividend yield contributes a substantial portion of the total return: over 40%. Although the dividend yield is significantly lower in the latter period, consistent with other studies, it is clear that dividends continue to have a major impact on total equity returns. Capital gains for the index are growing over time but they increase substantially in period 3 where capital gains make up over 70% of the total returns. These results suggest that, more recently, either investors value capital gains more than dividends, or firms more actively pursue growth strategies and are therefore re-investing more funds as opposed to paying them out to shareholders in the form of dividends. We can only weakly reject the null hypothesis of no difference in the total returns between periods 2 and 3 but we clearly reject the null hypothesis of no difference in the dividend yields over these periods. The P/E ratio has remained relatively stable across our sub-periods but with a decline between periods 1 and 2 then an increase between periods 2 and 3. It is interesting to see the increase in the volatility as well as the average of the P/E ratio in period 3.

These results indicate definite trends in the dividend payout policies over time. Using simple t-tests for the values for each series we reject hypothesis 1 of no differences in many of our series over our sample. As indicated in Figure 1, there is an especially noteworthy break in the patterns before and after World War II. If investors do value dividends as our fundamental valuation techniques would suggest, we would expect to see changes in investors' valuations of these firms in the periods before and after World War II.

Since much of our analysis investigates the role played by economic conditions in how investors value equity, Figure 2 characterizes our economic factors over our sample and their relationship to business cycles (as defined by recessionary periods). Looking at the long-term and short-term government bond rates in Figure 2a, we can see that the long-term rates were much more stable than the short-term rates until the start of the Great Depression. During the period between 1931, through World War II and into the early 1950s interest rates were very low, with the short-term rates very close to zero for much of this period. Interest rates rapidly increased from the early 1950s until the early 1980s when they peaked during the "Fed Experiment" with the Federal Reserve raising short-term interest rates to almost 20%. Interest rates have gradually been decreasing since this time. Although we see that the short- and long-term interest rates followed similar patterns, it is interesting to consider how the spread between them has changed over this time.

In Figure 2b we consider the term structure – the difference between the yields on the long- and short-term bonds. Given how we have defined the term structure, we see very frequent inversions of the yield curve in the period before World War I but far fewer subsequently. Interestingly we frequently observe periods of inversion just before or during periods when the U.S. economy was in a recession. Our data demonstrate the inverted yield curves which were believed to signal the recession in the early 1970s, 1980s and 2000s. Consequently, our term structure variable appears to be capturing many of the important economic factors it is hypothesized to be measuring.

In Figure 2c we present the default premium. We see it gradually decreasing over the latter part of the 1800s as the economy was gradually strengthening. To study how the default premium changes around downturns in the economy, we look at how it changes around the start of World War I, the Great Depression, the oil crisis in the early 1970s and the recessions in the 1980s and 1990s. The default premium appears to increase at the start of each of these major economic downturns. If we compare the timing of the default premium and the term structure (i.e., comparing Figures 2b and 2c), we see that the term structure appears to decrease before the economic downturns begin and therefore the term structure appears to lead the changes in the default premium around these events. After the initial decline in the term structure (following the start of the economic downturn), we see the term structure gradually start to increase until the economy has recovered. For the changes in the twelve month moving average of changes in the CPI in Figure 2d we see some evidence that increases in inflation precede the economic downturns, especially since the 1960s.

Finally in Figure 2e we see that the P/E multiples follow distinct patterns. For example, the P/E multiples are increasing until 1900, decreasing until the Great Depression, variable through the end of World War II when they start to rise again, falling through the 1970s and early 1980s and soaring afterward. These results highlight the fact that investors' perceptions of equity have changed over our long sample period. To further see how investors' valuation of equities has changed over time, Figure 2f presents the 36 month price momentum factor. This clearly demonstrates how equity prices rise and fall during periods of economic expansion and contraction.

Before formally performing our analysis, we calculate summary statistics for the economic and price-based factors we use in equation (6). Panel A of Table 2 illustrates the large variation within each of these factors over our sample period. Because our analysis uses the first ten years of the sample to obtain relatively stable starting values for our cost of equity and other important inputs, our summary statistics are from 1881 to 2005. The statistics are consistent with the patterns observed in Figure 2. Specifically, the values demonstrate the decline in the default premium and the changes in the term structure over our sample. The increasing role of inflation is clear, especially since World War II. The increasing valuation of earnings in equity prices can also be seen. Panel B of Table 2 presents the correlations between the factors. Not surprisingly, we find many significant correlations. One of the most interesting relationships is that the default premium is negatively correlated with the term structure. This is consistent with the default premium increasing and the term structure decreasing (i.e., inverting) as economic risk increases.

Somewhat surprisingly, given the negative correlation between the default premium and term structure, we find that inflation is negatively correlated with both the default premium and term structure. This implies that as inflation goes up, the risk of default is falling (the default premium is decreasing) but as inflation increases, short-term rates are increasing (the term structure is decreasing). Since inflation lags the changes in the economy, this is consistent with inflation increasing near the end of an economic cycle when the risk of default would be viewed as lower and the Fed would be raising short-term interest rates to control inflation and to try to slow the economy's growth.

The earnings yield increases as investors are willing to pay less for each dollar of earnings. As EP increases, we find the default premium increasing – the more risky firms become (i.e., the default premium increases), the less willing investors are to pay a premium for stocks. Similarly as the term structure decreases, we find investors willing to pay less. Finally as inflation increases, investors suspect pending problems for the economy and therefore are willing to pay less for stocks. Finally, as momentum increases we find a falling default premium, no relation to the term structure and increasing inflation. These relationships are consistent with prices rising as the risk of the economy is decreasing.

5.2 The Dividend Discount Models

In this section we investigate the ability of valuation techniques using expected future dividends to explain the actual value of the S&P Composite Index. The analyses in the previous section suggest a possible relationship between dividends and prices. If dividends are valued by investors, we should be able to use expected dividends to determine the current value of equities. Before formally examining the expected prices obtained using each model, Figure 3 illustrates the performance of the expected prices obtained from the DDM. The DDM appears to perform reasonably well at estimating the true prices over the sample.[11] Although there are some periods of relatively poor performance in the early part of the sample, the deviations between the actual and expected prices appear to decrease over time. The expected prices appear to be over-valuing equity during the early portion of the sample but the pricing errors appear to be more evenly distributed across over- and under-valuation in the latter portion of the sample. The differences between the actual and expected prices are seen to be the largest when there were large changes in actual prices (i.e., during the late 1920s and early 1930s)

In Table 3 we present the results from the estimation in equation (6). The first regression (Reg 1) demonstrates the relationships between the economic factors and the pricing errors. Because these regressions are run using the centered values for the factors, the intercept term represents the average pricing error over the corresponding sample period. The estimated intercept therefore indicates that we have an average under-pricing of 26% over the entire period. Since it is unlikely that investors could have anticipated the unprecedented growth in both dividends and stock prices over our full sample period, it is not surprising that the expected price is larger than the actual price for much of our sample. This is consistent with the results in Figure 3 where the majority of the underpricing is pre-1945.

As hypothesized we find a positive relationship between the changes in the default premium and the pricing errors. This indicates that an increase in the default premium is related to a decrease in the actual price and therefore an increase in the pricing errors. If we assume that an increasing default premium implies that current and future dividends are discounted at a higher rate, this would be consistent with investors reacting to the increase in uncertainty by either decreasing their forecasts of future dividends or valuing future dividends using a higher discount rate. Contrary to our hypothesis we find that there is also a positive relationship between the term structure of interest rates and the pricing errors. This suggests that as the short term interest rates are falling, the discount rate is rising and investors are viewing the economy as being riskier. Though this is not consistent with our previous conjecture, it is

[11] Note that we also consider a cumulative estimate for the cost of equity rather than the moving average of the past 30 years. Because the results are not qualitatively different, to conserve space only is the moving average results are presented.

consistent with the view that investors view the Fed's decreasing of short-term interest rates as a sign that the economy is weakening and the Fed is trying to help improve the economy.

Although not statistically significant in the overall period, we find a negative relationship between the pricing errors and changes in inflation as suggested in our hypotheses. For the earnings yield, EP, we see a positive relationship with the pricing errors. Since an increase in the EP multiple means that prices are falling (investors are less willing to invest in equity), this is consistent with our hypothesis that overall decreases in the actual price level lead to an increase in the EP ratio and thus would result in an increase in the pricing errors. In a similar fashion, as expected, we find that following periods of increasing prices as measured using the prices over the past 36 months (our momentum variable) there are increasing pricing errors.

To evaluate the ability of the Fed Model to predict whether or not stocks are over- or under-valued, we regress the pricing errors on a dummy variable which takes a value of one when the earnings yield is greater than the long-term government bond rate and zero otherwise (Reg 2). Since the Fed model suggests that equities are undervalued when the earnings ratio is higher than the return on the government bond (i.e., equities are being under-valued relative to what they are returning to investors and an increase in price will bring the earnings yield to a level closer to what investors could get by investing in bonds), this means that there is undervaluation of stocks when the dummy variable for the Fed model takes on a value of one and thus we expect a positive coefficient.

In the results for regression 2 we find that the Fed model has some predictive ability. The dummy for the Fed Model is statistically significant and suggests that when the Fed model indicates equity is being undervalued it actually is. However, in the third regression 3 (Reg 3) we add the Fed dummy variable to the original regression and find that the significance of the Fed dummy variable disappears. This suggests that the value of the Fed model to predicting the over or undervaluation of equity is being captured by the other economic factors we consider.

Looking across sub-periods, we find some differences in how our economic factors influence the pricing errors. Specifically, the estimated values for the intercept demonstrate that the pricing errors are largest in the first two sub-periods but close to zero in the final sub-period. This suggests that the means by which investors are actually valuing equity is more similar to the value based on the fundamental valuation methods in the most recent periods or investors' forecasts of future dividends have improved over time. For the various factors, a surprising difference over time is the relationship between the default premium and the pricing error - it is positive and significant for the first and second sub-periods but negative and not significant for the final sub-period. The positive relationship between the pricing errors and the term structure continues throughout the entire set of sub-periods.

Although the sign for inflation was not as expected in the overall period, in sub-period 3 we find that it becomes significantly positive. This changing role for inflation is consistent with the belief that investors did not view inflation as a factor in asset pricing until the late 1950s. As a result, it is not surprising that we first see a significant role for inflation in the final sub-period. The role of the EP ratio in our regression results also changes over time. The EP is found to be negatively related to the pricing errors in the first sub-period but has the expected positive relationship in the second and third sub-periods. The negative relationship between the EP and pricing errors is consistent with the well-documented differences in how investors value equity in the early part of the sample.

For the Fed Model, we are unable to estimate the second and third regression models in the first sub-period because the Fed model suggested that stocks were under-valued throughout the entire period. This belief that equity is undervalued at this time is consistent with the view that equity should be valued in a similar fashion to a bond with an expected return higher than that of bonds over this time. In the second and third sub-periods the Fed dummy by itself is statistically significant and has the expected positive sign. The ability of the other economic factors to predict future valuation of the equity is greater than the ability of the Fed model and therefore we find that the dummy variable becomes insignificant and has the wrong sign.[12]

[12] Because of the potential impact of outliers in the periods when there are large pricing errors, we also performed the analysis using winsorized values for the pricing errors, eliminating some major outliers around the 1930s. Since the results are similar using either the winsorized or the raw values, we only present the results for the raw data.

Since the previous analyses were in terms of the levels of the pricing errors, we are also interested in seeing how the changes in our economic factors help us predict changes in the pricing errors. Considering changes in the pricing errors and changes in our economic factors should also mitigate concerns related to the potential non-stationarity of the variables in our model[13] In the overall period, we find that the changes in pricing errors are increasing (the intercept is positive) but not significantly so. The significant economic factors for explaining the changes in the pricing errors are the changes in the default premium and inflation. We find that the pricing errors are increasing (the actual price is decreasing more than the expected price) as the default premium is increasing. This is consistent with our hypothesis that the increasing risk signified by the increasing default premium results in the pricing error increasing. On the other hand, we find that an increasing rate of inflation results in a decrease in the pricing errors. This suggests that as the rate of inflation increases the actual price is increasing more than the expected price so the stock price compensates for the impact of inflation at a more rapid rate than our expected price. For the models considering the changes in the pricing errors the dummy for the Fed Model does not have any explanatory power.

Across the different sub-periods we find that the changes in the pricing errors are not significantly different from zero in the first and second sub-periods, but they are significantly negative in the final sub-period. This is likely due to the persistent undervaluation of equity from the first two sub-periods being resolved in the final sub-period. For the default premium, we find a consistently positive relationship between the changes in the default premium and the changes in the pricing error. For the inflation, however, we find that the relationship is negative for the first two sub-periods, as it was in the overall period, but it is positive and significant in the final sub-period. This suggests that as inflation increases in the final sub-period, we do not always find the actual price increasing by an adequate amount to offset the

[13] It should be noted that we do not include the EP and momentum factors in this model because changes in these factors are directly related to changes in prices. Since this would be observationally very similar to the pricing errors, we only consider changes in the fundamental economic factors. This relationship between these factors and the pricing errors was less of an issue in the more general model.

increase in the price level. This is consistent with the evidence in the early 1970s when the Oil Crisis resulted in high inflation but stock prices were not increasing enough to offset this.

Overall the results from the estimation of the models for the pricing errors provide interesting evidence of relationships between these economic factors and the pricing errors. The evidence is broadly consistent with our hypotheses and suggests that the value of these economic factors in standard asset pricing models is likely related to their ability to forecast how investors are valuing assets and this can be more clearly seen by comparing the actual prices that investors are willing to pay to the expected prices based on a fundamental valuation.

5.3 The Implied versus Estimated Cost of Equity

We examine the differences between our estimated cost of equity and the implied cost of equity that equates the actual and theoretical equity prices. In Figure 4a the implied cost of equity is lower than the historically obtained cost during periods of economic uncertainty than in periods of economic expansion. This is consistent with our historical measures not adequately incorporating investors' expectations – they are backward looking and thus do not necessarily capture investors' current expectations regarding the future. Although caution must be exercised in interpreting the implied cost of equity near the end of our sample, the results suggest that investors were incorporating an increasingly large equity premium into prices over this period. This could be due to potentially unrealistic expectations for how equity prices would be increasing going forward, consistent with the results from Welch (2000) who finds that investors currently have unrealistically high expectations regarding the equity premium.

The relationship between the implied cost of equity and the business cycle in Figure 4b provide some interesting insights into the impact of various factors on how investors value equity. Specifically, this figure demonstrates how the equity premium increases as the economy enters a recession – we see the implied cost of equity increasing just before and especially during a period of economic contraction. Though it is evident in the entire sample period, it is increasingly evident during the less frequent economic contractions in the latter part of our sample.

To more formally consider the relationship between the estimated and implied costs of equity, Table 5 presents some summary statistics for each of these values as well as the difference between them. Because of difficulties in determining the implied cost of equity using the Dividend Discount Model (i.e., equation (2)) as we approach the terminal period, we only consider the costs of equity from 1881 to 1995 so we do not consider the final ten years. In the table we see that over the entire period the estimated and implied costs of equity are very similar and are just below 10%. Although the estimated cost of equity is slightly more variable and lower over time, the values are very similar. Over time, we see that the costs of equity have been increasing with the costs of equity being approximately 7%, 8% to 10%, and 11% in each of the sub-periods, respectively. It is interesting to note the stability (low standard deviation) of the cost of equity in the first sub-period relative to the subsequent periods. This is consistent with the belief that investors valued equity similar to bonds in the early part of our sample. As a result, the high dividends being paid by stocks allowed them to be valued using a cost of equity more similar to the cost of debt. As investors started to view equity investments in terms of both the dividends and capital gains, we see an increase in the level and variability of the cost of equity.

The results in Table 6 consider the regression of the level of the difference between the estimated and implied cost of equity and our economic factors. This is performed in a manner similar to that for the previously discussed pricing errors. The overall regression results demonstrate the average under-estimation of the cost of equity using our moving average for the market premium in the CAPM compared to the implied measure – we are under-estimating it by about 0.5%. Our economic factors also play a significant role in explaining the "errors" in our estimation of the cost of equity. We find that the implied cost of equity increases more than the estimated as the default premium increases – investors require a higher compensation for bearing risk as the economy is starting to do worse. Since the estimated cost of equity is based on a moving average of past prices, these changes in investor sentiment are more rapidly incorporated into the implied cost of equity than the estimated. However, we also find that the implied price increases more than the estimated price as the term structure increases. This is somewhat counter-intuitive because it suggests that investors require a higher compensation for bearing risk as the short-term rate is increasing. This could be interpreted as a signal that the economy is improving, but it is also possible that the short-term rates are decreasing in order to stimulate the economy and this results in a necessary increase in the cost of equity provided to investors. We also find that the implied cost of equity increases more than the estimated as the inflation rate increases and thus the implied cost of equity appears to change to incorporate the effects of inflation more rapidly than does the estimated cost of equity. Finally the EP and momentum factors demonstrate that the implied cost increases more than the estimated as the prices for equity are decreasing.

Although most of these relationships are stable over time, we do find that the relationship between the default premium and the errors in the estimation of the cost of equity change over time. Specifically, we find that the average errors are positive in the final sub-period – the estimated cost of equity is higher than the implied in the final sub-period. This is similar to the finding of Welch (2000) in which he finds that investors have been over-estimating the actual cost of equity recently. In our analysis this may be a result of the unprecedented increases in stock values and our estimation technique not allowing the model to compensate for the fact that this may not continue. With our economic factors we find that the majority of the relationships are consistent over time. One difference is the counter-intuitive finding that the implied cost of equity increases more than the estimated cost as the default premium decreases in the first and second sub-periods – investors require a higher compensation for bearing risk as the economy is starting to do better.

The final analysis we perform considers what factors influence the *changes* in the differences between the implied and estimated cost of equity. In Table 7 we see that the errors in estimation increase (i.e., our implied measure of the cost of equity is decreasing more than the estimated cost of equity) as the default premium decreases, consistent with our intuition for the default premium. For inflation, in the first two sub-periods we do not find the sensitivity between the cost of equity and inflation – the coefficient is only significantly negative in the final sub-period as one would have expected. This is consistent with existing research suggesting that the view of inflation in asset pricing and the require return to equity investors was not significant until the late 1950s.

Overall, these findings suggest that there is a significant role played by these economic factors in explaining asset prices, especially in terms of the cost of equity – one of the most important factors in asset pricing.

6. Conclusions

In this study we make several contributions to our understanding of how investors value financial assets. By comparing the valuation one would have obtained using fundamental valuation methods and the actual price for equity over a long period of time, our study complements the work in empirical asset pricing which focuses on the relationship between asset returns and economic factors. Since the fundamental valuation methods require an estimate of the cost of equity at each point in time, we also examine how the cost of equity has changed over time and across economic conditions as well.

Considering the actual prices and dividend payments for the S&P Composite Index over the period from 1871 to 2005, we find that our dividend-based valuation methods perform relatively well at explaining the actual prices for the S&P Composite Index, especially since 1945. When evaluating the level of pricing errors (differences between the actual price levels for the index and the expected prices), we find that these differences are frequently related to changes in our economic and price-related factors. The relationship between these factors and the short-term movements in actual prices around the expected price illustrate the significant role played by investors' expectations in asset pricing. Examining the dynamics of the changes in the pricing errors, we find that changing economic conditions significantly impact changes in the pricing errors.

Consistent with the changes in how investors valued equity over the past century, we find the cost of equity going from 7% at the beginning of the century to almost 11% today. Economic conditions also explain differences and changes between estimated and implied costs of equity. As a consequence our analysis provides some new insights into how the economic factors used in most empirical asset pricing tests may be related to how investors value equity investments.

References

Allen, Franklin, and Roni Michaely, 2002, "Payout Policy" North-Holland Handbook of Economics edited by George Constantinides, Milton Harris, and Rene Stulz; North-Holland.

Arnott, Robert and Peter L. Bernstein, 2002, "What Risk Premium Is "Normal?" *Financial Analyst Journal* Vol 58 (2).

Asness, Clifford (2000). "Stocks versus Bonds: Explaining the Equity Risk Premium." Financial Analysts Journal, March/April, 96-113.

Asness, Clifford (2003). "Fight the Fed Model." Journal of Portfolio Management, Fall, 11-24.

Bollerslev, Tim Robert Engle, and Jeffrey Wooldridge, 1988. "A Capital Asset Pricing Model with Time-Varying Covariances," *Journal of Political Economy*, 96(1), pages 116-31.

Bollerslev, T. and R. Hodrick, 1995, "Financial Market Efficiency Tests", The Handbook of Applied Econometrics I – Macroeconomics, edited by M. Pesaran and M. Wickins.

Brav, Alon John R. Graham, Campbell R. Harvey, and Roni Michaely, 2005, "Payout policy in the 21st century", *Journal of Financial Economics*, forthcoming.

Claus, J and J. Thomas, 2001, "Equity premia as low as three percent? Empirical evidence from analysts'earnings forecasts for domestic and international stock markets", *Journal of Finance* 56(5), pp. 1629-1666.

Cochrane, John, 1996, "A Cross-Sectional Test of an Investment-Based Asset Pricing Model" *Journal of Political Economy* 104, pp. 572-621

Cochrane, John, 2001, Asset Pricing, Princeton, N.J.: Princeton Univ. Press.

Cowles, Alfred, III and Associates, 1939, Common Stock Indexes, 2nd Edition, Bloomington, IN: Principia Press.

Donaldson, R.G. and M. Kamstra, 1996, "Using Dividend Forecasting Models to Reject Bubbles in Asset Prices: The Case of the Crash of 1929" *Review of Financial Studies*, 9, 333-383.

Estrada, Javier, 2005, The Fed Model: The Bad, the Worse, and the Ugly, Manuscript IESE Business School,

Fama, E. and K. French, 1988, "Dividend Yields and Expected Stock Returns", *Journal of Financial Economics* 22, 3-25.

Fama, Eugene, and Kenneth French, 2001, "Disappearing dividends: Changing firm characteristics or lower propensity to pay?", *Journal of Financial Economics* 60, 3-43.

Fama, Eugene F., and Kenneth R. French. 2002, "The Equity Risk Premium", *Journal of Finance*, Vol. 57, pp. 637-659.

Feinman, Joshua (2005). "Inflation Illusion and the (Mis)Pricing of Assets and Liabilities." Journal of Investing, Summer, 29-36.

Gordon, M. J., 1962, The Investment, Financing and Valuation of the Corporation, R. Irwin, Homewood Ill.

Gordon, M.J. and E. Shapiro, 1956, "Capital equipment analysis: the required rate of profit", *Management Science* 3, 102–110.

Goyal, Amit, and Ivo Welch, 2003, "Predicting the Equity Premium with Dividend Ratios," *Management Science* 49(5), pp. 639–654.

Homer, S. 1963. A history of interest rates. New Brunswick, N.J.:Rutgers University Press.

Jagannathan, Ravi, Ellen R. McGrattan and Anna Scherbina, 2000, "The declining U.S. equity premium," *Quarterly Review*, Federal Reserve Bank of Minneapolis 24 (4), pp. 3-19.

Jansen, Dennis, and Zijun Wang (2004). "Evaluating the 'Fed Model' of Stock Price Valuation: An Out-of-Sample Forecasting Perspective." Working paper.

Lander, Joel, Athanasios Orphanides, and Martha Douvogiannis (1997). "Earnings Forecasts and the Predictability of Stock Returns: Evidence from Trading the S&P." Journal of Portfolio Management, Summer, 24-35.

LeRoy, S. and R. Porter, 1981, "The Present-Value Relation: Tests Based on Implied Variance Bounds", *Econometrica* 49, 555-574.

Macaulay, Frederick R, 1938, The Movement of Interest Rates, Bond Yields, and Stock Prices in the United States Since 1856. New York: National Bureau of Economic Research.

Modigliani, Franco, and Richard Cohn (1979). "Inflation, Rational Valuation and the Market." Financial Analysts Journal, March/April, 24-44.

Morrison, Donald, 1983, Applied Linear Statistical Methods, Prentice-Hall, Englewood Cliffs, New Jersey.

Pastor, Lubos and Robert Stambaugh, 2001, "The Equity Premium and Structural Breaks", *Journal of Finance* 56(4), pp. 1207-39.

Poterba, J., and L. Summers, 1988, "Mean reversion in stock prices: evidence and implications", *Journal of Financial Economics 22*, 27-59.

Salomons, Roelof (2005). "A Tactical Implication of Predictability: Fighting the Fed Model." Journal of Investing, *forthcoming*.

Schwert, W., 1990, "Indexes of United States Stock Prices from 1802 to 1987," Journal of Business 63, 399-426.

Shiller, R., 1979, "The Volatility of Long-Term Interest Rates and Expectations Models of the Term Structure", *Journal of Political Economy* 87, 1190-1219.

Shiller, R., 1981, "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?", *American Economic Review* 71, 421-436.

Siegel, Jeremy (2002). *Stocks for the Long Run*. McGraw-Hill.

Skinner, Douglas, 2004, "What Do Dividends Tell Us About Earnings Quality?", Working Paper University of Chicago.

Smith, Mark, 2001, Toward Rational Exuberance: The Evolution of the Modern Stock Market, Farrar, Straus and Giroux

Smith, Mark, 2003, A History of the Global Stock Market : From Ancient Rome to Silicon Valley, University of Chicago Press.

Welch, Ivo, 2000, "Views of Financial Economists On The Equity Premium And Other Issues", The *Journal of Business* 73 (4), pp. 501-537.

Williams, John, 1938, The Theory of Investment Value, North Holland Publishing.

Wilson, J.W., and C.P. Jones. 1987. "A Comparison of Annual Common Stock Returns 1871–1925 with 1926–1985," *Journal of Business* 60, 235–258.

Yardeni, Edward (1997). "Fed's Stock Market Model Finds Overvaluation." Topical Study #38, U.S. Equity Research, Deutsche Morgan Grenfell.

Yardeni, Edward (1999). "New, Improved Stock Valuation Model." Topical Study #44, U.S. Equity Research, Deutsche Morgan Grenfell.

Table 1: Summary Statistics for the Characteristics of the S&P Composite Index

Means (and standard deviations in parentheses) for dividends, earnings, returns, and valuation measures based on monthly data from 1871 to 2005 (annualized except for the dividend payout and price/earnings ratio). Dividend changes, earnings changes, capital gains and total returns are based year-over-year measures. Mean differences are t-tests; standard deviation differences are F-tests. Period 1 is 1871-1913, period 2 is 1914-1944, and period 3 is 1945-2005.

	Period				Tests (p-values)	
	1871-2005	1871-1913	1914-1944	1945-2005	1 vs 2	2 vs 3
Change in dividends	0.0396	0.0219	0.0209	0.0609	0.8898	0.0001
	(0.1117)	(0.1191)	(0.1659)	(0.0596)		
Change in earnings	0.0612	0.0255	0.0648	0.0871	0.0394	0.2617
	(0.2201)	(0.1659)	(0.3284)	(0.1811)		
Dividend payout	0.6168	0.7049	0.7144	0.5053	0.4594	0.0001
	(0.1797)	(0.1438)	(0.2276)	(0.0953)		
Dividend yield	0.0457	0.0501	0.0579	0.0364	0.0001	0.0001
	(0.0162)	(0.0115)	(0.0155)	(0.0140)		
Capital gain	0.0597	0.0293	0.0454	0.0894	0.4653	0.0110
	(0.1880)	(0.1561)	(0.2667)	(0.1557)		
Total return	0.1053	0.0793	0.1033	0.1258	0.1965	0.0542
	(0.1815)	(0.1493)	(0.2558)	(0.1547)		
Price/earnings ratio	14.8349	14.4119	12.9423	16.1108	0.0001	0.0001
	(5.4570)	(2.9430)	(4.4077)	(6.8435)		

Table 2: Summary Statistics for Economic and Price-Based Factors, 1881-2005

The economic factors are the default premium (PREM) as measured as the difference between Moody's BAA and AAA bond yields, the term structure of interest rates (TERM) as measured as the difference between long-term government bond yields and t-bill rates, and year-over-year changes in the consumer price index (DCPI). The price-based factors are the average earnings yield (EP) or inverse of the price/earnings ratio for S&P Composite Index firms, and a price momentum factor (MOM) as measured by the average monthly change in the level of the S&P Composite Index over the preceding three years. Panel A summary statistics include the mean, standard deviation, minimum, and maximum monthly values, 1881 to 2005 while Panel B presents pair-wise correlations (with p-values of the test of the hypothesis that each correlation is not significantly different from zero in parentheses).

Panel A: Overall and Sub-Period Summary Statistics

	Variable	Mean	Std Dev	Min	Max
1881-2005	PREM	0.0142	0.0073	0.0032	0.0564
	TERM	0.0088	0.0127	-0.0494	0.0442
	DCPI	0.0261	0.0580	-0.1579	0.2367
	EP	0.0723	0.0305	0.0226	0.2092
	MOM	0.0054	0.0096	-0.0229	0.0385
1881-1913	PREM	0.0196	0.0043	0.0126	0.0283
	TERM	-0.0028	0.0089	-0.0494	0.0144
	DCPI	0.0023	0.0651	-0.1577	0.1712
	EP	0.0608	0.0093	0.0396	0.0944
	MOM	0.0030	0.0073	-0.0090	0.0263
1914-1944	PREM	0.0190	0.0076	0.0086	0.0564
	TERM	0.0112	0.0114	-0.0194	0.0334
	DCPI	0.0217	0.0772	-0.1579	0.2367
	EP	0.0957	0.0401	0.0307	0.2092
	MOM	0.0028	0.0122	-0.0229	0.0385
1945-2005	PREM	0.0090	0.0040	0.0032	0.0269
	TERM	0.0139	0.0110	-0.0265	0.0442
	DCPI	0.0408	0.0347	-0.0287	0.1967
	EP	0.0664	0.0246	0.0226	0.1506
	MOM	0.0081	0.0085	-0.0115	0.0331

Panel B: Correlations, 1881-2005

	PREM	TERM	DCPI	EP	MOM
PREM	1.0000	-0.1477	-0.2650	0.3677	-0.4684
		(0.0001)	(0.0010)	(0.0001)	(0.0001)
TERM		1.0000	-0.0486	-0.0485	-0.0116
			(0.0600)	(0.0606)	(0.6542)
DCPI			1.0000	0.2346	0.1013
				(0.0001)	(0.0001)
EP				1.0000	-0.3706
					(0.0001)
MOM					1.0000

Table 3: Pricing Error Regressions

The regressions are based on the dependent variable pricing errors presented in equation (6): $UP_t = a + \Sigma b_j * F_{jt} + e_t$ where "UP_t" is defined as $(E_t[P_t] - P_t) / P_t$, "P_t" is the actual price of the S&P Composite Index, and "$E_t[P1_t]$" is the expected valuation based on perfect foresight of future dividends and the terminal price (the cost of equity used to discount the dividends and terminal price is estimated using a rolling CAPM; see equations (2) and (3) for more details); "a" is the intercept term, "b_j" is the sensitivity of the pricing errors to factor j, "F_{jt}" is the value of economic (or price-based) factor j in period t, and "e_t" is the error term. The PREM, TERM, DCPI, EP, and MOM factors are described in Table 2. FED is a dummy variable (capturing the Fed Model predictions) taking the value of 1 if the earnings yield (EP) of the S&P Composite Index firms exceeds the yield on ten-year Treasury bonds, and 0 otherwise. T-statistics are presented in parentheses. Adj R-sq is the adjusted R-square.

	Intercept	PREM	TERM	DCPI	EP	MOM	FED	Adj R-sq
1881-2005								
Reg 1	0.2633	35.9147	8.6202	-0.3118	10.0820	-17.1128		0.563
	(20.23)	(15.93)	(8.25)	(-1.23)	(19.75)	(-10.70)		
Reg 2	0.2633						0.4839	0.075
	(20.22)						(11.03)	
Reg 3	0.2633	35.7175	8.8239	-0.2874	10.0046	-17.0101	0.0230	0.563
	(20.22)	(15.71)	(8.10)	(-1.12)	(19.10)	(-10.59)	(0.66)	
1881-1913								
Reg 1	0.2958	13.8806	1.1237	0.3649	-10.9202	-45.2429		0.218
	(9.27)	(2.04)	(0.33)	(0.74)	(-3.14)	(-9.58)		
Reg 2								n/a
Reg 3								n/a
1914-1944								
Reg 1	0.7738	47.9050	26.5022	0.4067	12.0358	-18.2376		0.638
	(22.02)	(6.62)	(5.63)	(0.76)	(7.83)	(-4.27)		
Reg 2	0.7738						1.5250	0.028
	(13.44)						(3.39)	
Reg 3	0.7738	43.8568	29.5795	0.3378	12.9445	-20.2383	-0.6905	0.642
	(22.15)	(5.92)	(6.07)	(0.63)	(8.19)	(-4.67)	(-2.26)	
1945-2005								
Reg 1	-0.0160	-3.9618	9.2936	1.5057	12.3994	0.0992		0.760
	(-2.13)	(-1.67)	(12.32)	(5.51)	(32.69)	(0.10)		
Reg 2	-0.0160						0.1487	0.031
	(-1.06)						(4.93)	
Reg 3	-0.0160	-11.6884	8.6711	1.0928	14.1668	-1.1337	-0.1292	0.774
	(-2.20)	(-4.59)	(11.78)	(4.03)	(31.78)	(-1.21)	(-7.00)	

Table 4: Pricing Error Change Regressions

The regressions are based on the dependent variable *changes* in the pricing errors presented in equation (6): $UP_t - UP_{t-1} = a + \Sigma b_j * F_{jt} + e_t$ where "UP_t" is defined as $(E_t[P_t] - P_t) / P_t$, "P_t" is the actual price of the S&P Composite Index, and "$E_t[P1_t]$" is the expected valuation based on perfect foresight of future dividends and the terminal price (the cost of equity used to discount the dividends and terminal price is estimated using a rolling CAPM; see equations (2) and (3) for more details); "a" is the intercept term, "b_j" is the sensitivity of the pricing errors to factor j, "F_{jt}" is the value of economic (or price-based) factor j in period t, and "e_t" is the error term. D_PREM is the change in the PREM variable, D_TERM is the change in the TERM variable, and D_CPI is the month-over-month change in the consumer price level. The PREM, TERM, and DCPI factors are described in Table 2. FED is a dummy variable (capturing the Fed Model predictions) taking the value of 1 if the earnings yield (EP) of the S&P Composite Index firms exceeds the yield on ten-year Treasury bonds, and 0 otherwise. T-statistics are presented in parentheses. Adj R-sq is the adjusted R-square.

	Intercept	D_PREM	D_TERM	D_CPI	FED	Adj R-sq
1881-2005						
Reg 1	0.0113	0.9692	0.0003	-1.4805		0.092
	(0.21)	(12.07)	(0.96)	(-2.48)		
Reg 2	0.0030				-0.0005	0.000
	(0.05)				(-0.03)	
Reg 3	0.0013	0.9693	0.0003	-1.4779	0.0008	0.092
	(0.21)	(12.07)	(0.96)	(-2.46)	(0.06)	
1881-1913						
Reg 1	0.0017	0.5829	0.0002	-1.8649		0.117
	(0.25)	(5.34)	(0.98)	(-4.32)		
Reg 2						
						n/a
Reg 3						
						n/a
1914-1944						
Reg 1	-0.0043	3.4166	0.0011	-1.0429		0.297
	(-0.21)	(12.35)	(0.62)	(-0.51)		
Reg 2	0.0009				0.0062	0.000
	(0.04)				(0.03)	
Reg 3	-0.0044	3.4417	0.0011	-1.0193	0.1699	0.297
	(-0.21)	(12.40)	(0.61)	(-0.49)	(1.07)	
1945-2005						
Reg 1	-0.0078	0.0709	0.0003	1.9104		0.021
	(-2.52)	(2.26)	(1.08)	(3.45)		
Reg 2	-0.0012				-0.0038	0.000
	(-0.46)				(-0.76)	
Reg 3	-0.0078	0.0707	0.0003	1.9157	-0.0037	0.021
	(-2.52)	(2.25)	(1.04)	(3.46)	(-0.74)	

Table 5: Summary Statistics for the Estimated and Implied Costs of Equity, 1881-1995

The variables include $K_e$est, the *estimated* cost of equity (or discount rate) using the CAPM: $K_e est_t = r_{f,t} + ß (MRP_t)$ where $r_{f,t}$ is the yield on a long-term U.S. government bond at time t, ß is assumed to be 1.0, and MRP_t is the estimated market risk premium at time t calculated as the U.S. market return (the S&P Composite Index) less the yield on a long-term U.S. government bond, on a rolling 30-year moving-average basis; $K_e$imp, the *implied* cost of equity, the imputed discount rate from the dividend discount model (see equation (2)) with the current price and perfect foresight of future dividends and a terminal price; and UR where $UR_t \equiv (K_e est_t – K_e imp_t)/ K_e imp_t$. Summary statistics include the mean, standard deviation, minimum, and maximum monthly values, 1881 to 1995.

	Variable	Mean	Std Dev	Min	Max
1881-1995	$K_e$est	0.0921	0.0207	0.0529	0.1585
	$K_e$imp	0.0969	0.0191	0.0609	0.1449
	UR	-0.0048	0.0227	-0.0885	0.0678
1881-1913	$K_e$est	0.0722	0.0099	0.0529	0.1041
	$K_e$imp	0.0762	0.0073	0.0609	0.0963
	UR	-0.0040	0.0162	-0.0434	0.0432
1914-1944	$K_e$est	0.0825	0.0124	0.0564	0.1160
	$K_e$imp	0.0973	0.0161	0.0634	0.1449
	UR	-0.0149	0.0239	-0.0885	0.0518
1945-1995	$K_e$est	0.1110	0.0121	0.0878	0.1585
	$K_e$imp	0.1096	0.0138	0.0883	0.1441
	UR	0.0014	0.0236	-0.0461	0.0678

Table 6: Estimated and Implied Costs of Equity Differences Regressions

The regressions are based on the dependent variable, the difference between the estimated and implied costs of equity presented in equation (7): $UR_t = a + \Sigma b_j * F_{jt} + e_t$ where $UR_t \equiv (K_e est_t - K_e imp_t) / K_e imp_t$; $K_e est$ is the *estimated* cost of equity (or discount rate) using the CAPM: $K_e est_t = r_{f,t} + ß (MRP_t)$ where $r_{f,t}$ is the yield on a long-term U.S. government bond at time t, ß is assumed to be 1.0, and MRP_t is the estimated market risk premium at time t calculated as the U.S. market return (the S&P Composite Index) less the yield on a long-term U.S. government bond, on a rolling 30-year moving-average basis; $K_e imp$, the *implied* cost of equity, the imputed discount rate from the dividend discount model (see equation (2)) with the current price and perfect foresight of future dividends and a terminal price; "a" is the intercept term, "b_j" is the sensitivity of the pricing errors to factor j, "F_{jt}" is the value of economic (or price-based) factor j in period t, and "e_t" is the error term. The PREM, TERM, DCPI, EP, and MOM factors are described in Table 2. FED is a dummy variable (capturing the Fed Model predictions) taking the value of 1 if the earnings yield (EP) of the S&P Composite Index firms exceeds the yield on ten-year Treasury bonds, and 0 otherwise. T-statistics are presented in parentheses. Adj R-sq is the adjusted R-square.

	Intercept	PREM	TERM	DCPI	EP	MOM	FED	Adj R-sq
1881-1995								
Reg 1	-0.0048	-0.7231	-0.3509	-0.0236	-0.3639	0.5733		0.549
	(-11.49)	(-10.46)	(-10.63)	(-3.07)	(-22.07)	(10.67)		
Reg 2	-0.0048						-0.0097	0.264
	(-7.83)						(-6.17)	
Reg 3	-0.0048	-0.7004	-0.3773	-0.0267	-0.3585	0.5630	-0.0034	0.551
	(-11.52)	(-10.10)	(-11.04)	(-3.45)	(-21.66)	(10.49)	(-2.90)	
1881-1913								
Reg 1	-0.0040	0.3526	-0.1296	-0.0215	0.2509	1.4645		0.336
	(-5.97)	(2.17)	(-1.60)	(-1.81)	(3.02)	(12.97)		
Reg 2								n/a
Reg 3								n/a
1914-1944								
Reg 1	-0.0149	-0.0056	-0.9133	-0.0238	-0.3516	0.8154		0.777
	(-24.99)	(-0.05)	(-11.49)	(-2.62)	(-13.53)	(11.30)		
Reg 2	-0.0149						-0.0630	0.112
	(-12.52)						(-6.80)	
Reg 3	-0.0149	-0.0095	-0.9104	-0.0238	-0.3507	0.8135	-0.0007	0.776
	(-24.96)	(-0.08)	(-10.98)	(-2.62)	(-13.04)	(11.03)	(-0.13)	
1945-1995								
Reg 1	0.0014	0.6582	-0.5228	-0.0706	-0.8604	-0.2823		0.765
	(3.08)	(4.55)	(-11.38)	(-4.49)	(-31.30)	(-3.98)		
Reg 2	0.0014						-0.0011	0.000
	(1.49)						(-0.55)	
Reg 3	0.014	1.2451	-0.4754	-0.0454	-0.9830	-0.2315	0.0091	0.790
	(3.25)	(8.10)	(-10.84)	(-2.99)	(-32.94)	(-3.43)	(8.39)	

Table 7: Estimated and Implied Costs of Equity Differences Changes Regressions

The regressions are based on the dependent variable, the *changes* in differences between the estimated and implied costs of equity presented in equation (7): $UR_t - UR_{t-1} = a + \Sigma b_j*F_{jt} + e_t$ where $UR_t \equiv (K_e est_t - K_e imp_t)/ K_e imp_t$; $K_e$est is the *estimated* cost of equity (or discount rate) using the CAPM: $K_e est_t = r_{f,t} + ß (MRP_t)$ where $r_{f,t}$ is the yield on a long-term U.S. government bond at time t, ß is assumed to be 1.0, and MRP_t is the estimated market risk premium at time t calculated as the U.S. market return (the S&P Composite Index) less the yield on a long-term U.S. government bond, on a rolling 30-year moving-average basis; $K_e$imp, the *implied* cost of equity, the imputed discount rate from the dividend discount model (see equation (2)) with the current price and perfect foresight of future dividends and a terminal price; "a" is the intercept term, "b_j" is the sensitivity of the pricing errors to factor j, "F_{jt}" is the value of economic (or price-based) factor j in period t, and "e_t" is the error term. D_PREM is the change in the PREM variable, D_TERM is the change in the TERM variable, and D_CPI is the month-over-month change in the consumer price level. The PREM, TERM, and DCPI, factors are described in Table 2. FED is a dummy variable (capturing the Fed Model predictions) taking the value of 1 if the earnings yield (EP) of the S&P Composite Index firms exceeds the yield on ten-year Treasury bonds, and 0 otherwise. T-statistics are presented in parentheses. Adj R-sq is the adjusted R-square.

	Intercept	D_PREM	D_TERM	D_CPI	FED	Adj R-sq
1881-1995						
Reg 1	0.0000	-0.0167	-0.0001	0.0150		0.098
	(-0.33)	(-12.13)	(-1.05)	(1.54)		
Reg 2	0.0000				0.0001	0.000
	(-0.39)				(0.28)	
Reg 3	-0.0001	-0.0167	-0.0001	0.0151	0.0001	0.098
	(-0.36)	(-12.12)	(-1.05)	(1.55)	(0.24)	
1881-1913						
Reg 1	-0.0001	-0.0108	0.0000	0.0229		0.071
	(-0.70)	(-4.76)	(-0.37)	(2.54)		
Reg 2						n/a
Reg 3						n/a
1914-1944						
Reg 1	0.0000	-0.0457	0.0000	0.0226		0.422
	(0.13)	(-16.10)	(-1.62)	(1.07)		
Reg 2	0.0000				-0.0003	0.000
	(-0.14)				(-0.16)	
Reg 3	0.0000	-0.0461	0.0000	0.0221	-0.0025	0.425
	(0.14)	(-16.21)	(-1.61)	(1.05)	(-1.56)	
1945-1995						
Reg 1	0.0004	-0.0036	0.0000	-0.0905		0.018
	(1.96)	(-1.98)	(-0.81)	(-2.94)		
Reg 2	-0.0010				0.0002	0.000
	(-0.45)				(0.72)	
Reg 3	0.0003	-0.0037	-0.0001	-0.0898	0.0002	0.017
	(1.00)	(-1.98)	(-0.78)	(-2.91)	(0.56)	

Figure 1a: Graph of S&P Composite Index price level and dividends, 1871-2005.

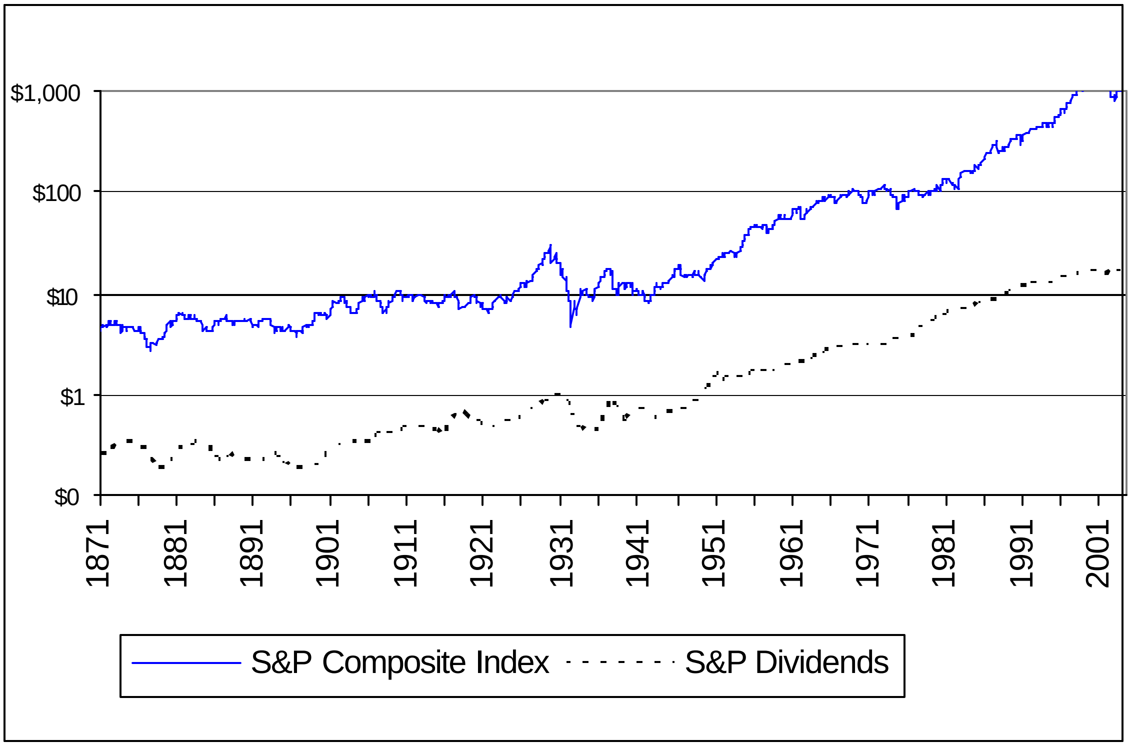

Figure 1b: Graph of the dividend yield for the S&P Composite Index and the long-term government bond yield, 1871-2005.

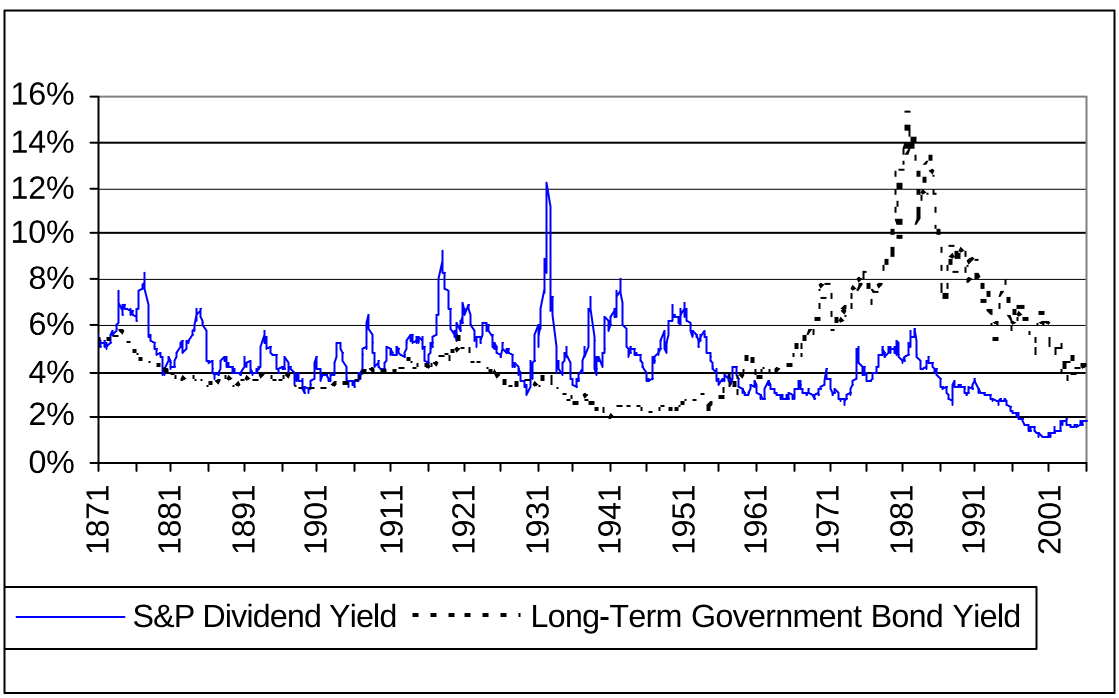

Figure 1c: Graph of the dividend payout ratio for the S&P Composite Index, 1871-2005.

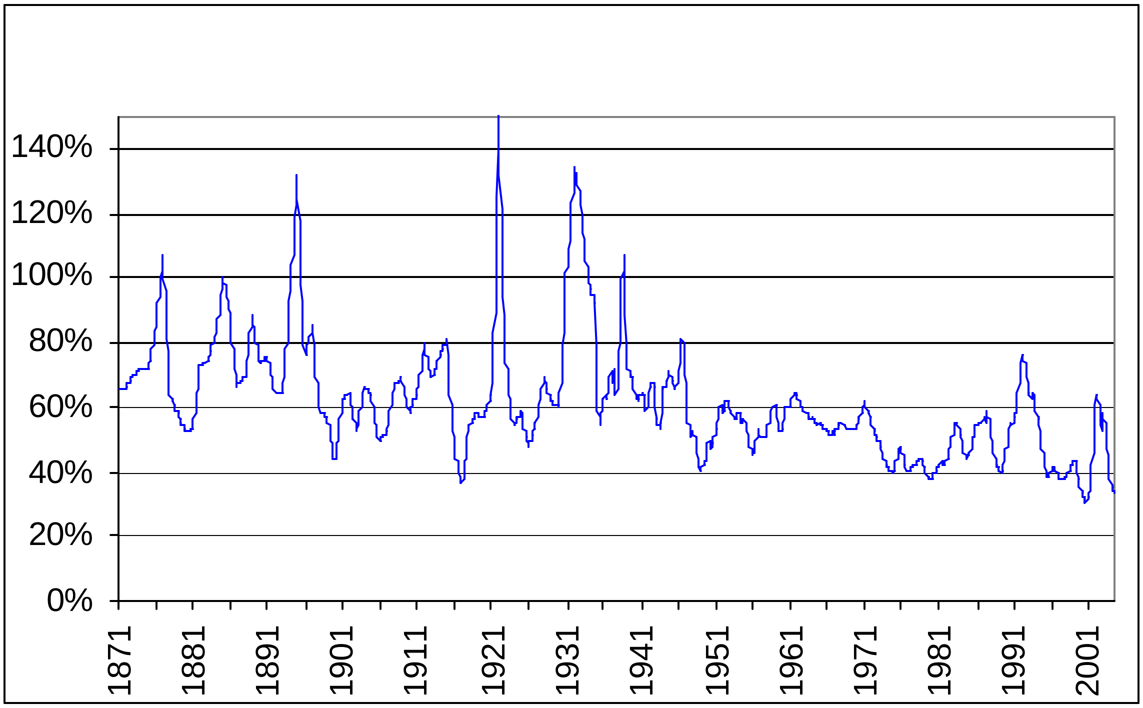

Figure 1d: Graph of the dividends paid on the S&P Composite Index versus earnings for the S&P Composite Index, 1871-2005.

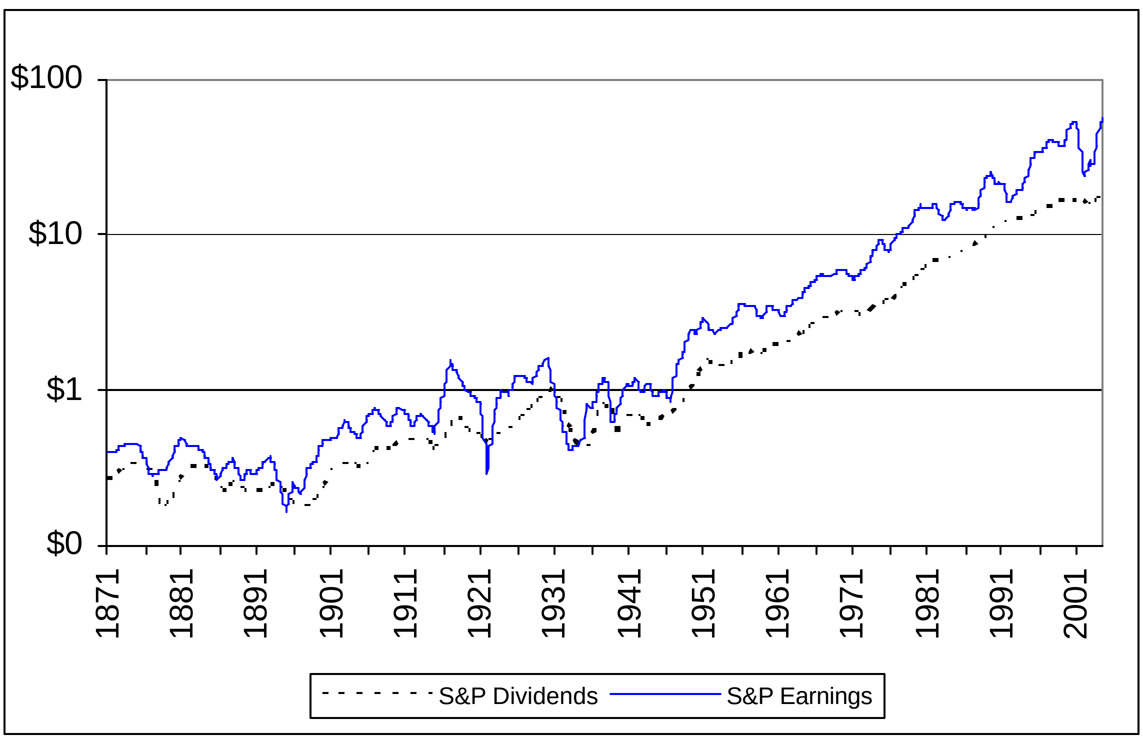

Figure 2a: Graph of the short-term and long-term government bond yields, 1871-2005.

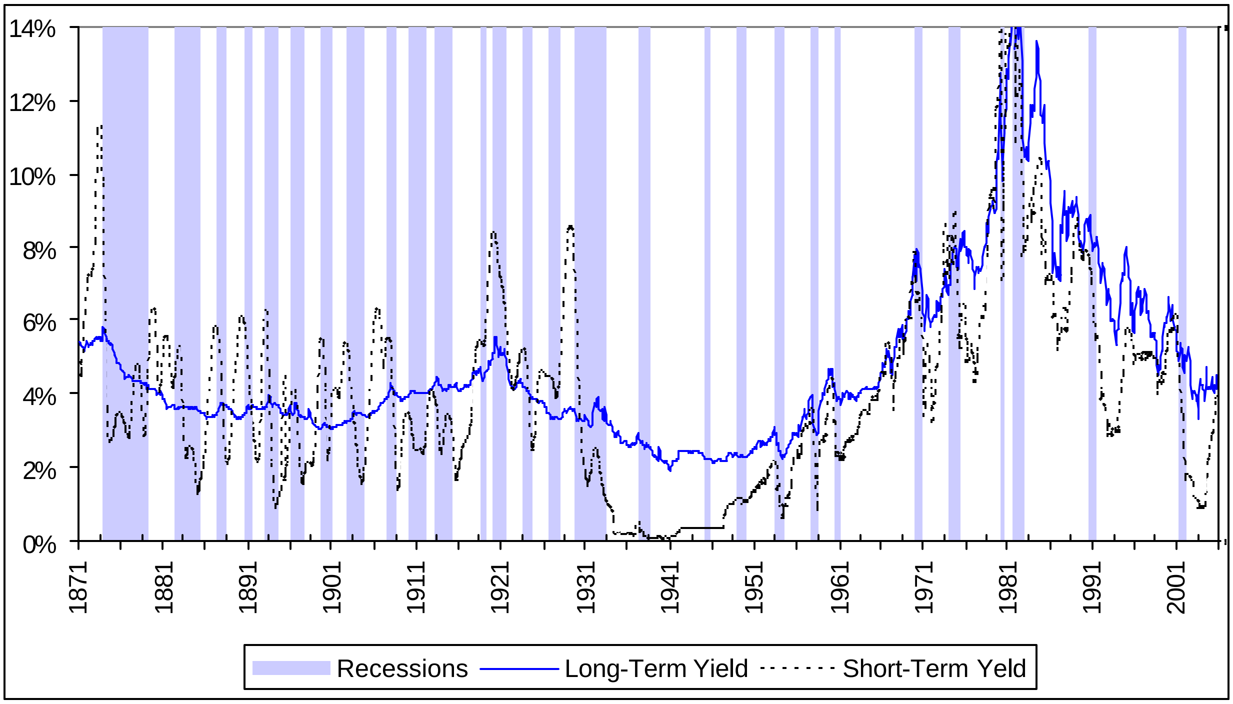

Figure 2b: Graph of the term structure measure (difference between long-term and short-term government bond yields), 1871-2005.

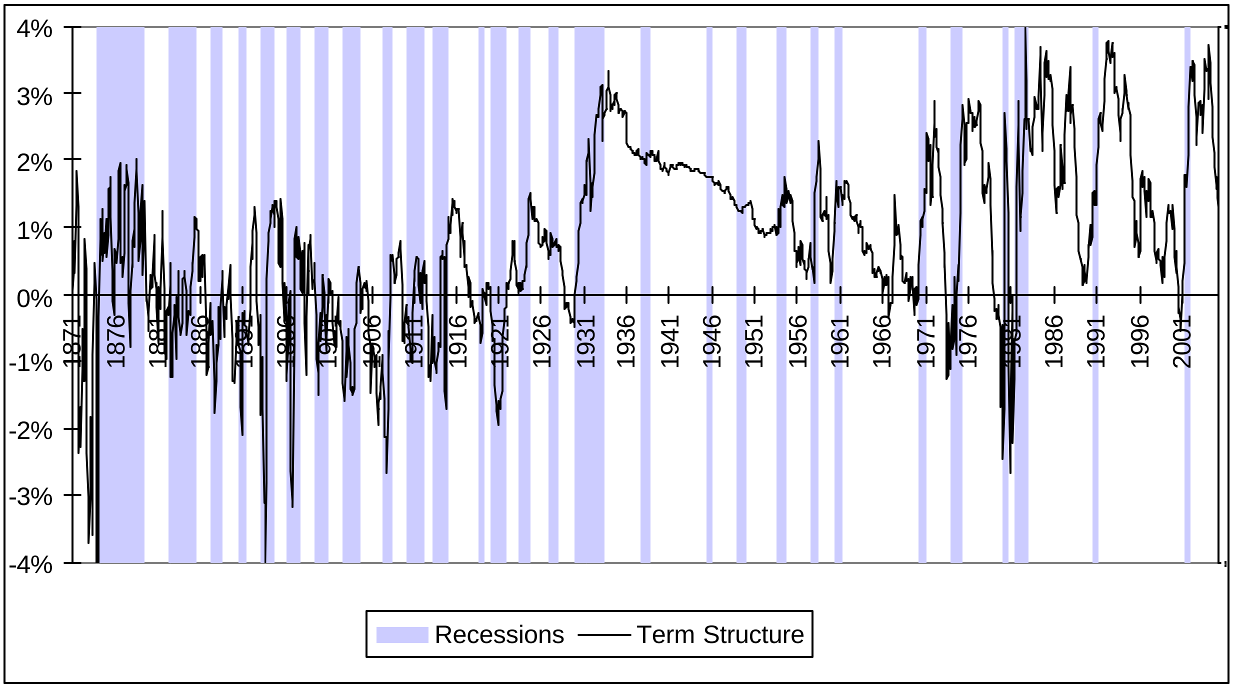

Figure 2c: Graph of the level of the default premium measure (the difference between AAA-rated and BAA rated bonds), 1871-2005.

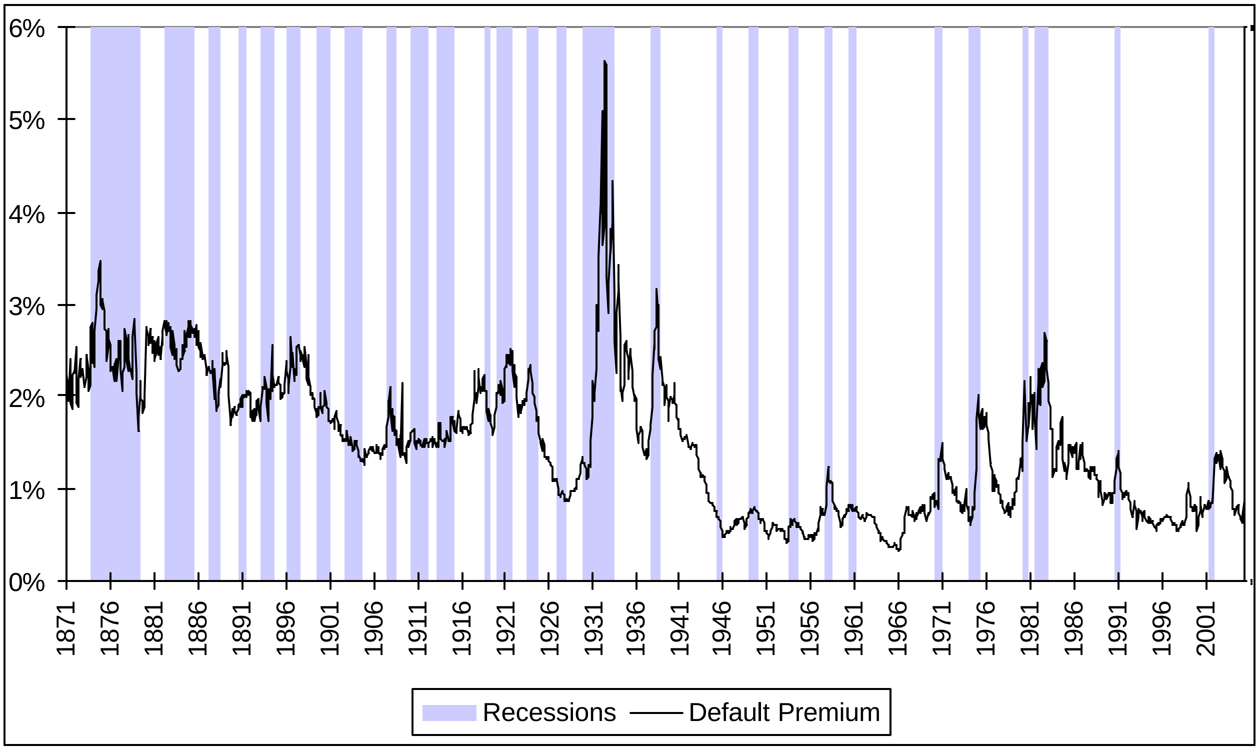

Figure 2d: Graph of the year-over-year change in the Consumer Price Index, 1871-2005.

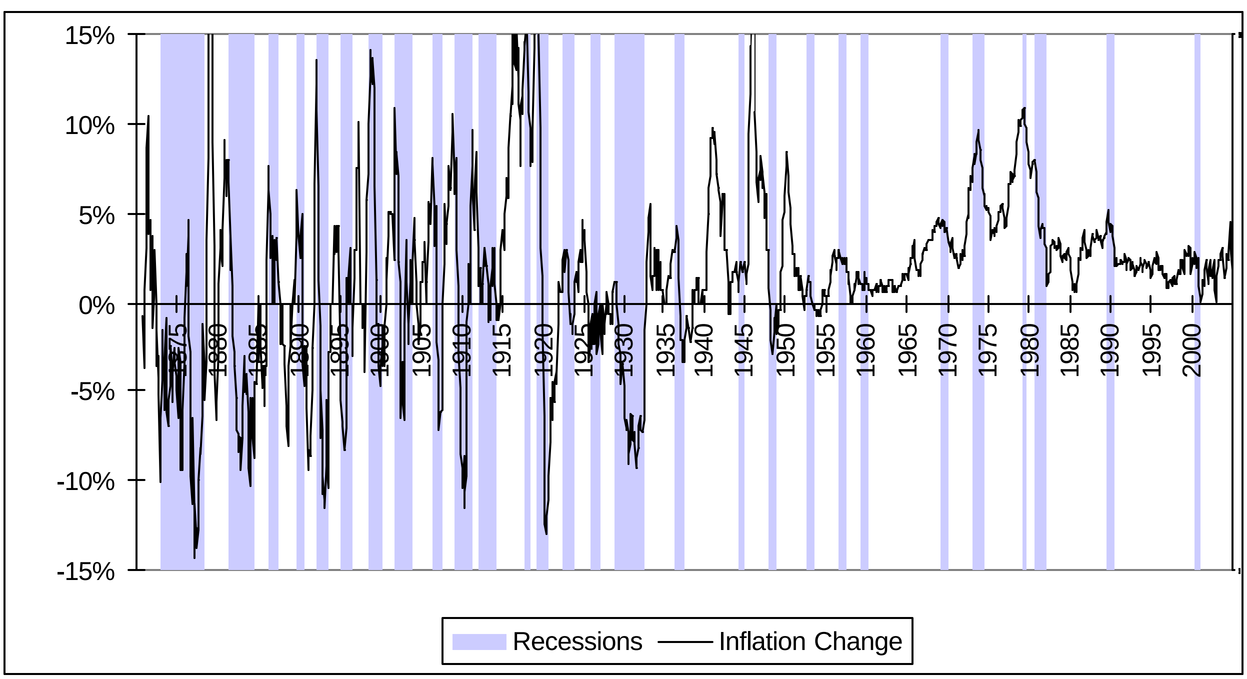

Figure 2e: Graph of S&P P/E multiple (based on a 10-year moving average of earnings), 1871-2005.

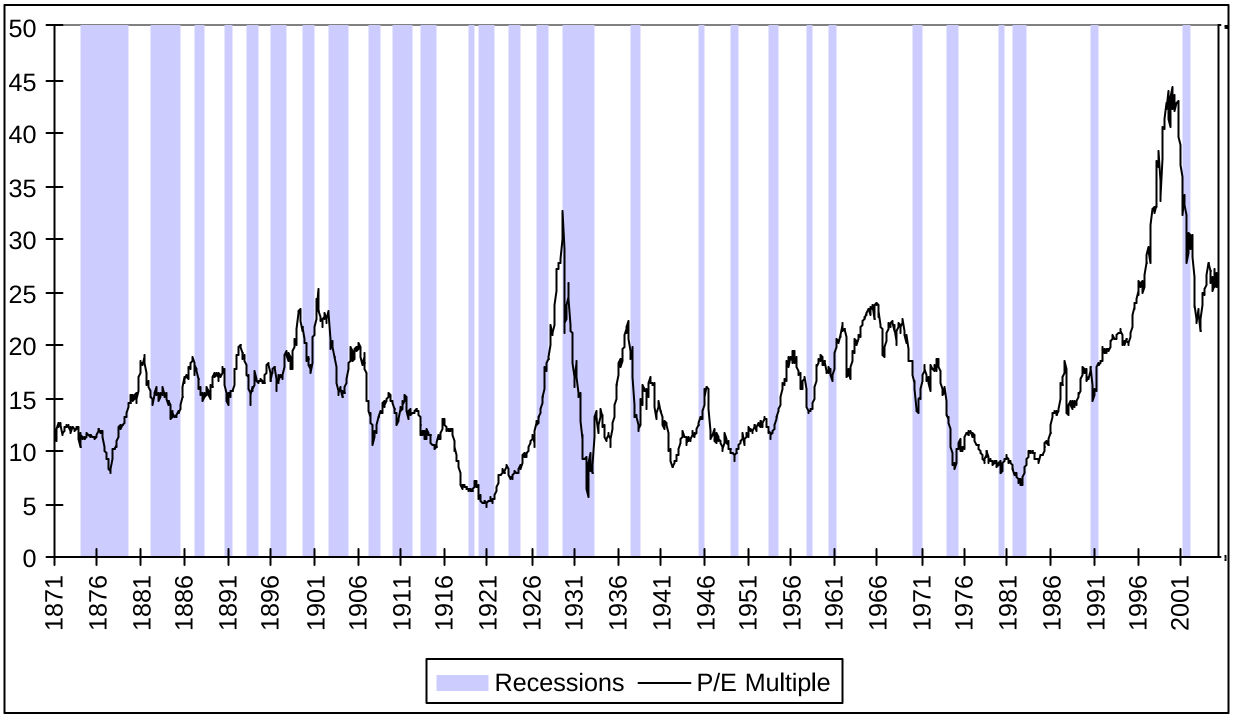

Figure 2f: Graph of 36-month price momentum, 1871-2005.

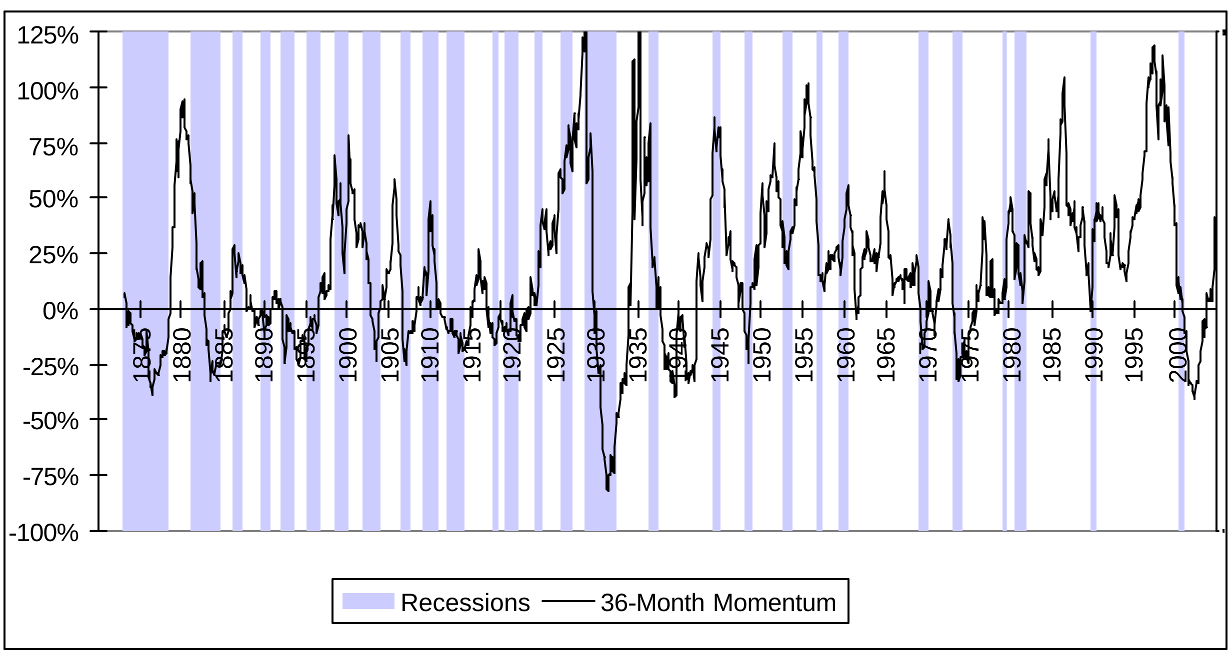

Figure 3: Graph of the actual price of the S&P Composite Index and the expected prices calculated using the DDM (equation (2)) and the cost of equity estimated using a moving average of the past 30 years, 1871-2005.

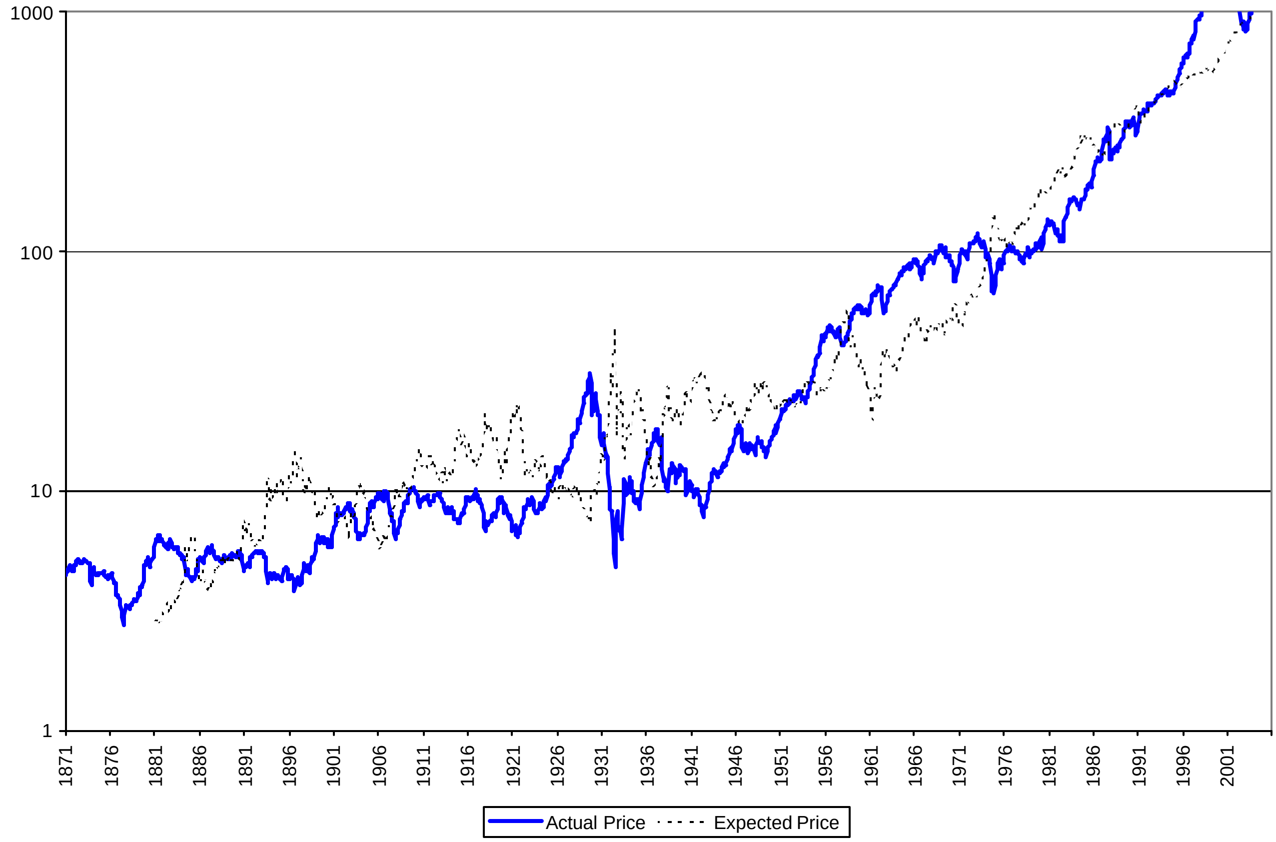

Figure 4a: Graph of the implied cost of equity from the DDM as well as the cost of equity estimated using the moving average of the past 30 years, 1871-2005.

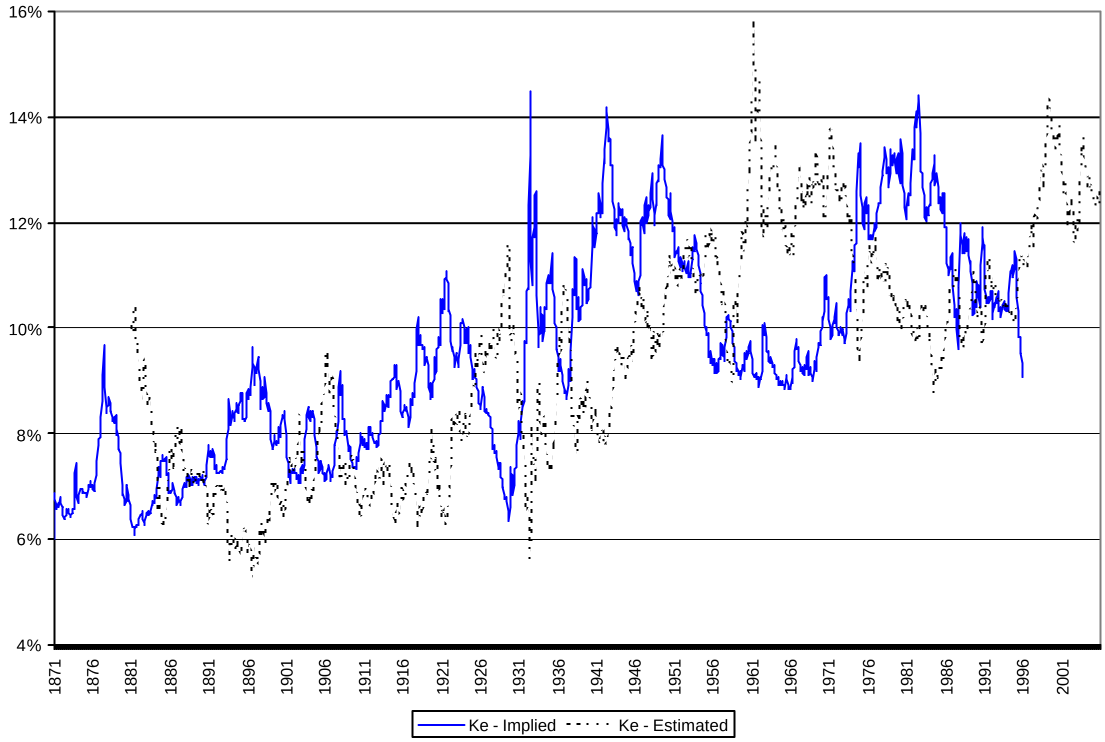

Figure 4b: Graph of the implied cost of equity from the DDM and recessions, 1871-1995.