Using Forecasts of Earnings to Simultaneously Estimate Growth and the Rate of Return on Equity Investment

PETER EASTON,* GARY TAYLOR,† PERVIN SHROFF,‡ AND THEODORE SOUGIANNIS**

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ABSTRACT

We develop a method for simultaneously estimating the cost of equity capital and the growth in residual earnings that are implied by current stock prices, current book value of equity, and short-term forecasts of accounting earnings. We demonstrate the use of our method by calculating the expected equity risk premium. Our estimate is higher than estimates in extant studies that are based on the same earnings forecast data. The main difference between our study and these papers is that while they provide arguments supporting an assumed rate of growth beyond the forecast horizon, we estimate this rate.

* Ohio State University and University of Melbourne; †University of Alabama; ‡University of Minnesota; **University of Illinois. We thank Jeff Abarbanell, Bill Cready, Andrew Christie, Tae Hee Choi, Doug Hanna, Carter Hill, Chandra Kanodia, John O’Hanlon, Richard Leftwich, Steven Monahan, Jim Ohlson, Ken Peasnell, Jinhan Pae, Stephen Penman, Peter Pope, Stefan Reichelstein, Greg Sommers, Paul Taylor, Martin Walker, Dave Williams, two anonymous referees, and workshop participants at the University of California, Berkeley, the University of Chicago, Lancaster University, Louisiana State University, Manchester University, the University of Minnesota, the University of Nebraska, New York University, the Ohio State University, the University of Oregon, the University of Southern California, and the University of Utah for helpful comments on earlier drafts. Earnings forecasts used in this paper are provided by I/B/E/S.
1. Introduction and Summary

We invert the residual income valuation model (using current stock prices, current book value of equity, and short-term forecasts of accounting earnings) to obtain an estimate of the expected rate of return for a portfolio of stocks. Our approach is analogous to the estimation of the internal rate of return on a bond using market values and coupon payments. We demonstrate the use of our method by calculating the expected equity risk premium and comparing this estimate with those in the extant literature.

Estimation of the cost of equity capital by inverting the residual income valuation model requires an estimate of growth in residual income beyond the forecast horizon. The contribution of our method is that we use the stock price and accounting data to simultaneously estimate both the implied growth rate and the internal rate of return. This growth rate provides an adjustment for the fact that our estimate of the internal rate of return is based on current book value of equity and short-term earnings forecasts.

We apply our method to the I/B/E/S sample of stocks for the years 1981 to 1998. To the extent that this sample represents the U.S. stock market, we provide an estimate of the expected return on the market. For the years 1981 to 1998, our estimates of the expected rate of return range from 11 percent to 16 percent. Our estimated premium over the risk-free rate (proxied by the yield on five-year Government T-Bonds) averages 5.3 percent over the years 1981 to 1998. This estimate is much higher than the estimates for comparable time periods obtained by other studies that use forward-looking data (Gebhardt, Lee, and Swaminathan [2001] estimate an average expected premium over the years 1981 to 1995 of 2.5 percent and Claus and Thomas [2001] estimate an average expected premium over the years 1985 to 1998 of 3.4 percent). 1 Our estimate is closer to the estimate of 4.5 percent in the earnings-based model in Fama and French [2002] determined using 50 years of historical data for the Standard and Poors Index. 2

The estimates of the equity risk premium in Claus and Thomas [2001] and Gebhardt, Lee, and Swaminathan [2001] are also based on the residual income valuation model. Rather than estimating the rate of growth beyond the forecast horizon, these papers provide arguments supporting an assumed rate. Claus and Thomas [2001] provide an economic argument for assuming that the rate of growth in residual income beyond the forecast horizon is three percent less than the risk free rate. Gebhardt, Lee, and Swaminathan [2001] assume the rate of growth beyond the I/B/E/S forecast horizon that is implied by fading the firm's return-on-book equity to its industry median over varying forecast horizons. Their justification for this assumption is that

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1 The relatively low estimate of the premium in these studies may be due to their assumptions about the rate of growth in residual earnings beyond the forecast horizon. We elaborate on this point in section 6.

2 Fama and French [2002] report an estimate of the real market premium of 4.3 percent. This corresponds to a nominal premium of 4.5 percent.
this fade "captures the long-term erosion in return-on-equity over time." Neither Claus and Thomas [2001] nor Gebhardt, Lee, and Swaminathan [2001] examine the empirical validity of their growth assumption.

Estimates of the expected rate of return on equity ($r$) may be very sensitive to assumptions about the rate of growth in residual income ($g$) and the literature provides little guidance as to the appropriateness of any particular assumed rate. Unlike these papers, which assume a rate of growth, we estimate the rate of growth that is implied by market prices, book values, and the finite period forecasts of accounting earnings.\(^3\) We invert the residual income valuation model and we use forecasts of earnings, recorded book values, and observed market prices to solve for estimates of the expected rate of return on equity and the expected growth in residual income.

The essential elements of the estimation procedure are as follows. The residual income valuation model equates price with the sum of book value and the present value of expected residual income. Our forecast data permit the calculation of aggregate earnings for the subsequent four-year period and hence residual income for the entire four-year period. We define $g$ as the perpetual rate of growth in residual income such that market price is equal to book value plus the present value of this four-year residual income growing in perpetuity. Thus, there are two unknown variables—$g$ and the expected rate of return $r$. Using the residual income valuation model as the foundation, we express current price as a linear function of current book value and expected aggregate four-year earnings.\(^4\) The multiples on book value and aggregate earnings are both functions of $r$ and $g$. Rearranging this expression leads to a simple linear relation between the ratio of the sum of earnings forecasts for the subsequent four years to current book value and the current price-to-book ratio. This specification leads to a linear (regression) relation in which both the intercept and the slope coefficient are functions of $r$ and $g$ permitting the estimation of these variables.

We demonstrate the use of the procedure in estimating the expected rate of return and the expected growth in residual income for the portfolio of stocks followed by I/B/E/S, for the Dow Jones Industrial Average and for portfolios of stocks in the energy, utility, auto, and banking industries. The

\(^3\) The following argument, suggested by a referee, provides useful intuition here. "Surely what we assign to $g$ is taken away from $r$ (the market has simply given us $r - g$). If $g$ is artificial then the corresponding $r$ is also suspect. Noise in the parsing process translates into noise in the discount rate estimate." The extant literature uses economic arguments as a basis for assigning $g$'s that are not implied by the market prices, book value and earnings forecasts and the consequent error is parsed to the estimate of $r$. In contrast, our method breaks $r - g$ for a portfolio of stocks into the portfolio $r$ and the portfolio $g$ that are implied by market prices, book values and analysts' earnings forecasts.

\(^4\) We use four years of forecasts because that is the longest time period for which data are readily available. The method could be applied to longer (or shorter) time periods depending on the availability/reliability of forecast data. We have repeated all of our analyses using shorter forecast horizons. Our estimates of the expected rate of return are not sensitive to varying the analysts' forecast horizon from one to four years.
relative ranking of the estimated expected rate of return across industries is consistent with our expectation and with the findings of Fama and French [1997] and Gebhardt, Lee, and Swaminathan [2001]. These industry level results provide a sense of what the method may yield if the model was applied to a group of similar firms (with comparable operating risk and accounting methods) to estimate the expected rate of return for, say, a firm that is not traded.

2. The Estimation Procedure

The procedure for determining the expected rate of return on a portfolio of stocks using forecasts of earnings, recorded book values, and stock prices has two essential elements. First, we use the fact that accounting earnings may be summed over time. In other words, the forecasts of earnings for, say, each of the next four years may be summed to obtain aggregate earnings for the entire four-year period and hence residual income for this period.\(^5\) Second, using the residual income valuation model as the foundation, we express current price as a linear function of current book value and expected aggregate four-year earnings. The multiples on book value and aggregate forecasted earnings are both functions of \(r\) and \(g\). Rearranging this expression leads to a simple linear relation between the ratio of the sum of earnings forecasts for the subsequent four years to current book value and the current price-to-book ratio. This specification leads to a linear (regression) relation in which both the intercept and the slope coefficient are functions of the expected rate of return and expected growth in residual income, permitting the estimation of these variables. The estimate of the expected rate of return is the internal rate of return that is, in effect, obtained by inverting the residual income model using the estimate of perpetual growth that is implied by market prices, book value, and the forecasts of earnings.

2.1 THE RESIDUAL INCOME VALUATION MODEL

The no arbitrage assumption and clean surplus accounting are sufficient to derive the residual income valuation formula:\(^6\)

\[
P_0 = B_0 + \sum_{i=1}^{\infty} (1 + r)^{-i} E_0 [X_t - r B_{t-1}] \tag{1}
\]

\(^5\) This attribute, which may be simply illustrated by the fact that annual earnings are equal to the sum of four quarterly earnings, is at the core of the empirical analyses in Easton, Harris, and Ohlson [1992]. They show that this aggregation of earnings over varying time intervals leads to increasing explanatory power of earnings for returns as the returns interval increases.

\(^6\) The no arbitrage assumption has been shown by Rubinstein [1976] to be sufficient to derive the dividend discount model. Clean-surplus accounting requires that reported book value of common equity at time \(t\) is equal to reported book value of common equity at time \(t-1\) plus net income available to common shareholders for period \(t-1\) to \(t\) minus dividends net of capital contributions to shareholders at time \(t\).
where

\[ P_0 \] is the market price per share at time 0,
\[ B_0 \] is the book value per share at time 0,
\[ E_0 \] is the expectation operator with expectations conditional on the information available at time 0,
\[ r \] is the expected rate of return on equity,
\[ X_t \] is the (comprehensive) earnings per share for fiscal period \( t-1 \) to \( t \), and
\[ [X_t - rB_{t-1}] \] is the residual earnings per share for period \( t-1 \) to \( t \).

Our approach involves the simultaneous estimation of \( r \) and the rate of growth \( g \) that are implied by the market prices, book values and forecasts of earnings. In contrast, prior studies estimating \( r \) from the residual income valuation model assume a forecast horizon and calculate a terminal value that captures residual earnings beyond the horizon. The terminal value is generally calculated by treating the horizon residual earnings as a perpetuity growing at an assumed rate. Since the growth rate is assumed, \( r \) is the only unknown variable, which is then inferred from the model.

Equation (1) may be re-written to isolate the finite period for which we have forecasts of earnings:

\[ P_0 = B_0 + \sum_{t=1}^{4} (1 + r)^{-t}E_0[X_t - rB_{t-1}] + \sum_{t=5}^{\infty} (1 + r)^{-t}E_0[X_t - rB_{t-1}] \] (2)

Recognizing that, under clean surplus accounting,

\[ B_t = B_{t-1} + X_t - d_t \] (3)

where \( d_t \) is the net dividend payment per share at time \( t \), the first summation of equation (2) may be re-written as follows:

\[ (1 + r)^{-4} \left\{ \sum_{t=1}^{4} E_0[X_t] + \sum_{t=1}^{3} ((1 + r)^{4-t} - 1)E_0[d_t] - ((1 + r)^4 - 1)B_0 \right\} \]

\[ = R^{-1}\{ X_{cT} - (R - 1)B_0 \} \] (4)

where \( R = (1 + r)^4 \) is one plus the four-year expected return on equity and \( X_{cT} \) is aggregate four year cum-dividend earnings. This term captures the present value of expected residual profitability over the next four-year period recognizing the notion (underscored in Ohlson [1995]) that, consistent with the assumption of no arbitrage and the Miller and Modigliani [1961] propositions, payment of dividends, \( d_t \), in period \( t \) reduces next period earnings by \( rd_t \).

In order to operationalize model (2) we treat the four-year residual earnings [from equation (4)] as a perpetuity and we define \( g \) as the (unknown)

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7 The steps in deriving equation (4) involve expression of \( B_5, B_2, \) and \( B_1 \) as functions of \( X_5, X_2, X_1, d_5, d_2, d_1, \) and \( B_0 \) and collecting terms.
annual growth rate such that:

\[ P_0 = B_0 + \left\{ X_{cT} - (R - 1) B_0 \right\}/\left\{ R - G \right\} \]  

(5)

where \( G = (1 + g)^4 \) is one plus the expected rate of growth in four-year residual income.\(^8\) The four-year growth rate of \((1 + g)^4 - 1\) is the rate such that the present value of the growing perpetuity (beginning with the four-year expected residual earnings calculated via equation (4)) explains the difference between price and current book value. In other words, \( g \) is the unique growth rate, which, if known, would permit the estimation of the internal rate of return implied by the current price, book value, and the four years of earnings forecasts. The advantage of simultaneously calculating this rate and the cost of equity capital is that the effects of GAAP accounting that lead to (1) a difference between book value and price and (2) short term forecasts of earnings being not necessarily indicative of long-run earnings, are taken into account when calculating \( r \). In other words, simultaneously calculating \( r \) and \( g \) provides an estimate of \( r \) that recognizes and adjusts for the fact that our estimate is based on book value and short horizon forecasts of earnings—\( g \) provides this adjustment.\(^9\) The remainder of the analyses in this section is the development of a procedure for simultaneously estimating \( g \) and \( r \).

Rearranging equation (5) yields:

\[ X_{cT}/B_0 = \gamma_0 + \gamma_1\{P_0/B_0\} \]  

(6)

where \( \gamma_0 = G - 1 \) and \( \gamma_1 = R - G \). So far our analysis has been at the individual firm level and we can write equation (6) as the following linear relation for each firm \( j \):

\[ X_{jcT}/B_{j0} = \gamma_{j0} + \gamma_{j1}\{P_{j0}/B_{j0}\} \]  

(7)

The linear relation between \( X_{jcT}/B_{j0} \) and \( P_{j0}/B_{j0} \) in (7) suggests that the average four-year expected rate of return \( (R - 1) \) and the average four-year growth in residual income \( (G - 1) \) may be estimated from the intercept and the slope coefficient from a linear regression of \( X_{jcT}/B_{j0} \) on \( P_{j0}/B_{j0} \) for any portfolio of \( j = 1, \ldots, J \) firms. Equation (7) is a classic random coefficient

\(^8\) We define \( g \) as the expected average annual rate of growth in residual income from the date on which the forecasts of earnings are made. This definition differs from the definition more frequently encountered when using the residual income model in equity valuation (see, for example, Penman [2000] and Claus and Thomas [2001]). Previous applications of the residual income model generally define \( g \) as the growth in residual income from the last year for which a forecast of earnings is available.

\(^9\) Although \( g \) adjusts for the fact that our estimate of \( r \) is based on book value and short horizon forecasts of earnings, providing a corresponding unique estimate of \( r \), different GAAP may lead to a different estimate of \( g \) and a different estimate of \( r \). This caveat applies to all of the studies cited in this paper that use forecasts of earnings to estimate \( r \) or implicit prices. For example, a change in GAAP that leads to different earnings within the forecast horizon would lead to different implicit prices in Lee, Myers, and Swaminathan [1999].
We run the regression:

\[ X_{jt}/B_{jt} = \gamma_0 + \gamma_1(P_{jt}/B_{jt}) + \epsilon_{jt} \]  

(8)

Notice that there is no error term in equation (7). The error term \( \epsilon_{jt} \) in (8) arises because of the firm-specific random component of the coefficients \( \gamma_{jt} \) and \( \gamma_{j1} \). The estimates of the coefficients \( \gamma_0 \) and \( \gamma_1 \) are non-stochastic and may be regarded as the mean of the firm-specific coefficients. It follows that the \( R \) and \( G \) implied by these estimates are the estimates for the portfolio of \( J \) firms.

We obtain our empirical proxy for \( X_{jt} \) by using I/B/E/S analysts' forecasts as the measure of \( E_0(X_t) \), \( t = 1, 2, 3, 4 \) and assuming \( E_0(d_t) = d_0, t = 1, 2, 3, 4 \). Thus, there are two sources of error in this proxy: (1) the market's expectations of future earnings may differ from I/B/E/S forecasts, and (2) expected dividends may not equal dividends paid at date 0. In this context where our aim is to calculate the internal rate of return on the portfolio of stocks, the independent variable (the price-to-book ratio) contains no error. Thus, we have set up the regression so that only the dependent variable is measured with error.

3. Data and Sample Selection

We illustrate our method of estimating \( r \) and \( g \) using the following data. The same data have been used in the numerous other studies based on the residual income valuation model cited elsewhere in this paper. Like these studies we do not attempt to adjust for possible biases in the forecast data. Accordingly, results must be interpreted with caution.

We obtain book value of equity (data item 60), price at fiscal year-end (data item 199), and number of shares outstanding (data item 25) from the 1999 Compustat annual primary, secondary, tertiary and full coverage research files. Earnings forecasts are derived from the summary 1999 I/B/E/S tape.

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10 We thank Carter Hill for bringing this to our attention and for helpful discussions on the application of a random coefficients model in our context. See Judge, Hill, Griffiths, Lutkepohl, and Lee [1988] pages 436–438 for a detailed discussion of this random coefficients model.

11 \( \epsilon_{jt} = \gamma_{jt} - \gamma_0 + (\gamma_{j1} - \gamma_1) (P_{jt}/B_{jt}) \). Since this error term is heteroskedastic we use White [1980] corrections to the standard errors.

12 Calculation of \( X_{jt} \) requires an estimate of \( r \) yet we are using \( X_{jt} \) to estimate \( r \). To overcome this apparent circularity, we begin by assuming that the displacement of future earnings due to the payment of dividends is 12 percent of the dividend payment based on the assumption that, if these dividends had been retained, the firm, they would have earned roughly the historical market return. Using an iterative procedure, we revise the \( r \) used in the calculation of \( X_{jt} \) until there is no change in our revised estimates of \( r \) and \( g \). For each of our samples, the change in our estimates of \( r \) due to this refinement is very small even in the first iteration. Estimates of \( g \) change very little across the iterations.

13 In this situation where one of the variables \( X_{jt}/B_{jt} \) is measured with error but the other variable \( P_{jt}/B_{jt} \) is not, the regression must be run with \( X_{jt}/B_{jt} \) as the dependent variable to obtain unbiased estimates of the regression coefficients (see Maddala [1977], pages, 292–293).

14 We delete observations with negative book value.
We determine median forecasts from the available analysts' forecasts on the I/B/E/S file released on the third Thursday of December. We include only firms with December fiscal year-end.\textsuperscript{15} For observations in 1995, for example, the December 1995 forecasts became available on December 21. These data included forecasts for a fiscal year ending just 10 days later (that is, December 31, 1995) and either forecasts for each of the fiscal years ending December 31, 1996, 1997, 1998, and 1999 or the forecast for the fiscal year ending December 31, 1996 and a forecast of growth in earnings for the subsequent three years (1997 through 1999). That is, in effect we have forecasts for the subsequent four years. When available, we use the actual forecasts for each subsequent year (in this example, 1996 through 1999) and when these forecasts are not available, we use the forecast for 1996 and calculate forecasts for 1997 through 1999 using the I/B/E/S forecasts of growth in earnings.\textsuperscript{16} Our sample covers the years 1981 to 1998 and includes a total of 26,561 observations.

\section{Empirical Analyses}

Descriptive statistics for the sample firms are provided in table 1. Since the sample composition changes over time, we caution the reader that conclusions about changes across years may reflect changes in sample composition rather than changes in the underlying (stock market-wide) variables.

The annual sample size increases each year from a low of 756 firms in 1981 to 2,508 firms in 1997. Equation (8) suggests that the estimates $\gamma_0$ (the intercept coefficient) and $\gamma_1$ (the slope coefficient) will be positive. The estimates of the intercept and slope coefficient are positive and significant at the 0.05 level in every year. The intercept ranges from a low of 0.31 in 1992 to a high of 0.55 in 1981. The estimate of the slope coefficient ranges from a low of 0.15 in 1998 to a high of 0.32 in 1984. The pooled adjusted $R^2$ is 42 percent.

The estimates of $r$ and $g$ for the pooled samples are 13.4 percent and 10.1 percent.\textsuperscript{17} Although there is an obvious time-trend in $r$ from an average of 14.2 percent for the 1981–1985 time period to 12.9 percent for the 1994–1998 time period, we do not draw conclusions from this because of

\textsuperscript{15} We delete firms with non-December year-end so that the market implied discount rate and growth rate are estimated at the same point in time for each firm-year observation. We use actual year-end book values (from Compustat) since most of the earnings and dividend activity are known by the third Thursday of December. The results are robust to using forecasts of year-end book value obtained via the clean surplus relation. That is, forecasts of book value are determined by taking opening book value, adding forecasted earnings (for the year ending approximately 10 days after the forecast) and subtracting dividends net of capital contributions.

\textsuperscript{16} In this example, firm-year observations with a negative forecast of earnings for 1996 are deleted because growth from this negative base is not meaningful in our context.

\textsuperscript{17} Recall $G = (1 + g)^4$ and $R = (1 + r)^4$. When calculating $r$ and $g$ we take the positive fourth roots. Of course, the negative and imaginary roots also exist but these are economically meaningless.
TABLE 1
Annual Estimates of the Expected Rate of Return (r) and the Expected Long-Term Growth in Residual Income (g)

<table>
<thead>
<tr>
<th>Year</th>
<th>n</th>
<th>γ₀</th>
<th>γ₁</th>
<th>R²</th>
<th>r</th>
<th>g</th>
<th>r - g</th>
<th>Gearn</th>
<th>Litg</th>
<th>T-Bond</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>756</td>
<td>0.55</td>
<td>0.28</td>
<td>0.54</td>
<td>16.2%</td>
<td>11.5%</td>
<td>4.7%</td>
<td>12.5%</td>
<td>13.9%</td>
<td>14.0%</td>
</tr>
<tr>
<td>1982</td>
<td>986</td>
<td>0.42</td>
<td>0.25</td>
<td>0.54</td>
<td>13.8%</td>
<td>9.2%</td>
<td>4.6%</td>
<td>10.5%</td>
<td>13.2%</td>
<td>9.9%</td>
</tr>
<tr>
<td>1983</td>
<td>1098</td>
<td>0.45</td>
<td>0.24</td>
<td>0.47</td>
<td>13.9%</td>
<td>9.6%</td>
<td>4.3%</td>
<td>11.5%</td>
<td>15.0%</td>
<td>11.4%</td>
</tr>
<tr>
<td>1984</td>
<td>1158</td>
<td>0.41</td>
<td>0.32</td>
<td>0.57</td>
<td>14.6%</td>
<td>9.0%</td>
<td>5.6%</td>
<td>12.2%</td>
<td>15.0%</td>
<td>11.0%</td>
</tr>
<tr>
<td>1985</td>
<td>1137</td>
<td>0.38</td>
<td>0.24</td>
<td>0.48</td>
<td>12.7%</td>
<td>8.3%</td>
<td>4.4%</td>
<td>10.5%</td>
<td>14.0%</td>
<td>8.6%</td>
</tr>
<tr>
<td>1986</td>
<td>1150</td>
<td>0.37</td>
<td>0.23</td>
<td>0.50</td>
<td>12.4%</td>
<td>8.2%</td>
<td>4.2%</td>
<td>9.7%</td>
<td>13.5%</td>
<td>6.9%</td>
</tr>
<tr>
<td>1987</td>
<td>1153</td>
<td>0.48</td>
<td>0.23</td>
<td>0.36</td>
<td>14.2%</td>
<td>10.2%</td>
<td>4.0%</td>
<td>11.2%</td>
<td>13.3%</td>
<td>8.3%</td>
</tr>
<tr>
<td>1988</td>
<td>1173</td>
<td>0.38</td>
<td>0.28</td>
<td>0.49</td>
<td>13.5%</td>
<td>8.4%</td>
<td>5.1%</td>
<td>10.9%</td>
<td>13.3%</td>
<td>9.2%</td>
</tr>
<tr>
<td>1989</td>
<td>1221</td>
<td>0.42</td>
<td>0.23</td>
<td>0.44</td>
<td>13.2%</td>
<td>9.1%</td>
<td>4.1%</td>
<td>11.2%</td>
<td>13.1%</td>
<td>7.9%</td>
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<tr>
<td>1990</td>
<td>1168</td>
<td>0.44</td>
<td>0.23</td>
<td>0.42</td>
<td>13.6%</td>
<td>9.5%</td>
<td>4.1%</td>
<td>10.6%</td>
<td>13.3%</td>
<td>7.7%</td>
</tr>
<tr>
<td>1991</td>
<td>1284</td>
<td>0.42</td>
<td>0.17</td>
<td>0.49</td>
<td>12.2%</td>
<td>9.1%</td>
<td>3.1%</td>
<td>10.2%</td>
<td>13.7%</td>
<td>6.0%</td>
</tr>
<tr>
<td>1992</td>
<td>1460</td>
<td>0.31</td>
<td>0.22</td>
<td>0.59</td>
<td>11.3%</td>
<td>7.0%</td>
<td>4.3%</td>
<td>9.9%</td>
<td>14.6%</td>
<td>6.1%</td>
</tr>
<tr>
<td>1993</td>
<td>1717</td>
<td>0.34</td>
<td>0.21</td>
<td>0.55</td>
<td>11.6%</td>
<td>7.5%</td>
<td>4.1%</td>
<td>10.7%</td>
<td>15.2%</td>
<td>5.2%</td>
</tr>
<tr>
<td>1994</td>
<td>1907</td>
<td>0.46</td>
<td>0.21</td>
<td>0.43</td>
<td>13.5%</td>
<td>9.8%</td>
<td>3.7%</td>
<td>12.5%</td>
<td>15.9%</td>
<td>7.8%</td>
</tr>
<tr>
<td>1995</td>
<td>2042</td>
<td>0.47</td>
<td>0.17</td>
<td>0.43</td>
<td>13.2%</td>
<td>10.0%</td>
<td>3.2%</td>
<td>12.4%</td>
<td>16.5%</td>
<td>5.4%</td>
</tr>
<tr>
<td>1996</td>
<td>2402</td>
<td>0.42</td>
<td>0.18</td>
<td>0.44</td>
<td>12.4%</td>
<td>9.2%</td>
<td>3.2%</td>
<td>11.9%</td>
<td>18.7%</td>
<td>6.2%</td>
</tr>
<tr>
<td>1997</td>
<td>2508</td>
<td>0.42</td>
<td>0.17</td>
<td>0.42</td>
<td>12.2%</td>
<td>9.1%</td>
<td>3.1%</td>
<td>12.1%</td>
<td>19.0%</td>
<td>5.7%</td>
</tr>
<tr>
<td>1998</td>
<td>2241</td>
<td>0.48</td>
<td>0.15</td>
<td>0.39</td>
<td>13.0%</td>
<td>10.3%</td>
<td>2.7%</td>
<td>12.6%</td>
<td>18.7%</td>
<td>4.7%</td>
</tr>
</tbody>
</table>

γ₀ and γ₁ are the estimates of the coefficients in the linear regression of the ratio of aggregate earnings-to-book value on the ratio of price-to-book value: X_jt/B_j0 = γ₀ + γ₁(P_j0/B_j0) + ε_jt where P_j0 is the price per share of firm j at time 0, B_j0 is the per share book value of equity of firm j at time 0, and X_jt is the aggregate expected cum-dividend earnings for the four-year period t = 1 to t = 4. n is the number of observations. R² is the adjusted R². r and g are the estimated expected rate of return on equity and long-term growth in residual income derived from the estimates of the coefficients γ₀ and γ₁ where r = ((1 + g)⁴ - 1) and g = (1 + r)⁴ - (1 + g)⁴. Gearn is the estimated growth in earnings which corresponds to the estimated growth in residual income (g). Litg is the average of the I/B/E/S estimates of long term growth in earnings. T-Bond is the five-year government bond yield. All estimates of r and g are significantly different from zero at the 0.001 level, based on White [1980] corrected standard errors.

The RATE OF RETURN ON EQUITY INVESTMENT

In view of arguments in the popular press that market expectations may have been overly optimistic (even without the benefit of hindsight), we provide some additional statistics to help address the question: Were the market’s expectations regarding rates of return reasonable? First, the average return on the Standard and Poors 500 Index over the years 1926 to 1998 was 13 percent which equals the expected rate of return for 1998.18 Second, the 5-year Treasury-bond yields for each year are included as the last column of table 1.19 As expected our estimate of the premium (that is, the difference

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19 The validity of comparisons with the T-bond yield is limited by the fact that we are calculating an r for the infinite horizon future while the T-bond yield is for a finite five-year horizon.
between \( r \) and the T-bond yield) is positive. The very low estimated premium in the early years of the data is partially explained by the fact that I/B/E/S concentrated on large firms during this period.\(^{20}\) A detailed comparison of estimates of the market premium is provided in section 6.

The implied growth in earnings (Gearn) is also reported in table 1.\(^{21}\) These estimates range from a low of 9.7 percent in 1986 to a high of 12.6 percent in 1998. The average estimate of Gearn for the entire time period 1981 to 1998 is 11.8 percent which is greater than the actual growth in earnings for the S&P 500 index of 7.92 percent. We also provide I/B/E/S forecasts of long term growth (ltg). These estimates are greater than our estimates of Gearn in every year for which we have data. Note, however, that our growth estimate is for an infinite horizon while the I/B/E/S forecast is for a much shorter horizon (about five years). The Spearman correlation between the I/B/E/S forecasts of long term growth in earnings and our estimates of Gearn is 0.606 and is significant at least at the 0.01 level.

5. Analyses of Subsamples

We consider several sub-samples of the data in order to demonstrate the application of our method of estimation.

The annual estimates of \( r \) and \( g \) for the Dow Jones Industrial firms are detailed in table 2.\(^{22}\) Consistent with the results in table 1, there is a significant negative relation (Spearman correlation of \(-0.86\)) between \( r - g \) and time. These estimates of \( r \) and \( g \) reflect the apparent bull market of the late 1990s. In other words, the high level of the DJIA at the end of 1998 can be explained by the small difference between expected return on equity and expected growth in residual earnings.

The following question, however, still remains: Was the market’s expected rate of return on the DJIA realistic? Since the focus of this paper is simply on estimating the market’s expectations of the rate of return on a portfolio of stocks (rather than using these estimates to comment on the rationality of the market) we provide some statistics that may shed some light on this question. We leave conclusions regarding mispricing to the reader. At

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\(^{20}\) We considered repeating the analyses for the sub-sample of firms that survived the entire period for which we have data. However, time-trends in the estimates of \( r \) and \( g \) for these data may represent no more than the changing economic characteristics of this particular group of firms over this portion of their life-cycle.

\(^{21}\) The formula used to derive Gearn is derived in the appendix.

\(^{22}\) Our estimates are for the firms in the DJIA for which we have complete data. The number of observations is between 27 and 29 in the 1990s but declines to only 23 observations in 1982 and 18 observations in 1981. In several years a DJIA firm was excluded as an outlier. These firms had either a price-to-book ratio or an aggregate forecasted earnings-to-book value ratio in the top/bottom 1 percent of the entire sample. We also include DJIA firms with fiscal years ending in months other than December. This introduces error due to the misalignment of prices, book values and the date of the earnings forecast. However, the estimates of \( g \) and \( r \) are very similar whether or not these observations are included.
TABLE 2

Annual Estimates of the Expected Rate of Return (r) and the Expected Long-Term Growth in Residual Income (g) for Firms in the Dow Jones Industrial Average

<table>
<thead>
<tr>
<th>Year</th>
<th>n</th>
<th>r</th>
<th>g</th>
<th>r - g</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>18</td>
<td>15.6%</td>
<td>9.4%</td>
<td>6.2%</td>
<td>0.55</td>
</tr>
<tr>
<td>1982</td>
<td>23</td>
<td>13.0%</td>
<td>5.8%</td>
<td>7.2%</td>
<td>0.74</td>
</tr>
<tr>
<td>1983</td>
<td>23</td>
<td>13.0%</td>
<td>6.5%</td>
<td>6.5%</td>
<td>0.61</td>
</tr>
<tr>
<td>1984</td>
<td>25</td>
<td>14.7%</td>
<td>8.1%</td>
<td>6.6%</td>
<td>0.64</td>
</tr>
<tr>
<td>1985</td>
<td>26</td>
<td>12.4%</td>
<td>5.9%</td>
<td>6.5%</td>
<td>0.68</td>
</tr>
<tr>
<td>1986</td>
<td>25</td>
<td>11.9%</td>
<td>6.6%</td>
<td>5.3%</td>
<td>0.70</td>
</tr>
<tr>
<td>1987</td>
<td>26</td>
<td>14.0%</td>
<td>8.2%</td>
<td>5.8%</td>
<td>0.74</td>
</tr>
<tr>
<td>1988</td>
<td>25</td>
<td>14.9%</td>
<td>9.5%</td>
<td>5.6%</td>
<td>0.71</td>
</tr>
<tr>
<td>1989</td>
<td>25</td>
<td>13.4%</td>
<td>8.1%</td>
<td>5.3%</td>
<td>0.87</td>
</tr>
<tr>
<td>1990</td>
<td>25</td>
<td>14.6%</td>
<td>9.8%</td>
<td>4.8%</td>
<td>0.51</td>
</tr>
<tr>
<td>1991</td>
<td>29</td>
<td>14.4%</td>
<td>11.2%</td>
<td>3.2%</td>
<td>0.83</td>
</tr>
<tr>
<td>1992</td>
<td>29</td>
<td>15.0%</td>
<td>11.0%</td>
<td>5.0%</td>
<td>0.67</td>
</tr>
<tr>
<td>1993</td>
<td>29</td>
<td>12.1%</td>
<td>6.8%</td>
<td>5.5%</td>
<td>0.68</td>
</tr>
<tr>
<td>1994</td>
<td>29</td>
<td>16.2%</td>
<td>12.6%</td>
<td>3.6%</td>
<td>0.55</td>
</tr>
<tr>
<td>1995</td>
<td>28</td>
<td>13.6%</td>
<td>9.7%</td>
<td>3.9%</td>
<td>0.54</td>
</tr>
<tr>
<td>1996</td>
<td>27</td>
<td>11.1%</td>
<td>6.0%</td>
<td>5.1%</td>
<td>0.61</td>
</tr>
<tr>
<td>1997</td>
<td>29</td>
<td>14.7%</td>
<td>11.5%</td>
<td>3.2%</td>
<td>0.48</td>
</tr>
<tr>
<td>1998</td>
<td>29</td>
<td>15.7%</td>
<td>13.6%</td>
<td>2.1%</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Correlation 0.16 0.57* -0.86**

r and g are the estimated expected rate of return on equity and long-term growth in residual income derived from the estimates of the coefficients \( \gamma_0 \) and \( \gamma_1 \) obtained from the following regression:

\[
X_{j(T)} / B_0 = \gamma_0 + \gamma_1 (P_{j0} / B_0) + \epsilon_0, \quad \text{where} \quad P_{j0} \text{ is the price per share of firm } j \text{ at time } 0, \quad B_0 \text{ is the per share book value of equity of firm } j \text{ at time } 0, \quad \text{and} \quad X_{j(T)} \text{ is the aggregate expected cum-dividend earnings for the four-year period } t = 1 \text{ to } t = 4. \quad \gamma_0 = (1 + g)^4 - 1 \text{ and} \quad \gamma_1 = (1 + r)^4 - (1 + g)^4. \quad n \text{ is the number of firms that make up the Dow Jones Industrial Average that are included in each annual portfolio. Correlation is the Spearman correlation between the respective column variable and time. * indicates significant at the 0.05 level, ** indicates significant at the 0.01 level. } R^2 \text{ is the adjusted } R^2. \text{ All estimates of } r \text{ and } g \text{ are significantly different from zero at the 0.001 level, based on White [1980] corrected standard errors.}

the end of 1998, the market’s expected rate of return on the DJIA was 15.7 percent. This rate is greater than the historic average return on the DJIA. The average annual return over the entire history of the DJIA (1896 to 1998) is 7.9 percent. Over the period during which there have been thirty stocks in the DJIA (1928 to 1998) the average annual return has been 7 percent. These rates, coupled with an expected growth in residual income of 13.6 percent in 1998, may suggest that, perhaps the market was overly optimistic. However, the average annual return on the DJIA over our sample period (1981 to 1998) is 15.4 percent—that is, slightly less than the expectation of 15.7 percent—and the average annual return over the years 1995 to 1998 was much higher (24.6 percent). Furthermore, the annual return was greater than 15.7 percent in eleven of the eighteen years of our sample period.

Table 3 compares the annual estimates of r for firms deemed to be in the energy (panel A), utility (panel B), auto (panel C), and banking industries

23 The source of data on the DJIA is the web site http://averages.dowjones.com/home.html.
We risk energy, and per classifications respectively) have ity number "y".

We estimated the expected rate of return on equity derived from the estimates of the coefficients \( \beta_0 \) and \( \gamma \) obtained from the following regression: 

\[
X_{T+1}/B_0 = \gamma_0 + \gamma(P_{T+1}/B_{T+1}) + \epsilon_0 \quad \text{where} \quad P_{T+1} = \text{the price per share of firm } j \text{ at time } 0, \quad B_0 = \text{the per share book value of equity of firm } j \text{ at time } 0, \quad \text{and} \quad X_{T+1}/T = \text{the aggregate expected cum-dividend earnings for the } T \text{-year period } t = 1 \text{ to } T = \gamma_0 + (1 + g)^T - 1.
\]

This is the estimate of the expected long-term growth in residual income. \( n \) is the number of observations. \( R^2 \) is the adjusted \( R^2 \). Energy firms are firms in the four-digit SIC codes 1310–1389, 2900–2911 and 2990–2999. Utility firms are firms in the four-digit SIC codes 4900–4999. Auto firms are firms in the four-digit SIC codes 2296, 2996, 3010–3011, 3537, 3647, 3694, 3700–3716, 3790–3792, and 3799. Banking firms are firms in the four-digit SIC codes 6000–6199. All estimates of \( r \) and \( g \) are significantly different from zero at the 0.001 level, based on White [1980] corrected standard errors.

We chose these industries because Fama and French [1997] and Gebhardt, Lee, and Swaminathan [2001] find that the energy and utility industries have a lower estimated risk premium and the auto and banking industries have a higher estimated premium than most other industry groups. Consistent with Fama and French [1997] and Gebhardt, Lee, and Swaminathan [2001], we find that the auto and banking industries have a higher expected rate of return (14.0 percent and 13.6 percent, respectively) than the energy and utility industries (10.6 percent and 11.4 percent, respectively). This application at the industry level provides

24 We categorized firms into industry groups based on the following four-digit SIC codes: energy, 1310–1389, 2900–2911, 2990–2999; utility, 4900–4999; auto, 2296, 2996, 3010–3011, 3537, 3647, 3694, 3700–3716, 3790–3792, and 3799; and banking 6000–6199. These industry classifications are defined in Fama and French [1997].

25 Caution must be exercised when comparing our estimates of the expected rate of return. We have estimated the expected rate of return on equity capital which differs from the expected rate of return on the operations of these industries. For the same level of equity risk, operating risk will be higher if either the debt-to-equity ratio is higher or if the cost of debt is higher.
a sense of what the method may yield if informed market analysts were to estimate the model for a group of similar firms (that is, firms that have comparable accounting methods and similar operating risk) in order to estimate the expected rate of return for, say, a firm that is not traded.

6. A Focus on the Equity Premium

In this section we compare our estimates of the market premium with three other estimates in the recent literature. Two of the other methods of estimation (Claus and Thomas [2001] and Gebhardt, Lee, and Swaminathan [2001]) are very similar to ours inasmuch as they use I/B/E/S analysts' forecasts and the residual income valuation model. The important difference is that they assume a rate of growth beyond the I/B/E/S analysts' forecast horizon whereas we simultaneously estimate this growth rate and the expected premium. The third paper, Fama and French [2002] assumes stationarity in the time-series of expected returns. Relying on this assumption, Fama and French [2002] use a long time-series of returns, dividend growth, and earnings growth to estimate the expected rate of return on the Standard and Poors' Index.

Fama and French [2002] provide three estimates of the expected rate of return on the Standard and Poors' Index using data from 1951 to 2000: (1) the average (historical) dividend yield plus the average rate of capital gain, (2) the average dividend yield plus the average rate of growth in dividends, and (3) the average dividend yield plus the average rate of growth in earnings. These estimates, expressed as real rates of return are 9.62 percent, 4.74 percent, and 6.51 percent, respectively; that is, with an average inflation rate of 4.0 percent, the nominal expected rates of return are 14.01 percent, 8.93 percent, and 10.77 percent, respectively.26 Subtracting the average historical return on 6-month commercial paper (used as the estimate of the risk free rate of return) of 6.28 percent, the implied market premiums are 7.73 percent, 2.65 percent, 4.49 percent, respectively.27

Although Fama and French [2002] do not rely on the residual income valuation model, they use the key variables from this model to choose among their three estimates of the expected market premium. They observe that the behavior of other fundamentals justifies the dividend and earnings growth models. Their argument, presented in the conclusion to the paper, is as follows:

"Most important, the average stock return [9.62 percent] for 1951–2000 is much greater than the estimate of the average income return on investment [7.6 percent]. Taken at face value, this says that investment during this period is on average unprofitable (its expected return is less than the cost of capital). In contrast, the lower estimates of the expected stock return from the dividend

26 The relation between the real and the nominal rates follows Fisher [1965].
27 Using the 5-year Government bond rate as the risk-free rate instead of the 6-month commercial paper rate changes the estimate of the implied market premiums by 0.05 percent.
[4.74 percent] and earnings growth models [6.51 percent] are less than the income return on investment [7.6 percent], so the message is that investment is on average profitable. This is more consistent with book-to-market ratios that are rather consistently less than 1.0 during the period [average 0.66].”

This argument may be expressed in the framework of the residual income valuation model facilitating comparisons of the Fama and French [2002] estimates of the equity premium and the estimates based on the residual income valuation model. The residual income valuation model (equation (1)) may be written as follows:

\[ P_0 = B_0 + (X_0 - rB_{-1})(1 + \kappa)/(r - \kappa) \]  \hspace{1cm} (9)

where \( \kappa \) is the perpetual rate of growth in residual income (from a base of \( X_0 - rB_{-1} \)) that equates \( P_0 \) and the right-hand side of (10).

That is:

\[ P_0 = B_0 + (\text{ROCE}_0 - r)B_{-1}(1 + \kappa)/(r - \kappa) \]  \hspace{1cm} (10)

where \( \text{ROCE}_0 \) is the return on common equity (referred to as the income return on investment in Fama and French [2002]). The critical data to which Fama and French [2002] refer in the above quote are seen in their table 1. The average book-to-price ratio is 0.66 and the average return on common equity is 7.6 percent. These estimates may be used to validate the estimates of the expected rate of return. For example, the estimate of the expected rate of return which is calculated by summing the average dividend yield and the average rate of growth in earnings is 0.0651 implying:

\[ 1 = 0.66 + (0.076 - 0.0651)0.66(1 + \kappa)/(0.0651 - \kappa) \]  \hspace{1cm} (11)

That is, \( \kappa = 0.043 \).”

---

28 Numbers in square brackets are taken from table 1 of Fama and French [2002] and added to the quote in the interests of clarity.

Our estimates of \( r \) also fall within the bounds defined by the average earnings yield and the average income return on investment as in Claus and Thomas [2001] and Fama and French [2001]. For every year of the sample period, since the average book-to-market ratio is less than one, we find that the average income return on investment is always greater than \( r \), and moreover, the difference between the average income return on investment and \( r \) increases as the average book-to-market ratio decreases over the sample period. For every year of the sample period, the average earnings yield is always lower than \( r \), as expected, given that the expected growth in residual income is always positive.

29 On the other hand, the estimate that is equal to the average dividend yield plus the average rate of capital gain is 0.0962 implying:

\[ 1 = 0.66 + (0.076 - 0.0962)0.66(1 + \kappa)/(0.0962 - \kappa) \]  \hspace{1cm} (12)

that is, \( \kappa = 0.141 \), which is greater than the estimate of the expected rate of return. Thus, Fama and French [2002] favor the earnings growth model (that is equation (12)).

Fama and French [2002] observe that their estimates from fundamentals are downward biased. They also note that the bias is larger when the average growth rate of dividends (rather than the average growth rate of earnings) is used to estimate the expected rate of capital gain.
TABLE 4

Annual Estimates of the Expected Market Premium for the I/B/E/S Sample of Firms, Firms in the Dow Jones Industrial Average, Firms in the Energy, Utility, Auto and Banking Industries, and as Reported in GLS [2001] and CT [2001]

<table>
<thead>
<tr>
<th>Year</th>
<th>I/B/E/S</th>
<th>DJIA</th>
<th>Energy</th>
<th>Utility</th>
<th>Auto</th>
<th>Banking</th>
<th>GLS</th>
<th>CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>2.2%</td>
<td>1.6%</td>
<td>7.3%</td>
<td>1.0%</td>
<td>3.6%</td>
<td>2.5%</td>
<td>0.2%</td>
<td>na</td>
</tr>
<tr>
<td>1982</td>
<td>3.9%</td>
<td>3.1%</td>
<td>4.8%</td>
<td>5.0%</td>
<td>3.5%</td>
<td>6.4%</td>
<td>1.9%</td>
<td>na</td>
</tr>
<tr>
<td>1983</td>
<td>2.5%</td>
<td>1.6%</td>
<td>0.5%</td>
<td>2.8%</td>
<td>5.2%</td>
<td>3.7%</td>
<td>0.6%</td>
<td>na</td>
</tr>
<tr>
<td>1984</td>
<td>3.6%</td>
<td>3.7%</td>
<td>3.1%</td>
<td>3.1%</td>
<td>7.0%</td>
<td>3.6%</td>
<td>-0.2%</td>
<td>na</td>
</tr>
<tr>
<td>1985</td>
<td>4.1%</td>
<td>3.8%</td>
<td>2.8%</td>
<td>4.9%</td>
<td>4.7%</td>
<td>5.1%</td>
<td>1.6%</td>
<td>3.0%</td>
</tr>
<tr>
<td>1986</td>
<td>5.5%</td>
<td>5.0%</td>
<td>1.3%</td>
<td>4.9%</td>
<td>4.4%</td>
<td>7.1%</td>
<td>2.6%</td>
<td>4.0%</td>
</tr>
<tr>
<td>1987</td>
<td>5.9%</td>
<td>5.7%</td>
<td>1.6%</td>
<td>4.0%</td>
<td>5.8%</td>
<td>7.2%</td>
<td>1.7%</td>
<td>3.1%</td>
</tr>
<tr>
<td>1988</td>
<td>4.3%</td>
<td>5.7%</td>
<td>-1.1%</td>
<td>3.3%</td>
<td>3.9%</td>
<td>5.2%</td>
<td>2.8%</td>
<td>3.4%</td>
</tr>
<tr>
<td>1989</td>
<td>5.3%</td>
<td>5.5%</td>
<td>1.7%</td>
<td>3.4%</td>
<td>6.8%</td>
<td>6.2%</td>
<td>3.8%</td>
<td>3.6%</td>
</tr>
<tr>
<td>1990</td>
<td>5.9%</td>
<td>6.9%</td>
<td>3.4%</td>
<td>3.6%</td>
<td>5.0%</td>
<td>6.9%</td>
<td>3.3%</td>
<td>3.5%</td>
</tr>
<tr>
<td>1991</td>
<td>6.2%</td>
<td>8.4%</td>
<td>4.2%</td>
<td>5.6%</td>
<td>4.6%</td>
<td>6.2%</td>
<td>3.1%</td>
<td>3.0%</td>
</tr>
<tr>
<td>1992</td>
<td>5.2%</td>
<td>8.9%</td>
<td>2.8%</td>
<td>3.8%</td>
<td>7.2%</td>
<td>6.1%</td>
<td>3.4%</td>
<td>3.1%</td>
</tr>
<tr>
<td>1993</td>
<td>6.4%</td>
<td>6.9%</td>
<td>4.3%</td>
<td>2.2%</td>
<td>9.3%</td>
<td>7.5%</td>
<td>4.4%</td>
<td>3.7%</td>
</tr>
<tr>
<td>1994</td>
<td>5.7%</td>
<td>8.4%</td>
<td>0.7%</td>
<td>2.3%</td>
<td>9.8%</td>
<td>5.9%</td>
<td>3.6%</td>
<td>4.1%</td>
</tr>
<tr>
<td>1995</td>
<td>7.8%</td>
<td>8.2%</td>
<td>3.2%</td>
<td>4.0%</td>
<td>7.3%</td>
<td>6.5%</td>
<td>4.6%</td>
<td>4.0%</td>
</tr>
<tr>
<td>1996</td>
<td>6.2%</td>
<td>4.9%</td>
<td>0.5%</td>
<td>3.0%</td>
<td>6.1%</td>
<td>4.3%</td>
<td>na</td>
<td>3.5%</td>
</tr>
<tr>
<td>1997</td>
<td>6.5%</td>
<td>9.0%</td>
<td>2.7%</td>
<td>2.3%</td>
<td>6.0%</td>
<td>4.7%</td>
<td>na</td>
<td>3.2%</td>
</tr>
<tr>
<td>1998</td>
<td>8.3%</td>
<td>11.0%</td>
<td>5.5%</td>
<td>3.5%</td>
<td>9.6%</td>
<td>6.6%</td>
<td>na</td>
<td>2.5%</td>
</tr>
<tr>
<td>Average</td>
<td>5.3%</td>
<td>6.0%</td>
<td>2.7%</td>
<td>3.5%</td>
<td>6.1%</td>
<td>5.7%</td>
<td>2.5%</td>
<td>3.4%</td>
</tr>
</tbody>
</table>

Market premium is defined as the estimated expected rate of return minus the risk free rate. I/B/E/S represents the sample of firms covered by I/B/E/S for which we have complete data. DJIA represents the firms that comprise the Dow Jones Industrial Average. Energy, Utility, Auto, and Banking represent firms belonging to the respective industry. The five-year T-bond rate is used as the risk free rate to calculate the premium for I/B/E/S, DJIA, Energy, Utility, Auto, and Banking portfolios. GLS represents the mean estimates of the equity premium reported by Gebhardt, Lee, and Swaminathan [2001]. CT represents the estimates of the equity premium reported by Claus and Thomas [2001]. na indicates that the estimate is not made in the comparison studies. Average indicates the average of the estimates reported in this table.

The estimate of the real rate of growth in residual earnings \( \kappa = 4.3 \) percent corresponds to a nominal rate of growth in residual earnings of 8.48 percent which is similar to (though somewhat smaller than) our estimates of expected growth in tables 1 and 2. Not surprisingly, it follows that our estimates of the expected market premiums (average of 5.3 percent) are similar to (though somewhat larger than) the Fama and French [2002] estimate (average of 4.5 percent).

We also estimate the expected equity premium for the DJIA and for firms deemed to be in the energy, utility, auto, and banking industries. These estimates are reported in table 4. The estimate of the equity premium for the DJIA is slightly higher (average of 6.0 percent) than the estimate for the I/B/E/S portfolio. Similar to Fama and French [1997] and Gebhardt, Lee, and Swaminathan [2001], the estimated equity premium is higher for

Thus we focus the comparison of our estimate of the expected premium on their estimate that is based on the average earnings growth rate. The similarity of our estimate of the expected premium based on ex ante forecast data and their estimate based on historic earnings data suggests that this downward bias in the Fama and French [2002] earnings model may be small.
the auto (6.1 percent) and banking (5.7 percent) industries as compared to the energy (2.7 percent) and utility (3.5 percent) industries. Thus, the ranking of the estimated industry risk premium appears to be similar across the three studies.

Table 4 also includes estimates of the equity premium obtained in Gebhardt, Lee, and Swaminathan [2001] denoted GLS and in Claus and Thomas [2001] denoted CT. These estimates are much lower than our estimates and those in Fama and French [2002] (even after adjusting for differences in risk-free rates used by these studies). The GLS estimate is negative in 1984. These lower estimates may be due to the assumed growth rate in these papers as it is evident from equations (5) and (9) that the estimate of the expected rate of return will be very sensitive to this assumed rate.

Gebhardt, Lee, and Swaminathan [2001] calculate the equity premium using five years of I/B/E/S analysts’ forecasts and the assumption that, at the end of the five years, the forecasted ROCE will fade to the industry median (proxied by the historical industry median). This assumption defines the rate of growth in residual income beyond the forecast horizon. Easton, Shroff, and Taylor [2001] provide a detailed analysis of the implications of this assumption. They show that for 20 of the stocks in the Dow Jones Industrial Average at December 31, 2000, the growth in residual income in year 2010 forecasted using the Gebhardt, Lee, and Swaminathan [2001] procedure is negative and the average forecasted growth rate is −11.7 percent. The implied expected rate of return on the DJIA (based on the Gebhardt, Lee, and Swaminathan [2001] growth assumption) is seven percent which is only slightly above the five-year Treasury Bond rate of 5.1 percent. Considering the pessimistic forecasts of future profitability, the implied riskiness of these firms is remarkably low.

Lee, Myers, and Swaminathan [1999] note the following reason for the potential lack of validity of the assumption that the ROCE will fade to the industry median: a firm’s return-on-book equity would not be expected to fade to the historic industry median return-on-equity—rather it will fade to the expected industry median. Since the industry return-on-equity will change from being high to low as the stage of the life-cycle of the firms in the industry changes from the growth phase through the stable phase and then the decline, the assumption that the historic industry median return-on-book equity will be equal to the expected return-on-book equity may not generally hold as a practical matter. Further, Gebhardt, Lee, and Swaminathan [2001] assume that, after the return-on-book equity has faded to the industry median the residual income continues at a constant level in perpetuity (that is, the rate of growth is zero). Since book value will generally continue to grow, this implies that the return-on-equity will decline asymptotically toward the expected cost of equity capital. Zhang [2000] shows that this will not occur when accounting is conservative.

Claus and Thomas [2001] use the (10-year) risk-free rate less 3 percent (as an approximation of the expected inflation rate) as their estimate of the
expected rate of growth in residual income. Over the years 1985 to 1998, their average estimate of this growth rate is 4.64 percent (3 percent less than 7.64 percent from their table II, column 8) which is considerably smaller than our estimate from the simultaneous estimation of the expected rate of return and the rate of growth and also considerably smaller than the estimate from Fama and French [2002]. With this low assumed growth rate, Claus and Thomas [2001] estimate that the equity premium is 3.4 percent (their Table II column 11).\(^\text{30}\) They note that increasing the estimate of the rate of growth to 10 percent leads to an estimate of the expected premium of 5.4 percent. This higher growth rate is more consistent with our estimate of the average rate of growth in residual earnings for 1985 to 1998 (9.0 percent—calculated from the year by year estimates in table 1) with a corresponding average estimate of the equity premium of 6 percent (calculated from the year by year estimates in table 4).

To summarize, it is apparent that estimates of the expected rate of return based on the residual income valuation formula are very sensitive to assumptions about the rate of growth in residual income beyond the forecast horizon. The method in this paper avoids this problem by simultaneously estimating the rate of growth and the expected rate of return using a cross-section (portfolio) of prices, book values and earnings forecasts. The resultant estimates of the rate of growth are similar to those implied by historical data used in Fama and French [2002] leading to similar estimates of the equity premium.

7. Summary and Conclusions

We have developed a method for determining estimates of the expected rate of return on equity and the expected growth in residual earnings for a portfolio of stocks. Simultaneous estimation of these expected rates provides a means of adjusting for the reliance of our method on book value of equity and forecasts of accounting earnings for a short horizon.

We demonstrate the use of this procedure in estimating the expected rate of return on equity and the expected growth in residual earnings for the portfolio of stocks followed by I/B/E/S, for the Dow Jones Industrial Average, and for portfolios of stocks in the energy, utility, auto, and banking industries.

We compare our implied estimates of the equity premium with estimates in the recent research literature. Our estimates are higher than those in other studies based on the residual income valuation model and we conclude that this difference occurs because we estimate rather than assume rates of growth in residual income. Our estimated equity premium (average of 5.3 percent over the years 1981 to 1998) is closer to the estimates based on historical earnings data in Fama and French [2002] (4.5 percent).

\(^{30}\) Their estimate of the equity premium equals 4.2 percent when the 5-year Government bond rate is used as the risk-free rate instead of the 10-year Government bond rate. This estimated equity premium is still considerably lower than our estimate.
APPENDIX

Derivation of an Estimate of the Growth in Earnings (Gearn) from our Estimate of Growth in Residual Income (g)

Although our estimate of growth in residual earnings is a fundamental ingredient in the implementation of the residual income model, the more common estimate of growth in the academic literature and in the business press is growth in earnings. For example, analysts (such as I/B/E/S, Standard and Poors, Value Line, and Zacks) provide forecasts of earnings rather than residual earnings and management frequently give growth forecasts for their firm’s earnings.

The derivation of our estimate of growth in earnings is provided in this appendix. This estimate (denoted Gearn) is a function of our estimates of $r$ and $g$. We provide estimates of Gearn in our empirical analyses in section 4.

The definition of growth in residual income, $g$, can be written as:

$$
\left\{ \sum_{t=5}^{8} E_0[X_t] + \sum_{t=5}^{7} ((1 + r)^{8-t} - 1) E_0[d_t] - ((1 + r)^4 - 1) E_0[B_4] \right\} \\
\left\{ \sum_{t=1}^{4} E_0[X_t] + \sum_{t=1}^{3} ((1 + r)^{4-t} - 1) E_0[d_t] - ((1 + r)^4 - 1) [B_0] \right\} = (1 + g)^4
$$

Assume $E_0(d_t) = d_0$ for all $t$, then this equation becomes:

$$
\left\{ \sum_{t=5}^{8} E_0[X_t] + FVED - ((1 + r)^4 - 1) E_0[B_4] \right\} \\
\left\{ \sum_{t=1}^{4} E_0[X_t] + FVED - ((1 + r)^4 - 1) [B_0] \right\} = (1 + g)^4
$$

where:

$$
FVED = \sum_{t=1}^{3} ((1 + r)^{4-t} - 1) E_0[d_t] = (1 + r)^3 + (1 + r)^2 + r - 2) [d_0]
$$

Since, under clean-surplus accounting:

$$
E_0[B_4] - B_0 = \sum_{t=1}^{4} E_0[X_t] - \sum_{t=1}^{4} E_0[d_t]
$$

31 An assumption about expected dividends is a necessary part of the derivation of a formula for growth in earnings. Note that the purpose of this appendix is to show how growth in earnings is related to growth in residual income and to provide a formula for estimating a growth variable with which academics and investors are more familiar.
it follows that:

\[
\frac{\left\{ \sum_{t=5}^{8} E_0[X_t] + FVED - ((1 + r)^4 - 1) \left\{ \sum_{t=1}^{4} E_0[X_t] - \sum_{t=1}^{4} E_0[d_t] + B_0 \right\} \right\}}{\left\{ \sum_{t=1}^{4} E_0[X_t] + FVED - ((1 + r)^4 - 1)[B_0] \right\}} = (1 + g)^4
\]

(a5)

If we define \( Gearn \) as the geometric average annual growth in earnings from the first four years to the second four years, then:

\[
(1 + Gearn)^4 \sum_{t=1}^{4} E_0[X_t] + FVED - ((1 + r)^4 - 1) \left\{ \sum_{t=1}^{4} E_0[X_t] - \sum_{t=1}^{4} E_0[d_t] + B_0 \right\} \\
- \left\{ \sum_{t=1}^{4} E_0[d_t] + B_0 \right\} \bigg/ \left\{ \sum_{t=1}^{4} E_0[X_t] + FVED - ((1 + r)^4 - 1)[B_0] \right\} = (1 + g)^4
\]

(a6)

Re-arranging yields our formula for four year growth in earnings:

\[
(1 + Gearn)^4 = ((1 + g)^4 + (1 + r)^4 - 1) + ((1 + g)^4 - 1) \\
\left\{ \frac{FVED}{\sum_{t=1}^{4} E_0[X_t]} \right\} - ((1 + r)^4 - 1) \left\{ \frac{4d_0}{\sum_{t=1}^{4} E_0[X_t]} \right\} \\
+ ((1 + r)^4 - 1)(1 - (1 + g)^4) \left\{ \frac{B_0}{\sum_{t=1}^{4} E_0[X_t]} \right\}
\]

(a7)

REFERENCES


