## Title
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**Authors**
Cornell, Bradford
Cheng, Simon

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**Bradford Cornell**
Anderson Graduate School of Management
University of California, Los Angeles

and

**Simon Cheng, CFA**
Finecon

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# Using the DCF Approach to Analyze Cross-sectional Variation in Expected Returns

Bradford Cornell
Professor of Finance
Anderson Graduate School of Management
University of California, Los Angeles
Los Angeles, CA 90024
bcornell@agsm.ucla.com
(310) 825-2922

Simon Cheng, CFA
Principal
FinEcon
10877 Wilshire Blvd., Suite 710
Los Angeles, CA 90024
(310) 208-2827

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**Abstract**

This paper attempts to shed light on the asset pricing questions raised by recent empirical research. Fama and French, among others, find that variables that are supposed to explain cross-sectional returns, specifically risk parameters that emerge from asset pricing models, have little explanatory power. On the other hand, firm characteristics such as size and book-to-market ratios, that do not fall out of any asset pricing model, are quite successful in explaining the cross-sectional distribution of historical returns. This has led to the suspicion that Fama-French type results are due to data problems, such as selection bias or data mining. In this paper, a new, direct estimate of expected returns is constructed using the discounted cash flow model and the IBES data. Consistent with previous empirical work, these new estimates of expected returns are found largely to be uncorrelated theoretical risk parameters, but to be significantly correlated with firm size and book-to-market ratios. However, the correlation between DCF expected returns and book-to-market ratios is found to be negative, as opposed to the positive correlation between book-to-market ratios and historical returns.

## 1. Introduction

Explaining the cross-sectional variation in expected returns on common stock is one of the central goals of finance theory, it has also proved to be one of the most elusive. This elusiveness is due in large part to the fact that the nature of the data makes it extraordinarily difficult to test competing theories. First, actual returns on common stock are so variable that reliable estimates of expected returns require long sample periods, even for sizable portfolios of securities. Second, expected returns vary over time, particularly for individual companies whose risk profiles can change, so that using long sample periods introduces non-stationarity. Third, given the fact that hundreds of researchers have poured over the same data set, significant results that have been found may be due to data mining as suggested by Lo and McKinley (1990), among others. In fact, Brown, Goetzmann and Ross (1995) show that using data conditional on the survival of the market is sufficient to introduce significant bias.

Despite the data problems, renewed interest in the empirical analysis of cross-sectional returns has been stimulated by two papers by Fama and French (1992, 1993). Although earlier research had documented that variables such as market capitalization, E/P ratios, and book to market ratios were related to average historical returns, Fama and French's work focused attention on the subject because they reach the conclusion that, "two easily measure variables, size and book-to-market equity seem to describe the cross-section of average stock returns."[1] Furthermore, they conclude that Beta has virtually no explanatory power. Despite this work, however, skeptics remain, in part because use of the Compustat data introduces potential new

[1] Fama and French (1992) present a review of the recent literature. A extensive review of the earlier literature is available in Keim (1988).

sources of bias. In particular, Kothari, Shanken and Sloan (1992) argue that the Fama-French results are due in part to survivorship bias in the COMPUSTAT data. It is not surprising, therefore, that some such as Black (1993) take the view that Fama-French results are spurious.

Doubts about the spurious nature of the results would be reduced if it could be shown that the higher returns earned by small capitalization and high book-to-market stocks are evidence of a risk premium or of a specific market inefficiency. This possibility has been studied recently by Choppa, Lakonishok and Ritter (1992), Lakonishok, Shleifer and Vishny (1994), Roll (1994) and Fama and French (1994b, 1995). Choppa Lakonishok and Ritter argue that part of the observed relation is due to the overreaction of stock prices to good and bad news. In related work, Lakonishok, Shleifer and Vishny present evidence to show that portfolios of "value" stocks, issued by companies with relatively low historical growth rates and high ratios of cash flow, book value and earnings to price, significantly outperform portfolios of "glamour" stocks issued by companies with the reverse characteristics. They claim that this is evidence of mispricing, associated with emotional "fads", because the differential cannot be explained as a risk premium. Roll (1994) also finds strong evidence that value stocks offer superior returns. Furthermore, Roll shows that the statistical significance of the difference between the returns on value stocks and glamour stocks *increases*, rather than decreases, after adjusting for risk using either the CAPM or the APT. While recognizing this work, Fama-French (1994b, 1995) maintain that the anomalies are risk premiums, but only emerge as such when the size and book value/market value factors are used. However, the second set of Fama-French results are subject to Black's criticism that the variables explain anomalies that other risk parameters cannot because they were selected on the basis of empirical research that indicated that they worked.

Given the current state of affairs some fresh evidence on the issue could prove most helpful. One approach to collecting new evidence, taken by Davis (1995), is to use an earlier sample period, during which the Compustat data were not available, to determine whether the Fama-French results still hold. A second approach, employed by Chan, Hamao and Lakonishok (1991), Rowley and Sharpe (1993), and Haugen and Baker (1995), is to see if same firm characteristics can explain the cross-sectional distribution of returns in other countries.

This paper takes third approach by using the discounted cash-flow (DCF) procedure to measure expected returns directly, rather than relying on historical returns as a proxy. As is explained in the next section, this approach is not without pitfalls. Application of the DCF model requires a forecast of future dividends (or dividend growth rates). Furthermore, the DCF calculation can introduce possible errors and biases into the estimation of expected returns. Nonetheless, they are *new* estimation problems that are largely independent of the data mining issues that arise when repeatedly analyzing the same historical return series. We feel, therefore, that although our work can hardly be said to be conclusive, it does provide fresh empirical information regarding the cross-sectional distribution of expected returns.

Using the DCF approach to estimate expected returns is not new. For decades, the DCF approach has been the choice of regulators and courts for setting required rates of returns on regulated companies. For example, the D.C. Circuit Court of Appeals has noted that "the Federal Energy Regulatory Commission appears quite wedded to DCF analysis and to the efficient market theory as its theoretical mainstay."[2] Using DCF expected returns in conjunction with asset pricing models is also not new. Harris (1986) and Gordon, Gordon and Gould (1989), compute DCF expected returns and examine whether they are related to variables such as own

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[2] *Tennessee Gas Pipeline Co. v. FERC*, 926 F.2d 1206, 1211 (D.C. Cir. 1991).

standard deviation and Beta. More recently, Rahman and Coggin (1994) use DCF expected returns series provided by Quantitative Financial Services (QFS) to compare the CAPM and several versions of the APT. They find that the APT is better able to explain variation in QFS expected returns, but that none of the models does very well. These earlier papers do not, however, address questions raised by the Fama-French analysis. In addition, they fail to consider several intricacies that arise when applying the DCF approach. This paper addresses these issues.

The remainder of the paper is organized as follows. The next section describes the data and empirical method. Potential problems with both the data and with the DCF approach are discussed in some depth. The empirical results are reported in section three. Section four summarizes the conclusions and discusses the implications of the results.

## 2. Data and Empirical Method

The DCF approach is conceptually straightforward. If forecasts of future dividends, or equivalently future dividend growth rates, are available on a year by year basis sufficiently far into the future, equation (1) can be solved for the required

$$P = \sum_{t=1}^{\infty} \frac{E(D_t)}{(1+k)^t} \qquad (1)$$

rate of return, k. The problem is that such detailed forecasts typically are not available so that compromises must be made. These compromises introduce the possibility of measurement error and bias.

In this paper, forecasts of dividend growth are based on survey data collected by Institutional Brokers' Estimate System (IBES). The IBES data set has been used in a wide variety of research papers on the grounds that analysts forecasts collected by IBES best reflect market expectations.[3]

Data in the IBES reports are the most comprehensive in the industry, representing a compilation of earnings estimates of over 2,000 analysts from over 100 firms. IBES collection procedures are designed to obtain timely forecasts made on a consistent basis. In the case of the data used here, IBES requests "normalized" five-year growth rates in earnings per share (EPS). The goal of the normalization is to remove distortions in the growth forecasts arising because of an unusual base year.

Unfortunately, the growth estimates provided by IBES are only for EPS, not dividends. By applying these growth rates to dividends, we are making the assumption that the payout rate is effectively constant, or more specifically, that variation in the payout rate does not affect the estimation of k.

The limitations of the forecast data raise a number of issues regarding application of the DCF approach. First, only the average growth rate over the five-year forecasting period is given. This is a problem because, holding constant the average growth rate, estimates of k can differ depending on the time path of growth during the five years. Unless the growth rate varies dramatically, however, the impact on k is small.

Second, and more importantly, the forecasts provide no information beyond five-year horizon. This is critical because real growth rates for individual companies cannot exceed the real growth rate for the U.S. economy indefinitely. Because a majority of the five-year forecasts are greater than the long-run growth rate forecast for the economy, some assumption must be made as to how those growth rates will converge toward the aggregate growth rate in the long run. Estimates of k can vary

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[3] See Timme and Eisemann (1989) for a complete description of the IBES data set and its construction.

considerably depending on the assumed path of convergence, particularly in the case of companies for which the forecast five-year growth rates are markedly in excess of sustainable levels. Unfortunately, it is impossible to asses accurately the extent of the error or bias introduced by this problem, because the true long-run growth rate for each company, and the speed of convergence to that growth rate, are unobservable. As a second best solution, several different assumptions regarding the convergence process are employed.

Third, the lack of individual year by year dividend forecasts makes the starting point particularly important. In theory, the first term in equation (1) is next year's expected dividend, but dividends are paid quarterly and expected future dividends must be approximated. Here the first term is assumed to be $D^*(1 + g)$, where g is the forecast five-year growth rate and D is four times the last dividend paid in 1992.

Fourth, errors can arise if the expected dividend payout for next year, the growth forecasts, and the stock price are not observed at the same point of time. To see the problem caused by nonsynchronous observation, suppose that a company has a stock price of $20 and that the expected dividend payout next year is $1. Analysts are currently forecasting that dividends will grow at 10 percent per year. Ignoring the convergence issue, the DCF expected return is 15 percent. Suppose now that new information arrives and the stock price drops to $15, but that neither the forecast dividend payout nor the forecast growth are adjusted. In that case, the DCF expected return appears to rise to 16.67 percent. That increase, however, is spurious. Assuming that the risk of the company's equity remains unchanged, the true expected return still would be 15 percent. The problem is that the analysts have not had time to adjust their expectations of next year's payout and the growth rate to reflect the new information.

Given the nature of the data, the foregoing timing problem cannot be eliminated totally. In this paper, the IBES report we rely on was published in January 1993 and covers the month of December 1992. The analysts whose forecasts appear in that report were contacted by IBES on a weekly basis at the time, so there is no more than a one week lag between the collection and compilation of the forecast data. There is, however, an uncertain lag between the time that the individual analysts last updated their forecasts and the time that the forecasts are given to IBES. For this reason, the total lag between the date the forecast was prepared and our observation date of December 31, 1992 could be as great as a month.

Finally, there is a conceptual issue that arises when using the DCF approach to estimate expected returns. The DCF model yields a long-run average cost of equity capital over the life of the firm. Most asset pricing models, on the other hand, give an short-run estimate of the cost of equity capital. If one is willing to assume that the cost of capital is constant, the horizon problem disappears. However, as Brennan (1993) shows, if expected returns on the market vary over time, the cost of equity for a company will be a function of the horizon over which it is estimated. In this paper, no adjustments are made to take account of the horizon problem.

***Assumptions Regarding Long-run Growth***

In the long run, growth rates for individual companies cannot remain above the growth rate of the U.S. economy. Consequently, it is necessary to estimate the long-run growth rate for the aggregate economy and to specify how growth rates for individual companies are related to the aggregate growth rate. In this paper, estimates of long-run aggregate growth are based on twenty-five year forecasts provided by Wharton Econometrics. As of December 1992, Wharton Econometrics was forecasting that over the next twenty-five years nominal growth rate for the U.S. economy would be 6.4 percent, consisting of 2.5 percent real growth and 3.9 percent inflation.

To determine whether they are reasonable, the Wharton forecasts were cross-checked in several ways. First, they were compared with the forecasts of Data Resources Incorporate (DRI), a leading competitor of Wharton Econometrics. In the third quarter of 1992, DRI was forecasting long-run real growth of 2.4 percent and long-run inflation of 3.75 percent, rates quite similar to Wharton's year-end forecast. Second, because real growth rates for the aggregate economy cannot change quickly, the Wharton forecasts were also compared with long-run historical growth rates. During the last century the average real growth rate for the U.S. economy was between 2.5 percent and 3.1 percent depending on the time period selected. Third, the inflation forecast is in line with long-term interest rates. In December 1992, the yield on twenty-year Treasury bonds was 7.05 percent. Subtracting the 2.7 percent historical real rate on long-term Treasury bonds over the period from 1926 to 1992 gives an implied inflation rate of 4.35 percent.[4] This is slightly higher than the DRI inflation forecast, but the discrepancy can be explained as a result of the widely held belief that real interest rates were higher December of 1992 than they were on average during the years from 1926 to 1992. At any rate, the difference is not large enough to reject the Wharton forecasts.

With respect to the rate of convergence to the long-run growth rate of 6.4 percent, four alternative assumptions are used. In the first case, it is assumed that the IBES growth rates are maintained into perpetuity. In the second case, growth rates are assumed to converge linearly to the long-run target over five years. To illustrate, if the five-year forecast growth rate for a company was 11.4 percent, the growth rate

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[4] The real return is based on the long-term Treasury bond series constructed by Ibbotson and Associates. The average maturity on the bonds in the Ibbotson sample is twenty years because thirty-year bond data are not available throughout the entire period.

during each of the next five years would be reduced by one percentage point until it equaled the aggregate growth rate of 6.4 percent. In the third case, the linear convergence is assumed to occur over fifteen years.

Whereas a company cannot maintain a growth rate in excess of the aggregate growth rate forever, it can grow at a lower rate. For instance, a utility pays out all its real earnings as dividends will grow only at the rate of inflation. It need not be the case, therefore, that companies with low forecast five-year growth rates subsequently have their growth rates rise to that of the aggregate economy. Consequently, in the fourth case, we assume that if a firm has a growth rate in excess of 6.4 percent, the growth rate converges linearly to 6.4 percent over fifteen years, whereas, if the IBES forecast is less than 6.4 percent, the growth rate is assumed to remain constant into perpetuity. The fourth assumption is our preferred case. To simplify the tables in some cases, where it does not make a material difference, results will be reported only for this convergence assumption.

It is worth noting that all the convergence assumptions tend to reduce the cross-sectional variation in DCF expected returns. This is because much of the variation in estimates of k is attributable to differing growth forecasts. The faster the convergence to the long-run growth rate, the smaller the cross-sectional standard deviation of expected returns tends to be.

***The Sample of Companies***

We begin with the 2,130 companies included in the December 1992 IBES survey. This universe is then limited to those companies that satisfy three criteria. First, the company must also have stock return data available on Center for Research in Securities Prices (CRSP) tape during the years from 1988 to 1992. Because the CRSP tape includes all New York and American companies and most of the larger NASDQ companies during the relevant period, this criterion is not very restrictive. Second, the company must have paid a dividend continuously for the last three years. This criterion is imposed on the grounds that the DCF model is likely to be less accurate when applied to companies that have not consistently paid a dividend. Third, as of December 1992, the dividend yield for the company must be at least two percent. This last criterion is imposed because companies with very small payout rates are likely to have high and rapidly changing dividend growth rates, making it difficult to apply the DCF model accurately given the limitations of the IBES data. The final two criteria cause the total number of companies used in the study to drop to 507.

The decision to limit the sample reflects a trade-off. Although the dividend requirements make it possible to apply the DCF approach more accurately, they also introduce a bias in the sample toward larger, older firms with a record of past success. The sample is also likely to have higher book-to-market ratios, on average, than the larger universe of companies studied by Fama and French. Finally, the dividend requirements also bias the sample in favor of utilities because utilities tend to pay large and consistent dividends. To take account of this problem, the empirical analysis is done twice, once for the full sample and once for a subsample with utilities excluded.

At first blush, it appears that our procedure introduces survivorship bias because of the dividend constraints. That problem, however, is overcome by using a direct measure of expected returns. Recall that the survivorship bias arises because the historical returns during the sample period for stocks included in the sample are "above average" because of the selection criteria. When a direct measure of expected returns is used this problem is eliminated because expected returns depend only on information available at the time analysts develop their forecasts, and, therefore, are unrelated to future returns during the sample period. Therefore, the concerns expressed by Kothari, Shanken and Sloan (1992), for example, do not apply. This is one of the benefits of the DCF approach to estimating expected returns.

***DCF Summary Statistics for the Sample Companies***

Summary statistics for the cross-sectional distribution of DCF expected returns are presented in Table 1. Results are presented for all four assumptions regarding the convergence of growth rates. For comparison, the table also presents the cross-sectional distribution of average annual returns over the previous five years. As expected, the cross-sectional variance of DCF expected returns is much less than the cross-sectional variance of average historical returns. This suggests that the DCF approach provides less noisy estimates of expected returns. The problem, of course, is that the DCF estimates may be biased whereas historical returns, although highly noisy, are unbiased estimates of expected returns in an efficient market.

Table 1 also confirms the intuition that the faster the assumed convergence to the long-run equilibrium growth rate, the smaller the cross-sectional variance of DCF expected returns. However, this effect is not large compared with the difference between the variance of the historical returns and the variance of each of the DCF expected return.

The range of the DCF expected returns is also much less than the range of the historical returns. Even if no convergence is assumed, the range of DCF returns is from a minimum of 4.7 percent to a maximum of 44.5 percent. In the preferred case of 15 year convergence for high growth companies, the range in narrowed to 4.7 percent to 33.9 percent. In comparison, the range of actual average returns over the previous five years runs from -11.4 percent to 75.0 percent.

It is also worth noting that most of the DCF expected returns are reasonable estimates of the cost of capital. When the preferred convergence assumption is used, 96 percent of the 507 companies have DCF expected returns of between 8 percent and 20 percent.[5] The percentages are even higher for the faster convergence assumptions.

Although the DCF expected returns for the sample as a whole are reasonable, this does not necessarily mean that much information is conveyed by the individual estimates. The same summary statistics could maintain if all the firms in the sample had DCF expected returns equal to the expected return on the market plus a normally distributed random error. To further investigate the nature of the DCF expected returns, Table 2 presents a breakdown by industry. The industry classification is taken from Fama and French (1994a) with a few changes to account for the fact that we have only 507 companies.[6] First, similar industries with relatively few companies in each, such as electronic equipment and measuring and control equipment, are combined into one group. Second, any industry that contains only one company and that cannot be reasonably combined with another industry is eliminated.

The summary statistics for the equal weighted industry portfolios presented in Table 2 indicate that not all the variation in DCF expected returns is random. Not only do the DCF expected returns vary across industries, but they do so in a way that is largely consistent with conventional wisdom regarding the industrial cost of equity capital. For example, using the preferred convergence assumption, utilities and banks have relatively low DCF expected returns of 10.6 percent and 9.6 percent, respectively. On the other hand, the average DCF expected return for entertainment companies is 13.4 percent and for healthcare and medical equipment companies it is 14. 6 percent.

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[5] Presumably virtually every company in the sample has a cost of capital between 8 percent and 20 percent. Given the level of interest rates in December of 1992, this range corresponds to Betas between 0.5 and 2.0 if the CAPM holds.

[6] For a detailed description of the industry groupings see the appendix of Fama and French (1994a).

*Estimating Betas*

To estimate Beta, a variant of the procedure employed by Fama and French (1992) and Davis (1995) is used. Specifically, in the first phase, Beta is estimated for all 507 companies using daily data for 1988. Following Dimson (1979), we estimate Beta as the sum of slopes in a regression of the individual stock return on the lagged, current and future return on the market. The value weighted CRSP index is used as a proxy for the market. Based on these preliminary estimates of Beta, the sample is divided into ten deciles. In the second phase, Beta is estimated for each of the ten portfolios by regressing the equal-weighted portfolio return on the current market return using monthly data over the forty-eight months from 1989 through 1992. These portfolio Betas are then assigned to each of the stocks in the portfolio.

*Estimating the Other Explanatory Variables*

Four sets of variables are used to explain the cross-sectional variation in DCF expected returns. The first set consists of CAPM Betas estimated as described above. The second set supplements the CAPM Beta with Betas computed with respect to the two Fama-French risk factors related to size and book to market ratios. The third set, consists of the Betas computed with respect to APT risk factors. The APT risk factors are the same factors used by Roll (1994). As Roll explains, these factors are extracted from a sample of individual security returns using the method of Connor and Korajczyk (1986). The CAPM Beta is excluded from this set because the first factor in the Roll set is similar to a large market index. The final set of explanatory variables consists of the firm characteristics found to be most highly correlated with historical returns. This includes both size and book to market ratios as well as earnings yield and dividend yield. The dividend yield is also included because of the possible bias introduced by non-synchronous observation of D, P and the growth forecasts. As noted earlier, failure to observe D, P and the growth forecasts at the same time can lead to a spurious correlation between the dividend yield and DCF expected returns.

Unlike the CAPM Betas, the risk parameters for the APT and Fama-French factors are estimated directly by applying ordinary least squares during the full sixty month period from 1988 to 1992. In the case of the APT, the risk parameters are estimated by regressing each company's stock return on mimicking portfolios returns for the five APT risk factors provided by Roll. In the case of the Fama-French model, the risk parameters are estimated by regressing the company's return on mimicking portfolios returns for the size factor (SMB) and the book to market factor (HML).[7]

The fact that we have DCF expected return data at only one point in time, and therefore, can run only one cross-sectional regression exacerbates the errors in variables problem caused by measurement error in the Betas. As Fama and French (1992 ) stress, sampling error in the estimates of the risk parameters is likely to be a serious problem when using their three factor model to compute expected returns. This is another reason why the firm characteristics are included as a set of explanatory variables. Unlike the risk parameters, the firm characteristics can be measured with little error.

If measurement error were the only problem, the risk parameters could be estimated more accurately by using longer time periods. However, there is also strong evidence of variation in the risk parameters over time. Recent work by Fama and French (1994a) shows that even for industries there is evidence of significant variation in the underlying risk parameters. This variation leads Fama and French to the surprising conclusion that accuracy with which the parameters are estimated is insensitive to the sample period as long as it is between three and ten years. As the sample period is lengthened, the benefit of reduced measurement error is offset by an

[7] Returns on the mimicking portfolios were provided by Eugene Fama.

increase in nonstationarity. In light of this, our choice of a five-year sample period is reasonable.

The firm characteristics used as explanatory variables are taken from the COMPUSTAT tape for year-end 1992 because year-end data generally are more accurate. This raises the specter of "look-ahead" bias because the year-end data reported by COMPUSTAT typically are not available until early the following year. Because we are using expected returns, rather than actual returns, the impact of this look-ahead bias is minimal. To see why, consider the example of book value. Based on the information available as of December 31, 1992, the market will form an expectation of the year-end book value, E(BV). Assuming that expectations are rational, this will differ from the book value revealed a few months later by a random error term, u, so that

$$E(BV) = BV + u . \qquad (2)$$

Look-ahead bias arises in cross sectional regressions using next period's *actual* returns because information that affects those returns is also likely to affect the innovation in the book value, u. The DCF expected returns, on the other hand, are based entirely on information available as of December 31. Therefore, the DCF expected returns will not be correlated with the innovation, u. Accordingly, the only bias that could arise would be a reduction of the estimated coefficients in a cross-sectional regression due to an errors in variables problem introduced by using BV instead of E(BV). This bias should be minimal because innovations in book value are small compared to the cross-sectional variation in BV.

Given these concerns, it is clear that our results must be interpreted with care. Even if none of the risk parameters are able to explain the cross-sectional variation in DCF expected returns, this may be evidence of the severity of the measurement error problem rather than a failure of the theoretical models.

## 3. Empirical Results

To be comparable with previous research, the empirical analysis takes two forms. The first part of the analysis consists of grouping the sample companies into deciles based on key variables including DCF expected return, Beta, and the firm characteristics. The second part is based on cross-sectional regressions in which the dependent variable is the DCF expected return and the explanatory variables are the risk measures and the firm characteristics. Because utilities may behave differently, and because there are a large number of utilities in our sample, results are presented both for the full sample and for a subsample with utilities excluded.

The findings based on portfolio grouping are presented in Table 3a for the full sample and in Table 3b for the subsample excluding utilities. Results are shown only for our preferred convergence assumption to conserve space. The results for the other convergence assumptions are similar. Although the two tables are not identical, the same basic features emerge from both. First, using DCF expected returns in no way resurrects the CAPM. When portfolios are grouped by the DCF expected return they show no observable relation to Beta. This remains true when convergence assumptions other than our preferred method are used to compute DCF expected returns.

Second, there is evidence that DCF expected returns are related to the Fama-French firm characteristics. Looking first at the sort on size, there is a tendency for large firms to have smaller DCF expected returns. There is also evidence of a book-to-market effect, but it runs in the opposite direction of that found by Fama and French. The sort on ln(BE/ME) reveals that firms with *high* book-to-market ratios tend to have *lower* DCF expected returns. This is more in line with the old story that high book-to-market firms are less risky because more of their value comes from assets in place and less from high risk growth opportunities, as opposed to the Fama-French story that high book-to-market ratios reflect financial distress and greater risk. It is worth noting that, consistent with the Fama-French results, the historical returns during our short five-year sample period are highly positively correlated with the book-to-market ratio. When firms are sorted on ln(BE/ME), five-year average historical returns rise almost monotonically from 7.3 percent to 23.2 percent. Nonetheless, this relation does not hold for DCF expected returns.

Third, there is no observable relation between the E/P ratio and DCF expected returns, but there is a strong positive relation between DCF expected returns and dividend yield. In fact, DCF expected returns line up directly with both the dividend yield and the IBES growth rate. This is no doubt due in large part to the timing bias discussed earlier. If all the variables are observed at the proper time, and if the DCF model worked perfectly, then the DCF expected returns should be related to reported growth rates and dividend yields only to the extent that those variables were proxies for risk.[8] A timing differential tends to produce spurious correlation. To see why, consider an extreme case in which the dividend yield and the expected growth rate are observed for different stocks (or at such different points in time that there is no relation between the two). If the dividend yield and the expected growth rate are largely unrelated, then both will be correlated with their sum (the DCF expected return). When simultaneous data are used, this spurious correlation is eliminated by the relation between dividend yields and expected growth rates. Unfortunately, as noted earlier, the data are such that it cannot be assured that the observations are simultaneous. This suggests that there will be spurious correlation between DCF

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[8] Although the DCF expected return equals the sum of the dividend yield and the expected growth rate, the relation between the DCF expected return and either the dividend yield or the expected growth rate considered alone is complex because the two are related in a fashion that varies from company to company.

expected returns and both dividend yields and expected growth rates. The fact that D/P ratios line up with DCF expected returns, but E/P ratios do not is evidence that the timing differential does pose a problem. For this reason, the DCF approach is not a good tool for determining the relation between dividend yields and expected returns. Fortunately, this issue is unique to dividend yield. Nonetheless, the DCF approach can be used to assess whether firm characteristics that do not directly enter the DCF calculation are correlated with expected returns.

The cross-sectional regression results reported in Table 4a for the full sample and in Table 4b for the subsample excluding utilities tell basically the same story. For the full sample, Beta is statistically insignificant and the sign of its coefficient is negative. When the utilities are removed, Beta becomes significant, but the sign of the coefficient is still *negative*. It is clear, therefore, that the DCF data are not supportive of the CAPM.

With respect to the firm characteristics, the impressions derived from the sorted portfolios are confirmed by the regressions. The coefficients of both firm size and book-to-market ratios are significantly negative with t-statistics in excess of 3.5 whether or not utilities are included and whether or not yield variables are added to the regression. The main problem, at least from the standpoint of Fama and French's work, is that the sign of ln(BE/ME) is wrong. In addition, it is disappointing that the explanatory power of the regression is a only 6.8 percent for the full sample and drops to 4.4 percent for the subsample. One of the hoped for benefits of the DCF approach was to increase the explanatory power of cross-sectional regressions by reducing the noise in the dependent variable. Although Table 1 shows that that cross-sectional standard deviation of DCF expected returns is much less than that of historical returns, the $R^2$s in Tables 4a and 4b fail to rise much compared to those reported by Fama and French.

The meager explanatory power of the regressions is reflected in the low coefficients of the explanatory variables. Looking at the full sample regression with just size and the book-to-market ratio included as explanatory variables, it can be seen that an increase of one standard deviation in the size variable causes the predicted DCF expected return to drop by only 52 basis points. Similarly, an increase of one standard deviation in ln(BE/ME) causes the DCF expected return to drop by 59 basis points. (The cross-sectional summary statistics for the explanatory variables are presented in Table 4c.) Thus, although the significance level for the coefficients is high, the economic impact of the variables is as not great as might be expected.

It is possible that spurious correlation between D/P and the DCF expected returns could also affect the regressions in which the firm characteristics are used as explanatory variables. If the D/P is not included in the regression, and if the firm characteristics are correlated with D/P, then the firm characteristics could be picking up some of the spurious correlation. An easy way to take account of this is to include D/P as an explanatory variable in the regression. As shown Panel D of Table 4a and 4b, when D/P is added to the explanatory variables its coefficient is positive and highly significant as predicted by the spurious correlation hypothesis. However, the coefficients of size and ln(BE/ME) variables are largely unaffected. Both remain negative and significant. In fact, they become slightly more negative. Thus, the results for the firm characteristics are not related to the spurious correlation problem that affects D/P.

The results for the APT factor loadings are a mixed bag with one important common characteristic - they are of limited economic importance. Whereas the explanatory power provided by the firm characteristics is small, the explanatory power of the factor loadings is nil. Turning to the regressions using loadings on the Fama-French factors (small-minus-big (SMB) and high-minus-low book to market (HML)), the $R^2$s are seen to be less than 2 percent. The coefficients of the Fama-French loading variables depend on whether or not utilities are included. With utilities in the sample, the SMB risk parameter is significant, but the HML is not, although both are positive as Fama and French predict. When utilities are excluded, the coefficients both remain positive, but now the HML coefficient is significant and the SMB coefficient is not. In any event, economic impact of the coefficients is small. The greatest impact is that of the SMB coefficient in Table 4a. In that case, the coefficient is .0059 and the cross-sectional standard deviation of the explanatory variable is 0.60 implying that a one standard deviation increase in the explanatory variable would cause the DCF expected return to rise by only 35 basis points.

Overall, the results are consistent with the growing body of research that finds that the CAPM fails to explain the cross-sectional variation of expected returns. On the other hand, the findings are not completely consistent with the work of Fama and French either. Although firm size and book-to-market ratios are found to be significant determinants of expected returns, the correlation between DCF expected returns and book-to-market ratios is negative, the reverse of what Fama and French report.

## 4. Conclusions and Implications of the Results

Designed to cast light on the mysterious behavior of cross-sectional stock returns, this study has served, in part, to deepen the mystery. The goal was to reduce noise and overcome data mining problems by using the DCF approach to compute a new estimate of expected returns. It could then be determined whether these new estimates of expected returns were correlated either with the risk parameters implied by theoretical models or with the firms characteristics suggested by the empirical literature.

Consistent with much recent work, the results reported here reject the CAPM. To the extent that a relation between DCF expected returns and Beta is found, the correlation is negative. However, the explanatory power is so low that the safest conclusion is that Beta is unrelated to DCF expected returns.

Essentially the same conclusion holds for the two versions of the APT that we tested. The explanatory power of the cross-sectional regressions is extremely low and the pattern of significant coefficients depends on whether or not utilities are included in the sample. While the results are not sufficiently negative to say that the data reject the APT, they clearly do not support it in any meaningful way. However, this may be a result of the fact that APT factor loading for individual firms are not measured with sufficient precision in our tests.

The most interesting results are for the two Fama-French firm characteristics: size and book-to-market ratios. Both of these characteristics are significantly correlated with DCF expected returns. Consistent with the previous empirical work based on historical returns, larger size is found to be associated with smaller expected returns. Inconsistent with the work of Fama and French, however, high book-to-market ratios are found be associated with lower, not higher, expected returns.

In light of the surprising finding regarding firm characteristics, and because of the limitations of the current study, further research would be beneficial. One obvious possibility is to extend the sample by calculating DCF expected returns at more points in time. Another possibility is to examine the individual companies in greater detail with an eye toward improving the accuracy of the DCF forecasts.

While it is possible that further research will resolve the issue, given the current state of affairs a perplexing practical question remains: how should the cost of equity capital be estimated? There are three basic alternatives. The first is to rely on a theoretical model such as the CAPM or the APT. The problem with this approach is that it is inconsistent with most of the recent empirical research. CAPM Betas have been shown to have virtually no explanatory power. Some versions of the APT have faired better, but this is probably due in part to the flexibility that one has in deciding how to implement the model. Even so, the empirical support is weak.

A second alternative is to rely on the empirical studies. This can be tied to the first alternative if one is willing to view firm characteristics, such as size and book-to-market ratios, as APT type risk factors. Without making this connection, firm characteristics can still be used to compute expected returns simply because "they work." However, given the lack of theoretical justification for this approach and in light of the suspicion that firm characteristics may "work" because of data mining, this approach does not engender total confidence.

It was hoped that this paper would help distinguish between these first two alternatives by determining whether the DCF approach was consistent with one or the other. Instead, the DCF approach emerges as a distinct third alternative, not entirely consistent with either. It is not consistent with the theoretical models because DCF expected returns are largely unrelated to the risk parameters. However, it is also not consistent with the empirical literature because the relation between DCF expected returns and firm characteristics is different than the relation between historical returns and the same firm characteristics.

Of the three methods, the DCF approach has much to recommend it. It is theoretically sound and easy to apply. The main problem is that it depends on dividend forecasts that can be difficult to come by, particularly for companies that are not paying dividends. Applying the DCF to such companies requires either forecasting when dividends are likely to begin and how they will grow after that, or finding comparable companies that already pay dividends. Admittedly both procedures have drawbacks. Forecasting dividends for a company that is yet to pay them is obviously somewhat speculative. Determining when two companies are comparable is also difficult. Nonetheless, when the alternatives are relying on estimates of risk parameters that entail significant measurement error and have no observable correlation with cross-sectional returns, or relying on firm characteristics that are correlated with historical returns, but are without theoretical support, the DCF method becomes more attractive. It also makes the decision of courts and regulatory agencies to rely on the DCF approach appear more reasonable.

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## Table 1

**Summary Cross-Sectional Statistics for Historical and DCF Expected Returns (All 507 Companies in Sample as of December 31, 1992)**

| | Mean | Standard Deviation | Minimum | Maximum | % Between 8% and 20% |
|---|---|---|---|---|---|
| **Historical Returns** (Five-year Equal-Weighted Annual Average) | 15.3% | 10.2% | -11.4% | 75.0% | 53% |
| **DCF Expected Returns** (No convergence) | 14.0% | 4.2% | 4.7% | 44.5% | 92% |
| **DCF Expected Returns** (Five-year convergence) | 11.5% | 2.1% | 8.5% | 33.0% | 99% |
| **DCF Expected Returns** (Fifteen-year convergence) | 12.0% | 2.4% | 8.2% | 33.9% | 98% |
| **DCF Expected Returns** (Fifteen-year convergence for high-growth companies No convergence for low-growth companies) | 11.6% | 2.6% | 4.7% | 33.9% | 96% |

*Notes :*

The companies are selected using following criteria : (1) Included in the IBES Survey with a five-year EPS growth rate, (2) At least 5-year trading history and 3-year dividend history as provided by CRSP, (3) Dividend yield must be at least 2% as of December 1992, and (4) Available data can be obtained from Compustat for calculating different accounting ratios as of December 1992.

## Table 2

## DCF Expected Return Sorted by Industry

| Industry Group | Industry | N | IBESg | D/P | DCF Expected Return | 5-Year Hist. Rtn. |
|---|---|---|---|---|---|---|
| 2-5 | Food Products | 19 | 12.1% | 4.3% | 13.4% | 19.3% |
| 6-7 | Entertainment | 2 | 10.5% | 4.8% | 13.4% | 37.8% |
| 8 | Printing and Publishing | 16 | 11.6% | 2.7% | 10.9% | 8.8% |
| 9 | Consumer Goods | 19 | 11.2% | 2.9% | 11.1% | 15.7% |
| 10 | Apparel | 5 | 11.8% | 4.5% | 13.7% | 23.5% |
| 11-12 | Healthcare & Med.Eqip | 5 | 15.6% | 3.7% | 14.6% | 30.5% |
| 13 | Pharmaceutical Products | 10 | 13.1% | 3.5% | 12.6% | 20.3% |
| 14 | Chemicals | 25 | 11.9% | 4.0% | 13.1% | 14.8% |
| 15 | Rubber & Plastic Products | 5 | 12.0% | 2.7% | 11.1% | 16.0% |
| 16 | Textiles | 3 | 9.3% | 2.7% | 10.2% | 12.0% |
| 17 | Construction Materials | 11 | 10.2% | 4.0% | 11.8% | 9.4% |
| 18 | Construction | 5 | 13.6% | 2.9% | 12.2% | 12.1% |
| 19 | Steel Works | 7 | 10.1% | 3.4% | 11.4% | 14.4% |
| 20 | Fabricated Products | 2 | 18.5% | 3.8% | 16.4% | 13.8% |
| 21 | Machinery | 27 | 11.2% | 3.0% | 11.3% | 12.9% |
| 22 | Electrical Equipment | 7 | 11.3% | 3.3% | 11.8% | 18.1% |
| 24 | Automobiles and Trucks | 14 | 9.4% | 3.0% | 10.5% | 17.1% |
| 25 | Aircraft | 8 | 6.9% | 3.3% | 9.3% | 14.9% |
| 26 | Shipbuilding, Railroad Eq. | 3 | 16.7% | 2.8% | 13.1% | 21.9% |
| 27 | Defense | 4 | 7.8% | 3.7% | 10.6% | 11.5% |
| 29 | Non-metallic Mining | 3 | 10.3% | 2.9% | 10.8% | 17.0% |
| 30-31 | Coal, Petro & Gas | 23 | 11.1% | 4.5% | 13.4% | 12.7% |
| 32 | Utilities | 134 | 4.8% | 5.8% | 10.6% | 17.2% |
| 33 | Telecommunications | 17 | 7.8% | 4.5% | 11.6% | 20.9% |
| 34-35 | Personal & Bus Services | 15 | 12.8% | 3.3% | 12.4% | 9.7% |
| 36 | Computer Services | 5 | 14.4% | 3.5% | 13.4% | 15.9% |
| 37 | Computers | 5 | 10.6% | 3.7% | 11.7% | 8.9% |
| 38-39 | Electronic Equipment | 14 | 11.0% | 3.4% | 11.6% | 14.2% |
| 40 | Business Supplies | 33 | 10.9% | 3.3% | 11.6% | 11.6% |
| 41 | Shipping Containers | 2 | 18.0% | 3.2% | 15.0% | 9.3% |
| 42 | Transportation | 8 | 9.6% | 3.4% | 10.7% | 19.2% |
| 43 | Wholesale | 17 | 11.0% | 3.1% | 11.3% | 12.6% |
| 44 | Retail | 23 | 12.2% | 3.0% | 11.8% | 13.6% |
| 45 | Restaurants, Hotel, Motel | 4 | 13.5% | 4.2% | 14.3% | 15.9% |
| 46 | Banking | 2 | 7.0% | 3.0% | 9.6% | 11.8% |

*Note :*

The DCF Expected Return assumes a 15-year convergence to long-term expected ecomony growth for high-growth companies and no convergence for low-growth companies.

## Table 3A

**Summary Statistics for Portfolios of Stocks Formed by Sorting on Key Characteristics For All Companies In Sample As of December 31, 1992**

| Portfolio Sorted By | DCF Exp.Rtn | Beta | LN(ME) | LN(BE/ME) | IBESg | D/P | E/P | 5-Year Hist.Rtn |
|---|---|---|---|---|---|---|---|---|
| DCF Expected Return | | | | | | | | |
| 1 | 17.2% | 0.79 | 13.03 | -0.68 | 15.1% | 6.0% | 5.0% | 16.3% |
| 2 | 13.0% | 0.90 | 13.93 | -0.63 | 11.0% | 4.4% | 5.1% | 14.8% |
| 3 | 12.3% | 0.88 | 13.76 | -0.52 | 10.7% | 4.2% | 5.5% | 16.7% |
| 4 | 11.8% | 0.95 | 14.17 | -0.58 | 10.5% | 3.8% | 5.0% | 13.8% |
| 5 | 11.4% | 0.92 | 14.30 | -0.56 | 10.3% | 3.5% | 5.7% | 12.9% |
| 6 | 11.0% | 0.88 | 13.87 | -0.48 | 9.6% | 3.5% | 5.9% | 14.7% |
| 7 | 10.6% | 0.87 | 13.71 | -0.52 | 9.6% | 3.3% | 6.3% | 16.4% |
| 8 | 10.2% | 0.87 | 14.10 | -0.48 | 8.0% | 3.8% | 6.0% | 16.2% |
| 9 | 9.7% | 0.86 | 14.20 | -0.28 | 6.9% | 3.9% | 7.2% | 15.0% |
| 10 | 8.6% | 0.76 | 13.90 | -0.20 | 3.4% | 5.1% | 7.2% | 16.4% |
| Size (ln(ME)) | | | | | | | | |
| 1 | 11.9% | 1.03 | 16.74 | -0.87 | 10.1% | 4.1% | 5.6% | 19.0% |
| 2 | 11.2% | 0.98 | 15.60 | -0.60 | 8.8% | 4.2% | 5.7% | 17.3% |
| 3 | 10.9% | 0.96 | 15.01 | -0.62 | 8.5% | 4.1% | 5.6% | 15.9% |
| 4 | 11.5% | 0.91 | 14.52 | -0.48 | 9.5% | 4.1% | 6.0% | 15.6% |
| 5 | 10.8% | 0.89 | 14.07 | -0.48 | 8.5% | 4.0% | 5.3% | 13.2% |
| 6 | 11.3% | 0.84 | 13.72 | -0.33 | 8.1% | 4.6% | 6.2% | 13.4% |
| 7 | 11.1% | 0.86 | 13.24 | -0.47 | 9.4% | 3.8% | 5.7% | 14.2% |
| 8 | 11.3% | 0.75 | 12.73 | -0.42 | 8.8% | 4.2% | 6.2% | 14.9% |
| 9 | 12.8% | 0.76 | 12.13 | -0.53 | 11.4% | 4.2% | 5.7% | 15.7% |
| 10 | 13.2% | 0.70 | 11.09 | -0.11 | 12.3% | 4.1% | 7.0% | 13.6% |
| Book to Market (BE/ME) | | | | | | | | |
| 1 | 11.5% | 0.84 | 12.65 | 0.37 | 8.7% | 4.2% | 8.6% | 7.3% |
| 2 | 11.8% | 0.84 | 13.53 | -0.02 | 8.5% | 4.9% | 6.9% | 13.0% |
| 3 | 10.1% | 0.82 | 14.08 | -0.15 | 5.2% | 5.3% | 6.5% | 14.8% |
| 4 | 10.7% | 0.78 | 13.81 | -0.26 | 6.8% | 4.8% | 6.2% | 15.2% |
| 5 | 11.2% | 0.81 | 13.63 | -0.37 | 8.5% | 4.2% | 5.4% | 15.5% |
| 6 | 11.7% | 0.90 | 13.89 | -0.47 | 10.1% | 3.8% | 5.2% | 14.6% |
| 7 | 11.9% | 0.91 | 14.11 | -0.59 | 11.6% | 3.3% | 5.2% | 16.1% |
| 8 | 12.1% | 0.94 | 14.29 | -0.79 | 11.0% | 3.8% | 5.1% | 16.1% |
| 9 | 11.9% | 0.90 | 14.25 | -1.04 | 11.9% | 3.2% | 4.6% | 17.4% |
| 10 | 13.1% | 0.95 | 14.75 | -1.68 | 13.1% | 3.8% | 5.0% | 23.2% |
| Estimated Beta | | | | | | | | |
| 1 | 11.6% | 1.28 | 14.71 | -0.60 | 10.6% | 3.4% | 4.3% | 12.1% |
| 2 | 11.4% | 1.16 | 14.81 | -0.67 | 10.6% | 3.3% | 4.7% | 13.4% |
| 3 | 11.3% | 1.00 | 14.96 | -0.72 | 11.1% | 3.2% | 4.6% | 14.4% |
| 4 | 12.2% | 0.94 | 14.45 | -0.51 | 10.9% | 3.8% | 5.1% | 12.7% |
| 5 | 11.3% | 0.93 | 13.93 | -0.44 | 10.0% | 3.7% | 6.2% | 15.6% |
| 6 | 11.0% | 0.74 | 13.79 | -0.40 | 7.5% | 4.7% | 7.0% | 17.7% |
| 7 | 11.7% | 0.74 | 13.69 | -0.43 | 8.8% | 4.5% | 6.8% | 15.2% |
| 8 | 11.9% | 0.72 | 13.22 | -0.47 | 9.2% | 4.6% | 5.7% | 16.5% |
| 9 | 11.0% | 0.62 | 13.21 | -0.28 | 7.0% | 5.0% | 7.0% | 17.8% |
| 10 | 12.7% | 0.55 | 12.11 | -0.41 | 9.5% | 5.1% | 7.6% | 17.7% |
| Dividend Yield (D/P) | | | | | | | | |
| 1 | 13.2% | 0.72 | 13.91 | -0.32 | 5.4% | 7.9% | 7.6% | 15.6% |
| 2 | 11.2% | 0.71 | 13.68 | -0.21 | 5.3% | 6.0% | 7.1% | 16.6% |
| 3 | 11.5% | 0.78 | 14.00 | -0.32 | 6.5% | 5.3% | 6.3% | 16.2% |
| 4 | 12.1% | 0.91 | 14.28 | -0.52 | 8.8% | 4.5% | 5.4% | 14.7% |
| 5 | 12.3% | 0.90 | 13.94 | -0.51 | 10.7% | 3.8% | 4.8% | 13.4% |
| 6 | 11.7% | 0.96 | 13.76 | -0.41 | 10.6% | 3.4% | 4.8% | 11.0% |
| 7 | 11.7% | 0.94 | 13.71 | -0.65 | 11.9% | 3.0% | 6.6% | 16.0% |
| 8 | 11.0% | 0.92 | 13.92 | -0.51 | 11.8% | 2.7% | 5.5% | 14.6% |
| 9 | 10.7% | 0.91 | 13.78 | -0.78 | 11.9% | 2.4% | 5.3% | 18.4% |
| 10 | 10.5% | 0.94 | 13.97 | -0.71 | 12.7% | 2.1% | 5.5% | 16.6% |
| Earnings/Price (E/P) | | | | | | | | |
| 1 | 11.1% | 0.81 | 13.46 | -0.07 | 7.5% | 4.9% | 13.5% | 14.4% |
| 2 | 11.5% | 0.80 | 14.34 | -0.41 | 7.1% | 5.3% | 8.8% | 18.3% |
| 3 | 11.4% | 0.83 | 14.25 | -0.37 | 8.7% | 4.5% | 7.8% | 18.7% |
| 4 | 11.0% | 0.81 | 13.32 | -0.46 | 8.1% | 4.4% | 7.0% | 16.4% |
| 5 | 10.9% | 0.81 | 13.92 | -0.53 | 8.3% | 4.2% | 6.4% | 16.9% |
| 6 | 12.0% | 0.88 | 13.98 | -0.68 | 10.6% | 3.8% | 5.7% | 17.1% |
| 7 | 11.3% | 0.91 | 14.29 | -0.89 | 11.8% | 3.0% | 4.9% | 17.3% |
| 8 | 11.6% | 0.91 | 13.82 | -0.78 | 11.2% | 3.3% | 3.6% | 14.5% |
| 9 | 13.5% | 0.94 | 13.67 | -0.43 | 11.0% | 4.7% | 1.0% | 11.0% |
| 10 | 11.6% | 0.99 | 13.91 | -0.33 | 11.1% | 3.2% | 0.0% | 8.2% |

## Table 3B

### Summary Statistics for Portfolios of Stocks Formed by Sorting on Key Characteristics For Non-Utility Companies In Sample As of December 31, 1992

| Portfolio Sorted By | DCF Exp.Rtn | Beta | LN(ME) | LN(BE/ME) | IBESg | D/P | E/P | 5-Year Hist.Rtn |
|---|---|---|---|---|---|---|---|---|
| DCF Expected Return | | | | | | | | |
| 1 | 18.0% | 0.80 | 13.22 | -0.80 | 15.6% | 6.3% | 4.8% | 17.5% |
| 2 | 13.3% | 0.87 | 13.94 | -0.74 | 12.2% | 4.1% | 4.6% | 14.7% |
| 3 | 12.5% | 0.98 | 13.79 | -0.60 | 12.4% | 3.6% | 5.0% | 15.8% |
| 4 | 12.0% | 0.98 | 14.48 | -0.65 | 10.3% | 3.9% | 5.0% | 14.3% |
| 5 | 11.6% | 0.94 | 14.10 | -0.60 | 11.1% | 3.3% | 4.6% | 12.8% |
| 6 | 11.2% | 0.93 | 14.19 | -0.60 | 11.1% | 3.1% | 5.9% | 13.1% |
| 7 | 10.9% | 0.95 | 13.80 | -0.58 | 10.5% | 3.0% | 5.4% | 15.2% |
| 8 | 10.6% | 0.93 | 13.84 | -0.63 | 10.7% | 2.7% | 5.6% | 16.5% |
| 9 | 10.1% | 0.96 | 14.18 | -0.62 | 10.2% | 2.5% | 5.2% | 13.7% |
| 10 | 9.2% | 0.93 | 13.72 | -0.28 | 7.9% | 2.5% | 6.7% | 12.6% |
| Size (ln(ME)) | | | | | | | | |
| 1 | 12.2% | 1.03 | 16.95 | -0.89 | 10.2% | 4.1% | 5.2% | 18.3% |
| 2 | 11.5% | 1.09 | 15.77 | -0.86 | 11.1% | 3.2% | 5.0% | 18.4% |
| 3 | 11.6% | 1.07 | 15.10 | -0.89 | 10.4% | 3.5% | 4.6% | 15.6% |
| 4 | 11.7% | 0.99 | 14.58 | -0.65 | 11.4% | 3.3% | 5.0% | 13.5% |
| 5 | 11.3% | 0.96 | 14.10 | -0.58 | 10.5% | 3.3% | 4.4% | 11.1% |
| 6 | 11.6% | 0.91 | 13.69 | -0.49 | 10.0% | 3.8% | 5.5% | 13.0% |
| 7 | 11.3% | 0.91 | 13.19 | -0.59 | 11.1% | 3.1% | 5.1% | 13.7% |
| 8 | 11.6% | 0.81 | 12.63 | -0.47 | 10.9% | 3.4% | 5.8% | 13.7% |
| 9 | 13.6% | 0.77 | 12.06 | -0.62 | 13.6% | 3.8% | 5.2% | 15.9% |
| 10 | 13.3% | 0.73 | 11.01 | -0.04 | 13.1% | 3.8% | 7.2% | 12.9% |
| Book to Market (BE/ME) | | | | | | | | |
| 1 | 11.9% | 0.90 | 12.37 | 0.40 | 10.7% | 3.5% | 8.2% | 4.9% |
| 2 | 11.4% | 0.98 | 13.37 | -0.06 | 10.0% | 3.6% | 5.4% | 9.4% |
| 3 | 11.4% | 0.92 | 13.84 | -0.28 | 10.1% | 3.5% | 4.2% | 11.6% |
| 4 | 11.4% | 0.90 | 13.91 | -0.42 | 10.0% | 3.5% | 5.7% | 15.4% |
| 5 | 12.1% | 0.96 | 14.10 | -0.52 | 11.5% | 3.4% | 4.3% | 14.4% |
| 6 | 11.9% | 0.90 | 13.90 | -0.61 | 11.8% | 3.2% | 5.5% | 15.1% |
| 7 | 12.2% | 0.95 | 14.38 | -0.76 | 11.1% | 3.8% | 4.8% | 15.7% |
| 8 | 12.3% | 0.92 | 14.18 | -0.93 | 11.8% | 3.5% | 4.7% | 17.9% |
| 9 | 11.6% | 0.94 | 14.57 | -1.18 | 11.6% | 3.1% | 4.9% | 16.7% |
| 10 | 13.6% | 0.92 | 14.69 | -1.83 | 13.7% | 3.9% | 5.2% | 25.6% |
| Estimated Beta | | | | | | | | |
| 1 | 11.4% | 1.28 | 14.55 | -0.34 | 10.1% | 3.5% | 4.0% | 9.9% |
| 2 | 11.4% | 1.19 | 14.36 | -0.58 | 10.6% | 3.3% | 5.3% | 13.7% |
| 3 | 11.5% | 1.10 | 15.10 | -0.81 | 10.7% | 3.4% | 4.3% | 12.7% |
| 4 | 11.4% | 1.00 | 15.34 | -0.92 | 11.8% | 3.0% | 4.8% | 16.9% |
| 5 | 12.4% | 0.94 | 14.43 | -0.43 | 11.1% | 3.8% | 5.1% | 10.6% |
| 6 | 11.5% | 0.93 | 13.75 | -0.48 | 11.1% | 3.2% | 5.8% | 14.7% |
| 7 | 11.7% | 0.81 | 13.48 | -0.71 | 10.9% | 3.6% | 5.8% | 17.8% |
| 8 | 12.4% | 0.74 | 13.13 | -0.61 | 11.3% | 3.7% | 5.8% | 14.0% |
| 9 | 12.1% | 0.70 | 12.95 | -0.62 | 11.1% | 3.7% | 4.5% | 16.7% |
| 10 | 13.8% | 0.58 | 12.09 | -0.62 | 13.7% | 4.0% | 7.6% | 19.4% |
| Dividend Yield (D/P) | | | | | | | | |
| 1 | 16.0% | 0.86 | 14.17 | -0.68 | 9.8% | 7.1% | 5.0% | 13.1% |
| 2 | 12.7% | 0.95 | 14.34 | -0.59 | 9.5% | 4.6% | 4.5% | 13.3% |
| 3 | 12.4% | 0.95 | 14.13 | -0.49 | 10.7% | 3.9% | 4.8% | 12.5% |
| 4 | 11.6% | 0.93 | 13.62 | -0.55 | 10.3% | 3.5% | 4.6% | 13.0% |
| 5 | 11.9% | 0.99 | 13.85 | -0.48 | 11.2% | 3.3% | 5.1% | 12.7% |
| 6 | 11.7% | 0.92 | 13.59 | -0.67 | 12.1% | 3.0% | 6.9% | 15.5% |
| 7 | 11.4% | 0.90 | 13.81 | -0.51 | 12.3% | 2.7% | 6.2% | 15.6% |
| 8 | 10.6% | 0.94 | 14.18 | -0.74 | 11.2% | 2.5% | 5.0% | 16.1% |
| 9 | 10.7% | 0.87 | 13.46 | -0.69 | 12.3% | 2.3% | 5.5% | 18.4% |
| 10 | 10.5% | 0.97 | 14.06 | -0.72 | 12.9% | 2.1% | 5.3% | 16.2% |
| Earnings/Price (E/P) | | | | | | | | |
| 1 | 11.5% | 0.87 | 13.27 | -0.23 | 9.8% | 3.8% | 14.0% | 12.7% |
| 2 | 12.8% | 0.93 | 14.20 | -0.57 | 11.4% | 4.0% | 8.2% | 19.4% |
| 3 | 11.2% | 0.94 | 14.05 | -0.64 | 10.8% | 3.1% | 7.0% | 16.7% |
| 4 | 11.6% | 0.89 | 13.86 | -0.67 | 11.0% | 3.3% | 6.3% | 15.1% |
| 5 | 12.1% | 0.92 | 14.15 | -0.84 | 11.5% | 3.5% | 5.6% | 19.2% |
| 6 | 11.4% | 0.91 | 14.39 | -1.01 | 12.6% | 2.8% | 4.9% | 17.5% |
| 7 | 11.8% | 0.93 | 13.69 | -0.88 | 11.8% | 3.2% | 3.9% | 14.8% |
| 8 | 12.0% | 0.96 | 13.99 | -0.58 | 11.4% | 3.5% | 2.4% | 15.1% |
| 9 | 13.8% | 0.94 | 13.85 | -0.46 | 10.6% | 5.0% | 0.2% | 8.0% |
| 10 | 11.4% | 0.99 | 13.80 | -0.23 | 11.4% | 2.9% | 0.0% | 7.7% |

**Table 4A**

**Cross-Sectional Regression Analysis On Individual Stock Returns On the Betas from Different Asset Pricing Models and Firm Characteristics For All Companies In Sample As of December 31, 1992 (t-values in parentheses)**

Panel A : CAPM Betas

| Dependent Variable | Intercept | Market Beta | Adjusted R-Square |
|---|---|---|---|
| DCF15Low | 0.1176<br>(26.64) | -0.0025<br>(-0.50) | -0.002 |

Panel B : Factor Loadings For Size and Book-to-Market Portfolios

| Dependent Variable | Intercept | Size (SMB) | Book-To-Mkt (HML) | Adjusted R-Square |
|---|---|---|---|---|
| DCF15Low | 0.1144<br>(71.64) | 0.0059<br>(3.32) | 0.0009<br>(0.42) | 0.018 |

Panel C : Factor Loadings for APT Factor Portfolios

| Dependent Variable | Intercept | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Adjusted R-Square |
|---|---|---|---|---|---|---|---|
| DCF15Low | 0.1159<br>(39.20) | -0.0011<br>(-0.33) | 0.0121<br>(3.74) | -0.0078<br>(-1.94) | 0.0120<br>(2.39) | -0.0027<br>(-0.44) | 0.050 |

Panel D : Firm Characteristics

| Dependent Variable | Intercept | Ln(ME) | Ln(BE/ME) | E/P | D/P | Adjusted R-Square |
|---|---|---|---|---|---|---|
| DCF15Low | 0.1550<br>(16.72) | -0.0032<br>(-4.72) | -0.0102<br>(-5.32) | | | 0.068 |
| DCF15Low | 0.1582<br>(16.86) | -0.0032<br>(-4.72) | -0.0093<br>(-4.73) | -0.0480<br>(-1.98) | | 0.074 |
| DCF15Low | 0.1404<br>(15.82) | -0.0037<br>(-5.74) | -0.0136<br>(-7.38) | | 0.4740<br>(8.33) | 0.180 |

## Table 4B

## Cross-Sectional Regression Analysis On Individual Stock Returns On the Betas from Different Asset Pricing Models and Firm Characteristics For Non-Utility Companies In Sample As of December 31, 1992 (t-values in parentheses)

Panel A : CAPM Betas

| Dependent Variable | Intercept | Market Beta | Adjusted R-Square |
|---|---|---|---|
| DCF15Low | 0.1384<br>(25.19) | -0.0208<br>(-3.62) | 0.032 |

Panel B : Factor Loadings For Size and Book-to-Market Portfolios

| Dependent Variable | Intercept | Size (SMB) | Book-To-Mkt (HML) | Adjusted R-Square |
|---|---|---|---|---|
| DCF15Low | 0.1222<br>(55.44) | 0.0004<br>(0.16) | 0.0057<br>(2.35) | 0.010 |

Panel C : Factor Loadings for APT Factor Portfolios

| Dependent Variable | Intercept | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Adjusted R-Square |
|---|---|---|---|---|---|---|---|
| DCF15Low | 0.1273<br>(32.98) | -0.0089<br>(-2.19) | 0.0010<br>(0.26) | -0.0046<br>(-1.05) | 0.0191<br>(3.59) | -0.0100<br>(-1.54) | 0.048 |

Panel D : Firm Characteristics

| Dependent Variable | Intercept | Ln(ME) | Ln(BE/ME) | E/P | D/P | Adjusted R-Square |
|---|---|---|---|---|---|---|
| DCF15Low | 0.1528<br>(14.65) | -0.0028<br>(-3.59) | -0.0077<br>(-3.59) | | | 0.044 |
| DCF15Low | 0.1554<br>(14.66) | -0.0028<br>(-3.63) | -0.0073<br>(-3.34) | -0.0349<br>(-1.34) | | 0.046 |
| DCF15Low | 0.1237<br>(15.32) | -0.0033<br>(-5.67) | -0.0077<br>(-4.74) | | 1.0559<br>(16.67) | 0.454 |

**Table 4C**

**Summary Cross-Sectional Statistics for Betas In Different Pricing Models (All Companies in Sample as of December 31, 1992)**

| | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|
| **CAPM Beta** | 0.87 | 0.22 | 0.55 | 1.28 |
| **Fama & French Model :** | | | | |
| **SMB Loading** | 0.25 | 0.60 | -1.18 | 2.48 |
| **HML Loading** | -0.50 | 0.49 | -2.13 | 1.08 |
| **APT :** | | | | |
| **Factor 1 Loading** | 0.80 | 0.37 | -0.13 | 2.18 |
| **Factor 2 Loading** | 0.00 | 0.40 | -0.85 | 1.17 |
| **Factor 3 Loading** | -0.08 | 0.28 | -1.49 | 0.67 |
| **Factor 4 Loading** | -0.02 | 0.22 | -0.71 | 1.09 |
| **Factor 5 Loading** | -0.03 | 0.18 | -0.81 | 0.73 |
| **Firm Characteristics :** | | | | |
| **Ln(ME)** | 13.90 | 1.63 | 7.85 | 18.14 |
| **Ln(BE_ME)** | -0.49 | 0.58 | -3.58 | 1.71 |
| **E/P** | 0.06 | 0.04 | 0.00 | 0.56 |
| **D/P** | 0.04 | 0.02 | 0.02 | 0.20 |