

The Relative Cost of Capital for Marginal Firms over the Business Cycle

by Gikas A. Hardouvelis and Thierry A. Wizman

This article explores the differential effects of the business cycle on the opportunity cost of raising funds, the so-called cost of capital, for a cross-section of firms in the economy. Although much anecdotal evidence on the differential cost-of-capital effects exists, macroeconomists have not examined this issue rigorously. Traditional economics textbooks typically assume that the cost of capital is uniform across all firms in the economy. Empirical macroeconomic models rarely distinguish between the relative costs of capital for different types of firms. Furthermore, monetary policy in the United States does not aim at controlling credit selectively for different business sectors or types of firms.

Despite the dearth of economic research on this issue, informed opinion has long held that swings in business activity do not affect all firms equally. In particular, the performance of small firms or financially distressed firms has been considered susceptible to variation in economic conditions. Hence the cost of capital for such "marginal" firms may show greater cyclicity, responding with particular sensitivity to the advent of recessions. A "flight to quality" by investors anticipating hard times, or a general change in investors' attitudes toward risk as their own positions deteriorate, may disproportionately affect the cost of capital for firms that bear more systematic risk than their larger or stronger counterparts.¹

¹Additional channels of influence exist in an environment with asymmetric information. Mark Gertler and R. Glenn Hubbard have shown how a general deterioration in the collateral value of corporations during recessions might lead to higher capital costs for troubled firms. In an environment with asymmetric information, lenders require collateral value. If marginal firms come much closer

The reallocation of capital away from marginal firms during cyclical downturns can have important aggregate repercussions. An economy in which economic hardships are not equally distributed across firms is more vulnerable to adversity. A mild recession may turn into a severe recession following a wave of bankruptcies by marginal firms unable to refinance their obligations at relatively low costs.² Because variation in the costs of capital across firms can have such consequences, the issue deserves fuller exploration.

We begin our analysis by defining the cost of capital and describing our methods of measuring it. Next we examine how the cost of capital for a representative firm on the New York Stock Exchange and the American Stock Exchange varies with changes in the business

Footnote 1 continued

to bankruptcy in recessions, the probability-weighted or expected bankruptcy cost as a share of assets may increase more for marginal firms. Since this cost must be subtracted from tangible assets to derive the expected value of collateral, marginal firms may experience a greater deterioration in the expected value of collateralizable net worth, thereby incurring a relatively high external cost of capital ("Financial Factor in Business Fluctuations," in *Financial Market Volatility: Causes, Consequences and Policy Recommendations*, Federal Reserve Bank of Kansas City, 1988).

²William Lang and Leonard Nakamura present an example in which the loss of firms during a recession may lengthen the recession ("The Dynamics of Credit Markets in a Model with Learning," *Journal of Monetary Economics*, vol. 26 [1990], pp. 305-18). The relative capacity of small and large firms to borrow over the business cycle is examined in two recent articles: Stephen Oliner and Glenn Rudebusch, "The Transmission of Monetary Policy to Small and Large Firms," Board of Governors of the Federal Reserve System, Working Paper, 1992; and Mark Gertler and Simon Gilchrist, "The Role of Credit Market Imperfections in the Monetary Transmission Mechanism: Arguments and Evidence," Board of Governors of the Federal Reserve System, Working Paper, 1992.

cycle. The bulk of the empirical work deals with the cross-sectional differences among these firms. All non-financial firms traded on the New York and American stock exchanges are divided into portfolios according to accounting characteristics such as size, the ratio of book equity to market equity, leverage, and earnings. We then consider how the short-term cost of capital differs across the extreme portfolios and trace these differences throughout the sample period 1963-91. Finally, we estimate the cross-sectional sensitivity of the short-term cost of capital to different risk measures and track this sensitivity over the business cycle. Our analysis reveals that the relative cost of capital for marginal firms exhibits a counter cyclical pattern. We attribute this finding in part to a cyclical pattern in the cross-sectional sensitivity of the short-term cost of capital to the risk measures of size, book-to-market equity, and leverage.

What is the cost of capital?

Chief financial officers traditionally measure the cost of capital as the *weighted-average cost of capital* (WACC). The WACC is typically expressed as a weighted average of the expected returns to the equity- and debt-holders of the firm:

$$(1) \quad WACC = e \times [E(r^e)] + (1 - e) \times [E(r^d)].$$

$E(r^e)$ and $E(r^d)$ are the expected—or required—returns on equity and debt, respectively, and e is the share of equity in the total market capitalization of the firm.

To understand why the WACC is the opportunity cost of capital, consider the example of a firm contemplating an investment requiring an initial capital expenditure of \$50 million that is expected to yield a cash flow of \$60 million in the next year. The firm will compare the benefit from the project with the benefit that would arise if the firm committed the same \$50 million to a financial investment with comparable risk. If the expected benefit from the financial investment exceeds the benefit associated with the project, then the firm will forgo the capital expenditure and the project. The benefit from the financial investment, expressed as a rate of return, is the opportunity cost of a capital expenditure, or the cost of capital.³

In using WACC as a measure of the cost of capital, the finance literature assumes that the risk of the capital expenditure project is comparable to the average risk of

the firm's existing projects and that the financial markets are able to perceive and price the latter risk properly. However, the average risk of a firm's existing projects is equal to the average risk of the firm's debt and equity because of the balance sheet identity that equates the value of assets with the value of liabilities plus net worth. It follows that the opportunity cost of the commitment to the new project is the expected benefit from the financial investment of buying the existing mix of the firm's equity and debt, the WACC of equation 1. The higher this weighted average, the higher the cost of capital, and the less likely that new capital projects will be undertaken today.

In equation 1, the expected return on equity is the dividend yield, or dividends paid per share (D/P), plus the expected capital gain yield, or percentage change in price ($\Delta P/P$). The expected return on debt (for a one-period fixed-principal loan, for example) is positively related to the probability of default, π , and the interest rate charged, i , which in turn is usually expressed as a benchmark fixed rate (LIBOR, PRIME, T-BILL) plus a margin to reflect the risk class of the borrower.

Equation 1 helps illustrate how policy actions influencing the expected return on financial assets are linked to the level of capital expenditure by firms. Actions that increase a benchmark rate of interest increase the expected return on debt directly through i . But they also increase WACC indirectly through the expected return on equity, since investors seeking the highest risk-adjusted rates of return will bid down this price until the expected return on an equity investment reflects equity's opportunity cost. In this manner, the capital budgeting decisions of firms and the policy actions of governments are linked.

Measuring the cost of capital

In theory, measuring the weighted average cost of capital is straightforward: one first determines the costs of the individual sources of capital, equity and debt, and then computes the weighted average of these costs. In practice, however, the expected return on the debt portion is difficult to estimate. First, a database containing the rates of return on the debt instruments for a large group of firms does not exist, mainly because most debt instruments trade in thin markets and not all firms issue debt in organized markets. Second, small, risky firms usually do not have access to debt markets and instead rely upon banks for both short- and long-term borrowing. Unlike interest rate data from organized capital markets, data on contractual bank interest rates are largely undocumented. Third, even if we assume that a contractual rate of interest exists and is observable for all classes of firms and at each point in time, we cannot readily construct the corresponding expected return on

³To be sure, a firm making a capital budgeting decision must also match the financial return "horizon" with the lifespan of the prospective capital project to arrive at an appropriate cost of capital. For example, the return on a project that is expected to earn a cash flow over the next ten years must be compared with the return on the firm's financial claims over the same period if the capital project is not reversible and cannot be liquidated.

debt. The reason is that the contractual rate on a loan will differ from the expected return on that loan whenever default on the principal is possible, and the probability of default, π , is hard to estimate.

Unlike data from the debt markets, data from the stock markets are readily available. The Center for Research in Securities Prices, for example, maintains a database of monthly returns for all stocks traded on the New York Stock Exchange and the American Stock Exchange since 1962. For 1991, the database includes more than 5,000 firms, only a subset of which have access to organized nonintermediated debt markets. The wide availability of stock price data suggests that the expected return on equity may serve as the most practical proxy for the cost of capital for a wide range of firms.

Nevertheless, we need to consider how much a measure based on required stock returns alone would differ from the WACC. Theoretical considerations suggest that it will differ little. First, the market value of equity figures prominently in the value of total corporate capital, 70 percent on average over the sample period examined. Second, the required return on equity and the required return on debt are positively correlated. They share a common risk-free return, and their respective risk premia tend to move in the same direction over the course of the business cycle. Thus, for the purpose of studying the time variation in the *relative* cost of capital for firms differing by size, solvency, and net worth, data on the return to equity capital may be the most feasible guide. We pursue this approach below.

Predictability of stock returns and the cost of equity capital

We construct a time series of expected monthly returns for a firm (or portfolio of firms), j , by regressing the time-series of its realized monthly real stock returns, r_j^o , on a number of state variables, s_1, \dots, s_n . The state variables are observable measures that proxy for the fundamental determinants of expected monthly stock returns: the risk-free interest rate, the underlying unobservable risk of equity investments, and the price of that risk. The regression equation is as follows:

$$(2) \quad r_{j,t+1}^e = b_0 + b_{j,1}s_{1,t} + \dots + b_{j,n}s_{n,t} + u_{j,t+1}$$

By the properties of ordinary least squares, the fitted value from this regression, call it $\hat{r}_{j,t+1}^e$, is an unbiased conditional estimate of the expected rate of return $E_t(r_j^o)$. This is true even if we have misspecified the regression equation by omitting pertinent state variables that help forecast r_j^o . Because the realized return is regressed on a set of lagged state variables, the fitted value is unambiguously an *ex ante* return. The regression residual, u_j ,

represents the unanticipated component of the real stock return, which is driven by the effect of contemporaneous news.

Our use of a monthly return horizon for stocks is intended to capture the exact turning points of the cost of capital over the business cycle. Nevertheless, the choice of monthly returns is not innocuous and implies a specific interpretation of the cost of capital as a short-term equity cost of capital. The short-term cost of capital particularly affects a firm's choice of the optimal time to begin a long-term project. If the expected monthly financial return is high, a firm has an incentive to delay undertaking a long-term project in favor of reevaluating the relative merits of the project one month hence.⁴

What set of variables best determines expected returns? Recent research has isolated certain variables that help to predict returns on broad stock market indexes. Campbell and Shiller use the slope of the term structure of interest rates and the dividend yield on stocks as predictors of market returns. Fama and Schwert use inflation; Keim and Stambaugh, the yield spread between bonds of varying quality. Fama and French examine simultaneously the dividend yield, the term structure spread, and the default risk spread to predict both excess stock and bond market returns. Chen considers each of the state variables listed above as well as the level of short-term interest rates.⁵

The ability of financial variables to predict returns is not surprising. Prices derived in efficient financial markets incorporate investors' and borrowers' current per-

⁴For example, suppose that the current short-term cost of capital is 10 percent per period but is expected to revert to 5 percent per period next period and to stay at that level perpetually, so that the effective long-term cost of capital is 5 percent per period. A new firm with 100 dollars in cash is contemplating committing this sum to a capital project whose initial cost is 100 dollars any time the firm undertakes it. The project is expected to generate 5 dollars per period in perpetuity. The value of the firm in the next period will be 100 dollars, independent of the firm's decision to postpone the project or take it up immediately. However, the value of the firm today does depend on the timing of the project. If the firm commits the cash today, the market value of the firm today will fall to 95.45 dollars because this is the value that will make the expected capital gain return over the next year ($[5/95.45] \times 100$ percent) plus the cash flow return ($[5/95.45] \times 100$ percent) equal to the current required 10 percent return. To avoid a capital loss, the firm will postpone the investment to the next period.

⁵John Y. Campbell, "Stock Returns and the Term Structure," *Journal of Financial Economics*, vol. 18 (1987), pp. 373-99; John Y. Campbell and Robert J. Shiller, "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors," *Review of Financial Studies*, vol. 1 (1988), pp. 195-228; Eugene F. Fama and William Schwert, "Asset Returns and Inflation," *Journal of Financial Economics*, vol. 5 (1977), pp. 115-46; Donald B. Keim and Robert F. Stambaugh, "Predicting Returns in the Stock and Bond Markets," *Journal of Financial Economics*, vol. 17 (1986), pp. 357-90; Eugene F. Fama and Kenneth R. French, "Dividend Yields and Expected Stock Returns," *Journal of Financial Economics*, vol. 22 (1988), pp. 3-26; Nai-Fu Chen, "Financial Investment Opportunities and the Macroeconomy," *Journal of Finance*, vol. 46 (1991), pp. 529-54.

ceptions about the risk of future prospects as well as the underlying time discount rates. Investors' required rate of return in the stock market is not unrelated to their required rate of return from other assets. The observable prices of those other assets can, therefore, be useful in capturing the unobservable required rate of return in the stock market. We use these variables in our empirical exercises below.

This regression approach differs from the traditional approach to estimating the expected return on equity. The traditional approach, drawing on the capital asset pricing model (CAPM) of Sharpe, Lintner, and Markowitz, measures risk directly using the asset's "beta," that is, the covariance of the asset's return with the return on the stock market.⁶ Recent evidence, however, suggests that proxies for beta constructed using historical returns may suffer from measurement error and may not bear any relationship to expected returns.⁷ Rather than measure risk directly, our regression approach assumes that variation in fundamental risk and the price of that risk, although unobservable, are captured by the state variables.

Estimating the cost of capital for the representative firm

We estimate the cost of capital for a "representative" firm—that is, one that has risk-return characteristics similar to the stock market as a whole. The expected return for such a firm is the expectation of the value-weighted average of returns for all firms in the stock market.

Panel A of Table 1 presents evidence of the power of the economic and financial variables to predict the real return of the representative firm. The real return is the one-month value-weighted return on the New York Stock Exchange minus the rate of consumer price inflation. The table summarizes the results of regressing the real return on the values of the following predictive variables: the spread between yields on Aaa-rated and Baa-rated corporate bonds, QUAL; the spread between yields on ten-year Treasury bonds and three-month Treasury bills, TERM; the twelve-month percentage change in the consumer price index, INFL; cumulative dividends over the past twelve months divided by the last month's New York Stock Exchange price index (a

dividend yield), DYLD; and the three-month Treasury bill rate, TBIL. All independent variables are lagged one period in the regression. The box contains a more detailed description of the state variables.

The regression sample runs from August 1958 to December 1991. Although using a higher order lag specification increases the adjusted R² in some cases, it does not appreciably change the time series behavior of the fitted values of the regression. In the spirit of parsimony, therefore, we use the one-lag specification.

The results support a finding that the chosen variables are determinants of stock returns. With the exception of TERM, each predictive variable is significant at the 1 percent level. Furthermore, the estimation indicates that 11 percent of the variation in stock market returns can be explained using only one lag of the predictive variables. Since the monthly stock returns exhibit high variability, an R² of 11 percent is quite high

Table 1
The Cost of Capital of the Representative Firm
August 1958-December 1991

Panel A: Predicting the Real Return on the Value-weighted NYSE Index

$$RRET_t = \beta_0 + \beta_1 QUAL_{t-1} + \beta_2 TERM_{t-1} + \beta_3 INFL_{t-1} + \beta_4 DYLD_{t-1} + \beta_5 TBIL_{t-1} + u_t$$

β_0	β_1	β_2	β_3	β_4	β_5
-0.04 (0.01)	2.77 (0.82)	-0.55 (0.29)	-0.31 (0.12)	2.24 (0.56)	-0.65 (0.16)
	0.027	0.008	0.014	0.050	0.034

R² = 0.11 Durbin-Watson = 1.92

Panel B: The Cost of Capital of the Representative Firm over the Business Cycle

Change from Trough to Peak (Average across Six Recoveries)	Change from Peak to Trough (Average across Six Recessions)
-3.51	2.12

Notes: See the box for the definitions and descriptions of the variables. Inside the parentheses in panel A are standard errors corrected for conditional heteroskedasticity using the method in Halbert White, "A Heteroskedasticity-Consistent Covariance Matrix Estimator and Direct Test for Heteroskedasticity," *Econometrica*, vol. 48 (1980), pp. 817-38. The third row in Panel A reports the partial R² associated with each independent variable. Peaks and troughs in Panel B correspond to National Bureau of Economic Research reference cycles plus the 1966 credit crunch. Dates of peaks are: April 1960, August 1966, December 1969, November 1973, January 1980, July 1981, and July 1990. Dates of troughs are: April 1961, December 1966, November 1970, March 1975, July 1980, and November 1982.

⁶William F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance*, vol. 19 (1964), pp. 425-42; John Lintner, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics*, vol. 47 (1965), pp.13-37; Harry Markowitz, *Portfolio Selection: Efficient Diversification of Investments* (New York: Wiley, 1959)

⁷See Eugene F. Fama and Kenneth R. French, "The Cross Section of Expected Stock Returns," *Journal of Finance*, vol. 47 (1992), pp. 427-65.

but nonetheless unsurprising. As we mentioned earlier, in efficient markets, financial variables readily incorporate all current information about future economic prospects.

Table 1 also reports the *partial* R^2 of each predictive variable, defined as the loss in R^2 when the variable is removed from the general one-lag specification. The reported partial- R^2 s suggest that the greatest loss in predictive power comes from excluding the dividend yield.

The aggregate cost of capital over time

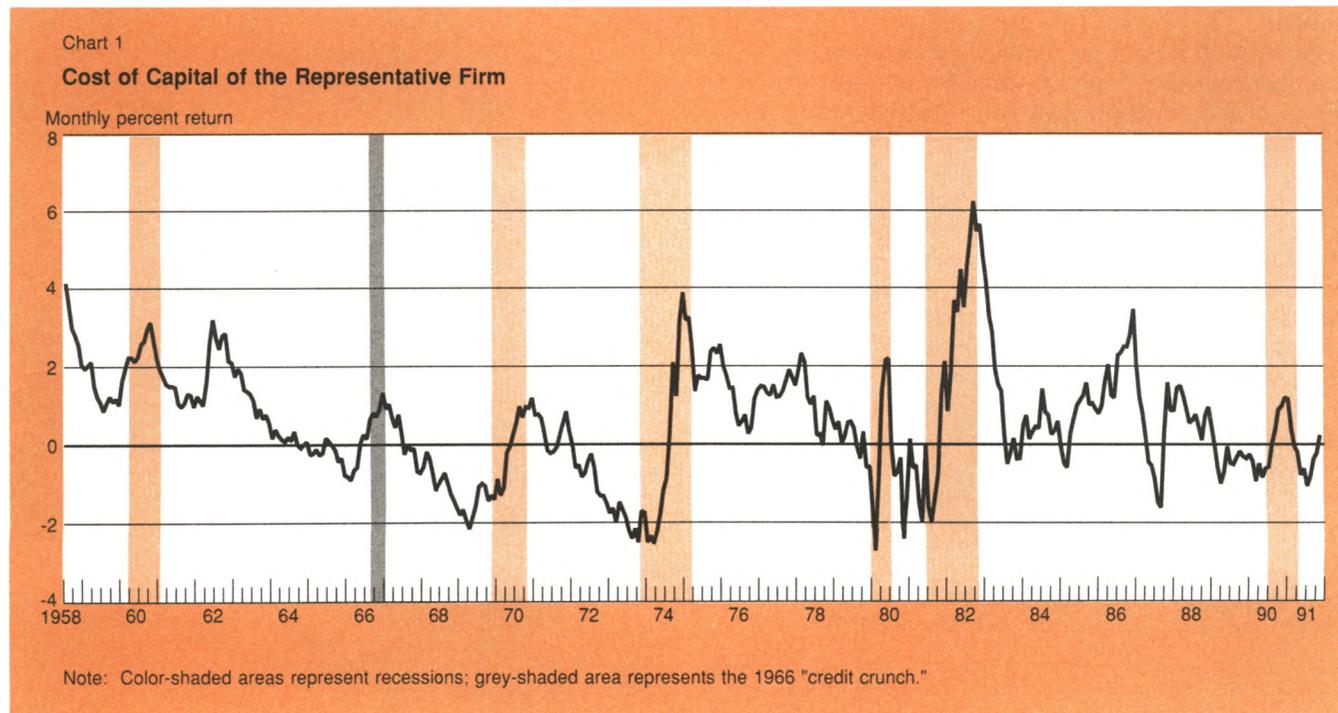
Chart 1 plots the cost of capital of the representative firm over three decades from 1958 to 1991. Color-shaded areas in the chart indicate periods of recession as defined by the National Bureau of Economic Research. The 1966 "credit crunch," which we date from August to December of 1966, is shaded in grey.⁸

Although the time-series mean of the expected monthly return on the representative firm is 0.6 percent (or 7.4 percent annualized), the chart shows that the aggregate cost of capital is not constant but has a strong cyclical property, reaching a peak toward the end of recessions. During recoveries it tends to decrease or stay the same.

⁸See Mark Wolfson, *Financial Crises* (Armonk, New York: M.E. Sharpe, 1982).

Other features of Chart 1 are also noteworthy. First, expected returns are especially volatile in the early 1980s. This period is characterized by strong gyrations in short-term interest rates (as well as in the term structure and quality spreads), a pattern that reflects economic uncertainty. Second, during the mid-1970s, there appears to be a string of *negative* expected returns. Although we would not expect the cost of capital to be negative, a negative measured expected return on the stock market may indicate measurement error. Alternately, the cost of capital in this period may indeed be negative. The negative expected return in the mid-1970s is not specific to the stock market. Huizinga and Mishkin show that during the same period the real rate of interest was negative. McCauley and Zimmer, using a different technique to approximate the cost of capital, find that this cost was negative during the part of the 1970s covered in their sample.⁹ Although investors may have anticipated higher inflation in this period, nominal interest rates did not adjust one-for-one with the increase in inflationary expectations. Whatever the explanation, the negative cost of capital estimates for

⁹See John Huizinga and Frederic Mishkin, "Monetary Policy Regime Shifts and the Unusual Behavior of Real Interest Rates," Carnegie-Rochester Conference on Public Policy, vol. 24 (1986), pp. 231-74; Robert McCauley and Steven Zimmer, "Explaining International Differences in the Cost of Capital," this *Quarterly Review*, vol. 14, no. 2 (Summer 1989), pp. 7-28.



the aggregate stock market in the 1970s do not affect our main analysis, which concentrates on the *relative* cost of capital between types of firms.

Another feature in Chart 1 that requires some explanation is the extreme values assumed by the expected return at the troughs of the 1974 and 1982 recessions. In the 1982 episode, this value is 6 percent, or four times the historical mean, measurement error notwithstanding.¹⁰ If compounded over twelve months, a 6 percent monthly return implies an annualized return of more than 100 percent. The implied annualized rate may not appear realistic either as an expected rate of return over a year or as a "hurdle rate" that prospective projects must meet to be judged worthwhile. Recall that our measure of the cost of capital is a short-term cost affecting the decision to postpone the project for a month in order to reevaluate its relative merits. Thus considered, an occasional monthly cost of capital of 6 percent, if short-lived, is not unrealistic. As Chart 1 indicates, the expected monthly rate of return may have a strong tendency to revert to its average value following large swings away from its norm. Thus, unusually large or small *ex ante* monthly rates of return are not necessarily expected to persist. A firm considering a capital project with a life of one year would probably not have gauged the project's expected long-term return against a cost of capital of 100 percent, but rather against a cost closer to the long-run annual return of 7 percent, albeit higher.¹¹

The average change in the representative firm's cost of capital during recoveries and recessions is summarized in Panel B of Table 1. The monthly cost of capital falls by 351 basis points from trough to peak and rises by 212 basis points from peak to trough.

Evolution of the relative cost of capital of marginal firms

Constructing portfolios of firms

This section analyzes the relative cost of capital for a cross-section of firms ranked by measures of size, financial distress, and leverage. We use monthly common stock returns of nonfinancial firms listed on the New York Stock Exchange and the American Stock Exchange whose returns data appear in the monthly tapes of the Center for Research in Securities Prices

tapes and whose income and balance sheet data appear in Standard and Poor's Industrial COMPUSTAT tapes.

Our analysis requires operational definitions of the criteria of size, distress, and leverage. We rely on the measures of operating performance that have been shown in earlier empirical studies to explain the cross-sectional variation in average stock returns.¹² We measure the *size* of a firm by the total market value of its equity (ME). One measure of distress is the ratio of book equity to market equity (BE/ME). A high value of book equity to market equity indicates that investors forecast poor future performance (a low market equity) relative to the firm's past performance (a high book equity). Distress is also associated with insolvency. Firms with negative current earnings (before special charges and extraordinary items) are less solvent; firms with positive current earnings are more solvent. Finally, we define leverage as the ratio of the balance sheet value of debt to the market value of equity (D/ME). The debt-to-market equity ratio is taken to be a measure of the future debt burden, although it may not be a good indicator of the current interest payment burden.¹³ A detailed description of the accounting variables can be found in the box.

Our analysis uses portfolios of firms to reduce the importance of idiosyncratic error attaching to the use of individual firms. We construct sixty portfolios based on three quantitative accounting criteria: market equity (ME); book-to-market equity (BE/ME); and debt-to-market equity (D/ME). We also construct two additional portfolios using a binary earnings (E) criterion: negative earnings or positive earnings.

For a given year, the first group of portfolios (numbers 1-20) is constructed by first ranking all firms in ascending order according to their market value of equity at the end of the previous December and then partitioning them into twenty equal groups by number. Portfolio 1, therefore, contains the smallest firms and portfolio 20 the largest firms, according to the market equity criterion.

The second group (numbers 21-40) and the third group (numbers 41-60) are formed by ranking and partitioning firms on the basis of book-to-market equity and debt-to-market equity, respectively. All firms with negative annual earnings at the end of the last December are placed in portfolio 61, while all firms with positive cumulative annual earnings are placed in portfolio 62.

¹⁰The standard errors of the estimates of the monthly cost of capital for the representative firm range from 0.3 percent to more than 1 percent over the sample period from August 1958 to December 1991.

¹¹One could, in principle, derive the long-term cost of capital from the short-term cost of capital, the state variables, and their joint autocorrelation properties. The main results of this article would not be affected, however, if the joint autocorrelation properties of the state variables and the individual portfolio returns are similar across the portfolios that we later construct.

¹²See Fama and French, "The Cross Section of Expected Stock Returns."

¹³A firm that has issued a large amount of zero coupon long-term debt, for example, may not be burdened with high interest payments at present.

Box: Definitions and Sources of Data**Stock market returns and state variables**

RRET: Value-weighted monthly New York Stock Exchange (NYSE) return (source: Center for Research in Securities Prices [CRSP]), less the monthly percentage change in the consumer price index (source: Bureau of Labor Statistics).

QUAL: Difference between the annualized bond-equivalent yields on Moody's Aaa-rated and Baa-rated corporate bonds (source: Citibase); monthly average of daily closing yields.

TERM: Difference between the annualized bond-equivalent yields of a ten-year Treasury bond and a three-month Treasury bill (source: Citibase); monthly average of daily closing yields.

INFL: Percentage change in the consumer price index over the preceding twelve months (source: Bureau of Labor Statistics).

DYLD: Cumulative dividends on the value-weighted NYSE over current and preceding eleven months (source: CRSP), divided by the current end-of-month value-weighted NYSE index.

TBIL: Annualized bond-equivalent yield of a three-month Treasury bill (source: Citibase); monthly average of daily closing yields.

Accounting variables

ME: Market value of equity defined as the price of stock multiplied by the number of shares outstanding (in millions of dollars, source: CRSP). Portfolio $\ln(\text{ME})$ is the average $\ln(\text{ME}_i)$ of all firms i in each portfolio. In the cross-sectional regressions of July of year t through June of year $t+1$, ME is the market equity at the end of June of year t . However, the twenty ME portfolios (numbers 1-20) for the same regressions are formed on the basis of each firm's market equity at the end of December of year $t-1$.

BE/ME: Ratio of book equity (BE) to market equity (ME). BE is defined as the book value of common equity plus balance-sheet deferred taxes in millions of dollars at the end of fiscal year $t-1$ (source: COMPUSTAT). ME is measured in millions of dollars at the end of December of year $t-1$. Portfolio $\ln(\text{BE/ME})$ is constructed as the average $\ln(\text{BE/ME}_i)$ across the firms in the portfolio. The year $t-1$ portfolio value of $\ln(\text{BE/ME})$ is used in the cross-sectional regressions of July of year t through June of year $t+1$.

D/ME: Ratio of book value of debt (D) to market value of equity (ME). D is total value of book assets minus book equity for the fiscal year ending in calendar year $t-1$ (source: COMPUSTAT). ME is measured in millions of dollars at the end of December of year $t-1$. Portfolio $\ln(\text{D/ME})$ is the average $\ln(\text{D}_i/\text{ME}_i)$ across firms in the portfolio. The year $t-1$ portfolio value of $\ln(\text{D/ME})$ is used in the cross-sectional regressions of July of year t through June of year $t+1$.

Portfolio formation

A. Portfolios 1-20, ranked annually by market value of equity, ME: All NYSE and American Stock Exchange (AMEX) firms in the cross section of the CRSP and COMPUSTAT tapes—excluding finance and real estate firms with two-digit SIC classification numbers 60-69—are equally divided into twenty portfolios of ascending order based on size. Size is measured by the market value of a firm's equity (ME) at the end of December of year $t-1$. Portfolio 1 contains the smallest firms while portfolio 20 contains the largest firms. These portfolios are used in constructing equal-weighted portfolio returns for the fiscal year from July of year t through June of year $t+1$.

B. Portfolios 21-40, ranked annually by book-to-market equity, BE/ME: All NYSE and AMEX firms in the cross section of the CRSP and COMPUSTAT tapes—excluding finance and real estate firms with two-digit SIC classification numbers 60-69—are equally divided into twenty portfolios of ascending order based on their book-to-market ratios, BE/ME. BE is the fiscal year $t-1$ COMPUSTAT value of a firm's common equity, and ME is the CRSP value of a firm's ME at the end of December of year $t-1$. Portfolio 21 contains firms with the smallest BE/ME, while portfolio 40 contains firms with the largest BE/ME. These portfolios are used in constructing equal-weighted portfolio returns for the fiscal year from July of year t through June of year $t+1$.

C. Portfolios 41-60, ranked annually by debt-to-equity ratio, D/ME: All NYSE and AMEX firms in the cross section of the CRSP and COMPUSTAT tapes—excluding finance and real estate firms with two-digit SIC classification numbers 60-69—are equally divided into twenty portfolios of ascending order based on their book debt-to-market equity, D/ME. D is the year $t-1$ COMPUSTAT value of a firm's book assets minus common equity and ME is the CRSP value of market equity at the end of December of year $t-1$. Portfolio 41 contains firms with the lowest D/ME, while portfolio 60 contains firms with the highest D/ME. These portfolios are used in constructing equal-weighted portfolio returns for the fiscal

Box: Definitions and Sources of Data (Continued)

year from July of year t through June of year $t+1$.

D. Portfolios 61-62, formed annually on the basis of negative or positive earnings: All NYSE and AMEX firms in the cross section of the CRSP and COMPUSTAT tapes—excluding finance and real estate firms with two-digit SIC numbers 60-69—are divided into two portfolios

according to whether earnings are positive (portfolio 61) or negative (portfolio 62). Earnings are cumulative over the firm's fiscal year that ends in calendar year $t-1$, and are defined as income before extraordinary items plus income-statement deferred taxes minus preferred dividends (source: COMPUSTAT).

Financial firms (Standard Industrial Classification numbers 60-69) are excluded from the portfolios primarily because their accounting numbers do not have the same economic significance as those of nonfinancial firms.

The portfolio rankings on the basis of the four variables are repeated every December from 1962 to 1990. As a result, the composition of firms in each portfolio changes on a yearly basis, as it would in a mutual fund, but the relative quantitative characteristic common to the firms in the portfolio does not. Having formed the portfolios on the basis of each December's rankings, we then generate the corresponding portfolio returns for the following July-June period as the equal-weighted average of the returns to the stocks in the portfolio. Our procedure leads to sixty-two time series of portfolio returns, from July 1963 to December 1991. Each portfolio's return series can be thought of as the time series of returns associated with a mutual fund whose composition changes each July.¹⁴

The average market equity of a firm in portfolio 1 is about twelve-hundred times smaller than the corresponding value for a firm in portfolio 20 (Table 2, Panel A). The average ratio of book equity to market equity is 0.15 for the firms in portfolio 21 and rises by a factor of 22 to 3.33 for the firms in portfolio 40. The average ratio of debt to market equity is 0.05 for the firms in portfolio 41 and rises by a factor of 164 to 9.03 for the firms in portfolio 60.

Panel A of Table 2 provides evidence on the cross-section of the historical average real return performance of the extreme portfolios. The average monthly real return corresponds to the average unconditional cost of capital. Historically, a typical investor in an average small firm (portfolio 1), as well as a firm with high book-to-market equity (portfolio 40), a high leverage ratio (portfolio 60), or negative earnings (portfolio 61), has

demanding a higher expected return. Column 2 lists the cumulative real returns on a 1 dollar investment in each portfolio made in June 1963. The largest discrepancy in investment performance is between the largest market equity firms, which yielded roughly 3 dollars as of December 1991, and the smallest market equity firms, which yielded 197 dollars. These results are consistent with intuition: over time, marginal firms are riskier and consequently must offer a higher return in order to attract investors.

Evidence on the time-series behavior of the relative cost of capital

To trace the relative cost of capital over time and examine how it varies with economic conditions, we construct the expected returns on the portfolios by regressing each of the sixty-two time series of real returns on the lagged state variables described earlier. The size portfolios are considered first. Chart 2 plots the relative cost of capital of small firms. The relative cost of capital is constructed as the *difference* in the fitted values of the real returns between the smallest and largest market equity portfolios (portfolio 1 minus portfolio 20). Chart 2 demonstrates that the relative cost of capital of the smallest firms has a decidedly countercyclical component. It rises during a recession and invariably peaks at its trough. Generally, it declines over expansions, albeit not uniformly. To be sure, the large increase in 1986 was not associated with an official recession, but recession conditions existed in some geographic regions. Moreover, like the 1966 episode, 1986 was associated with a minor slowdown in business activity during the first half of the year; nominal GNP of nonfinancial corporate business actually fell between the first and second quarters of 1986. Observe that the relative cost of capital was as large during the 1966 credit crunch as during the 1970 recession that followed. Neither episode was as significant as the 1975 or 1982 recession.

A string of negative relative costs of capital occurred during the early 1980s. On average, the 1980s differed from the 1960s and 1970s in this regard. Chart 2 sug-

¹⁴The use of a six-month gap between the month in which the accounting variable is measured and the first month over which we calculate returns ensures that the accounting variables, which we take to represent risk, are in the information set of the investor.

gests that the relative cost of capital of small firms in the 1980s was lower than the historical standard. This finding may reflect investors' underestimation of fundamental risk during the early period of the boom or the effect of lower capital gains taxes.

Chart 3 plots the difference between the expected return on the extreme portfolios ranked by book-to-market equity. Specifically, the chart shows the difference in the regression fits between the highest and lowest book-to-market equity portfolios (portfolio 40 minus portfolio 21). Again, a cyclical pattern emerges, although in this case the severity of the 1966 episode is muted. Unlike the relative cost of the smallest market equity firms, the estimated relative cost of capital for the largest book-to-market equity firms is invariably positive. Book-to-market equity may be a better indicator of fundamental risk than the size of the firm: it captures expected future performance relative to past perfor-

mance, and the expectation of poor performance may be associated with greater uncertainty about the firm's prospects.

Chart 4 plots the relative cost of capital of the most highly leveraged firms: the cost of capital for the largest debt-to-market equity firms minus the cost for the smallest debt-to-market equity firms (portfolio 60 minus portfolio 41). The series mimics the relative cost of capital for the smallest market equity firms plotted in Chart 2 and the largest book-to-market equity firms plotted in Chart 3.

In Charts 2-5, the recession that began in July 1990 also affected the cost of capital in the typical way. Although the rise in the relative cost of capital was as pronounced as in the 1966 and 1969 episodes, the duration of the rise was shorter. The unavailability of recent 1992 data prevents us from examining whether the relative cost of capital has subsequently risen further.¹⁵

Table 2

Portfolio Characteristics

July 1963-December 1991

Panel A: Relative Investment Performance of the Extreme Portfolios

	Average Monthly Real Return (Percent)	Cumulative Value in December 1991 of One Dollar Invested in June 1963 (Inflation Adjusted, in Dollars)
Extreme ME portfolios		
Lowest ME portfolio (1) with average ln(ME) = 1.18	1.96	197.66
Highest ME portfolio (20) with average ln(ME) = 8.30	0.44	3.17
Extreme BE/ME portfolios		
Lowest BE/ME portfolio (21) with average ln(BE/ME) = 1.89	0.44	2.15
Highest BE/ME portfolio (40) with average ln(BE/ME) = 1.19	1.19	67.15
Extreme D/ME portfolios		
Lowest D/ME portfolio (41) with average ln(D/ME) = -2.90	0.50	3.08
Highest D/ME portfolio (60) with average ln(D/ME) = 2.20	1.35	34.84
Negative earnings portfolio (61)	1.28	22.71
Positive earnings portfolio (62)	0.86	10.70

Panel B: Time Average of Cross-sectional Correlations of Portfolio Characteristics (Portfolios 1-62, July 1963-December 1991)

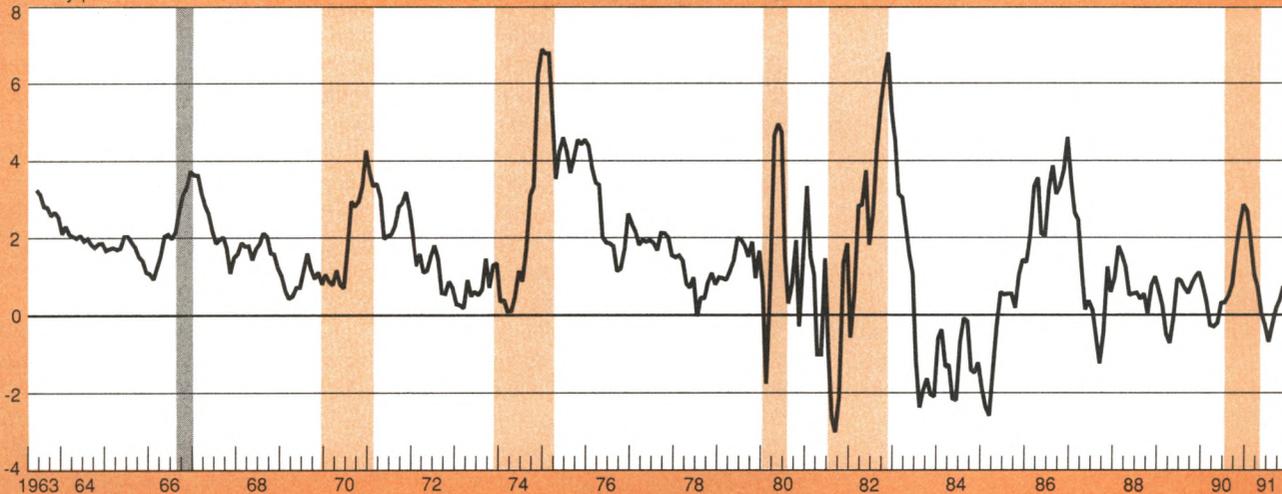
r_j	1.0	\hat{r}_j	0.16	$\ln(\text{ME})_j$	-0.038	$\ln(\text{BE/ME})_j$	0.071	$\ln(\text{D/ME})_j$	0.055
\hat{r}_j		1.0		-0.438	1.0	0.510	-0.547	0.437	
$\ln(\text{ME})_j$				1.0		-0.560		-0.547	
$\ln(\text{BE/ME})_j$						1.0		0.880	
$\ln(\text{D/ME})_j$								1.0	

Notes: The variable r is the real return of the portfolio; \hat{r} is the fitted value of the real return. See the box for the definitions and descriptions of the other variables.

Chart 2

Cost of Capital for Firms with Low Market Equity minus Cost of Capital for Firms with High Market Equity

Monthly percent return

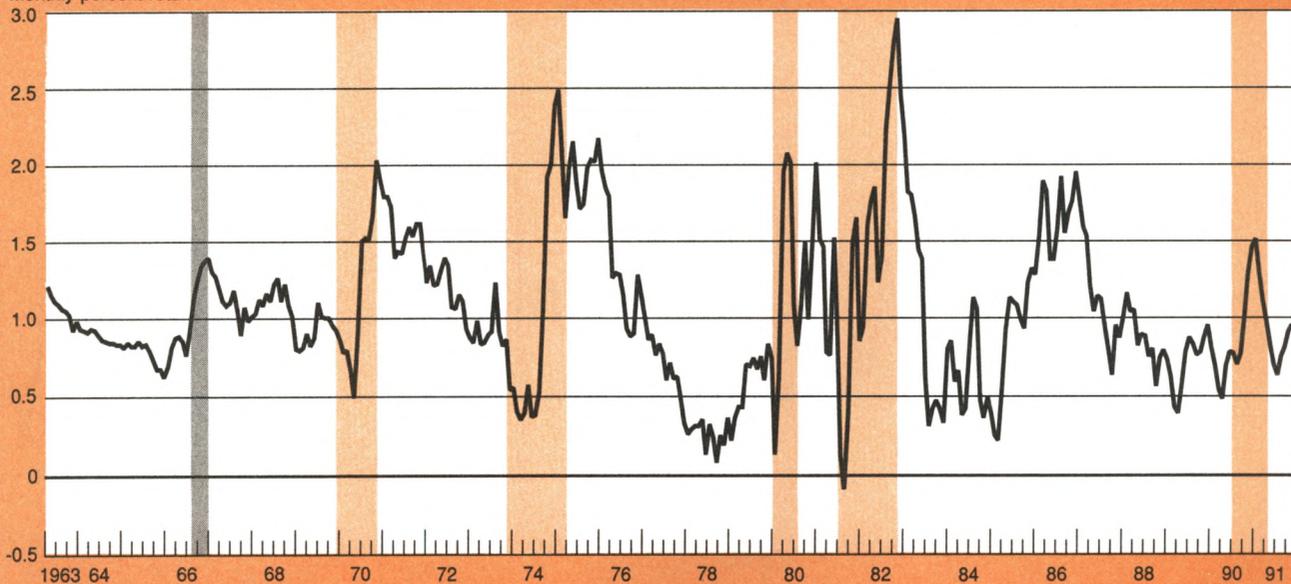


Note: Color-shaded areas represent recessions; grey-shaded area represents the 1966 "credit crunch."

Chart 3

Cost of Capital for Firms with High Book-to-Market Equity minus Cost of Capital for Firms with Low Book-to-Market Equity

Monthly percent return



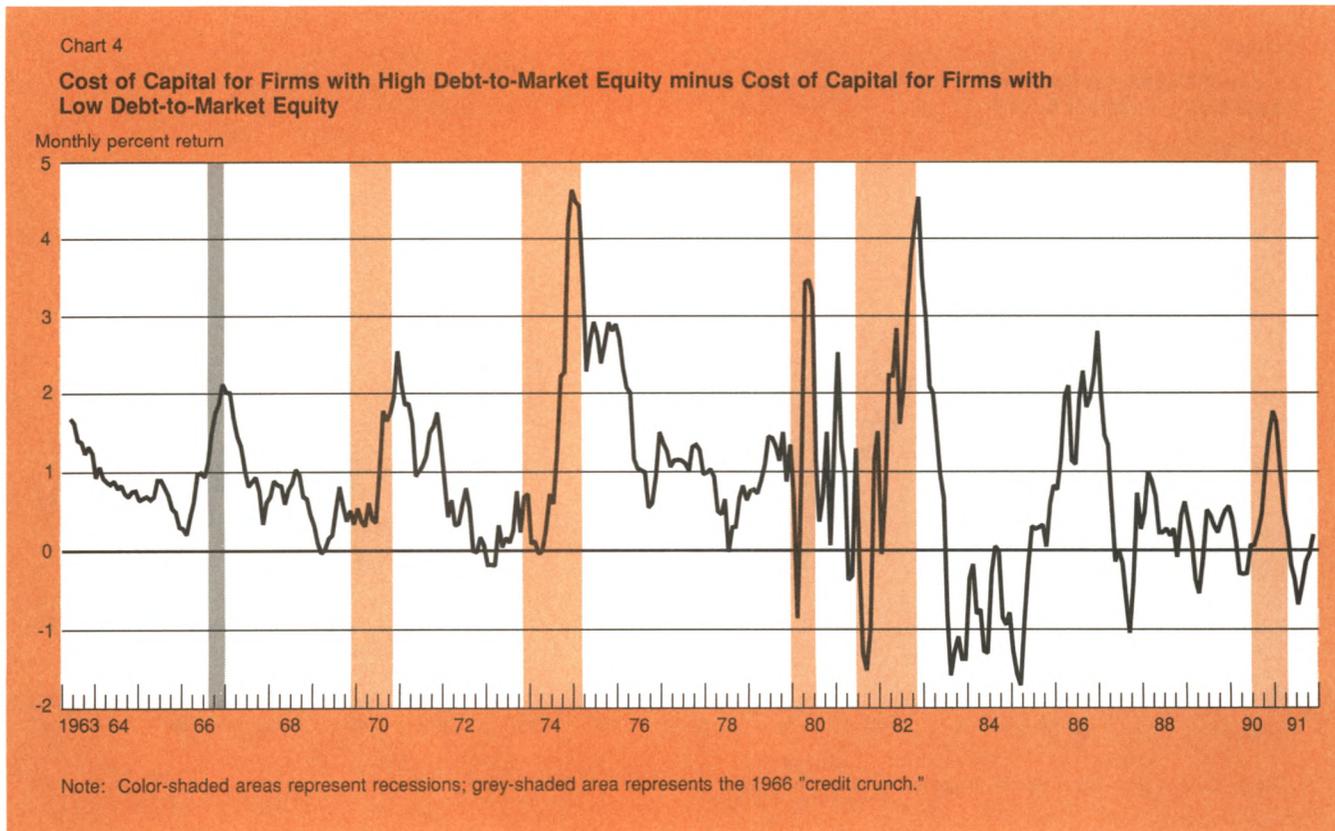
Note: Color-shaded areas represent recessions; grey-shaded area represents the 1966 "credit crunch."

When Charts 2, 3, and 4 are considered collectively, the most striking feature is the nearly identical pattern in the relative costs of capital. In part, this shared pattern reflects the use of a common variable, the market value of equity in the measures of size, distress, and leverage. Nevertheless, the measures do impart independent information about the risk of a firm. Not all of the cross-sectional variation in the first risk factor, market equity, is explained using the other risk factors. In Panel B of Table 2, the average cross-sectional correlation of the log of book-to-market equity, $\ln(\text{BE}/\text{ME})$, with the log market equity value, $\ln(\text{ME})$, is -0.56 , a result that implies a univariate R^2 of only 0.31. The cross-sectional correlation of the log debt-to-equity, $\ln(\text{D}/\text{ME})$, with the log of market equity, $\ln(\text{ME})$, is -0.55 , implying a univariate R^2 of 0.30. The correlation between $\ln(\text{BE}/\text{ME})$ and $\ln(\text{DE}/\text{ME})$ across the sixty-two portfolios is somewhat higher at 0.88, implying a univariate R^2 of 0.77.

¹⁵In the charts, the recession that officially began in July 1990 ends in May 1991. But since May 1991 is not an official recession trough, the 1990 recession is not considered in computing the peak-to-trough averages in the tables accompanying the text.

The relative cost of capital of “insolvent” firms is shown in Chart 5. The chart represents the expected return on the portfolio of firms having negative earnings (portfolio 61) minus the expected return for the portfolio of firms with positive earnings (portfolio 62). Although the sorting criterion for constructing these two portfolios makes no reference to each firm’s market value of equity, the historical pattern of relative expected returns is similar to the pattern that emerged in the extreme portfolios’ relative cost of capital when we used the other risk criteria. We conclude that the similar cyclical pattern produced in Charts 2 through 5 is not spurious; rather it represents common business cycle variation in the relative cost of capital for the “riskiest” of firms, however defined.

Panel A of Table 3 summarizes some of the main evidence from this section by tabulating the average trough-to-peak and peak-to-trough changes in the relative cost of capital depicted in Charts 2-5. The business cycle variation in the relative monthly ex ante rate of return is largest for the smallest market equity portfolio, declining from trough to peak by 366 basis points and then rising from peak to trough by 329 basis points. The



business cycle variation in the monthly cost of equity capital for the largest book-to-market firms is less pronounced; it falls and then rises by 99 basis points over the full cycle.

The sensitivity of the cost of capital to the amount of risk

The evidence so far suggests that the cost of capital of the riskiest of firms fluctuates more than that of the safest firms over the business cycle, but it reveals little about the source of these relative changes. Differences between the required rates of return on the extreme portfolios may vary over time as a result of variations in either the "price" of risk—the sensitivity to size, leverage, and distress—or the relative quantity of risk—relative size, leverage, and distress. The price of risk may change as investors' attitudes toward risk change over the business cycle. The relative amount of risk may change if, for example, the leverage of the highly levered firms increases by more than that of the less levered firms during an economic downturn.

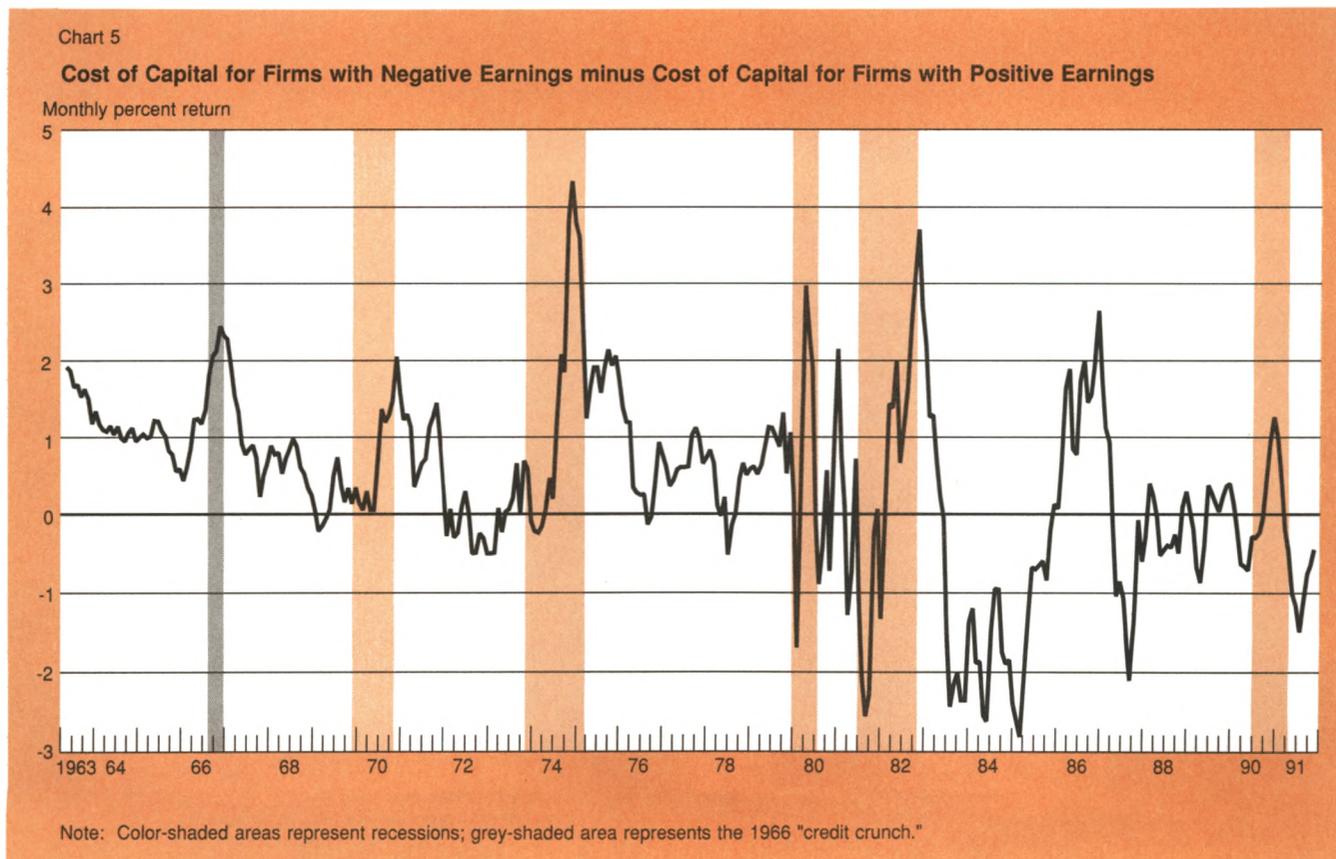
In this section we separate the price of risk from the

quantity of risk by estimating the cross-sectional sensitivity of the cost of capital to our accounting measures of size, distress, and leverage. We trace the evolution of these sensitivities over business cycles. Such an exercise allows us to interpret the observed changes in the relative cost of capital more effectively. Furthermore, the analysis uses the entire cross-section of firm portfolios instead of the extreme portfolios.

We can think of the expected return for a firm j , or its cost of capital, as the sum of a risk-free rate and a risk premium. This risk premium is the product of the underlying price of risk and the amount of risk:

$$(3) \quad E(r_{j,t+1}^e) = r^f(S_t) + \gamma(S_t) \times \sigma_j(S_t)$$

where $E(r_j^e)$ represents the expected return for firm (or portfolio) j , $\sigma_j(S_t)$ represents the amount of risk attached to j , and $\gamma(S_t)$ represents the price of risk or the sensitivity of the expected return to the amount of risk. The term $r^f(S_t)$ is constant across the portfolios but varies over time and reflects, among other things, the risk-free rate. Observe that the price of risk, $\gamma(S_t)$, is the same



across firms, reflecting a common sensitivity to the amount of risk, but can vary over time with the economic state, denoted by S_t . The quantity of risk, $\sigma_j(S_t)$, can vary both across firms and across time. Equation 3 is similar to equation 1, except that we have broken out the effect of the state variables on the price of risk from the effect on the amount of risk.

Equation 3 suggests a way of estimating the price of risk γ : each month, regress the cost of capital for a cross-section of twenty portfolios on measures that

serve as proxies for the underlying risks, specifically on the natural logarithms of ME, BE/ME, and D/ME.¹⁶ The cross-sectional regressions have the form:

$$\begin{aligned} \hat{r}_j^e &= \alpha + \gamma_{ME} \times \ln(ME)_j & j &= 1, \dots, 20 \\ \hat{r}_j^e &= \beta + \gamma_{BE/ME} \times \ln(BE/ME)_j & j &= 21, \dots, 40 \\ \hat{r}_j^e &= \delta + \gamma_{D/ME} \times \ln(D/ME)_j & j &= 41, \dots, 60 \end{aligned}$$

¹⁶Fama and French ("The Cross Section of Expected Stock Returns") suggest that using the log transformation of ME, BE/ME, and

Table 3

Changes in the Relative Cost of Capital of Small, Distressed, and Leveraged Firms over the Business Cycle

July 1963-December 1991

Change in:	Change from Trough to Peak (Average across Five Recoveries, in Percent)	Change from Peak to Trough (Average across Five Recessions, in Percent)
Lowest ME portfolio minus highest ME portfolio (1 minus 20)	-3.66	3.29
Highest BE/ME portfolio minus lowest BE/ME portfolio (40 minus 21)	-0.99	0.99
Highest D/ME portfolio minus lowest D/ME portfolio (60 minus 41)	-2.35	2.12
Negative earnings portfolio minus positive earnings portfolio (61 minus 62)	-2.08	1.75

Notes: Construction of variables is described in the box. Peaks and troughs correspond to National Bureau of Economic Research reference cycles plus the 1966 credit crunch. Dates of peaks are: August 1966, December 1969, November 1973, January 1980, July 1981, and July 1990. Dates of troughs are: December 1966, November 1970, March 1975, July 1980, and November 1982.

Table 4

The Average Cross-sectional Sensitivity of the Cost of Capital to Market Equity, Book-to-Market Equity, and Debt-to-Market Equity

July 1963-December 1991

Panel A: Twenty Portfolios Ranked Annually by Value of Market Equity

$$\hat{r}_j = 1.485 - 0.150 \ln(ME)_j; \quad R^2 = 0.550$$

(0.178) (0.013) (0.017)

$j = 1, 2, \dots, 20$

Panel B: Twenty Portfolios Ranked Annually by Ratio of Book Equity to Market Equity

$$\hat{r}_j = 0.931 + 0.387 \ln(BE/ME)_j; \quad R^2 = 0.504$$

(0.112) (0.009) (0.012)

$j = 21, 22, \dots, 40$

Panel C: Twenty Portfolios Ranked Annually by Ratio of Debt to Market Equity

$$\hat{r}_j = 0.845 + 0.140 \ln(D/ME)_j; \quad R^2 = 0.279$$

(0.112) (0.009) (0.011)

$j = 41, 42, \dots, 60$

Notes: A cross-sectional regression is performed in each of the 342 months of the sample. The reported coefficients and R²s are the time series averages of the cross-sectional values. Inside the parentheses are the standard errors based on the *time-series* variability of the cross-sectional estimates. The variable \hat{r}_j is portfolio j 's cost of capital in percent per month, computed from the time series regression of the form in equation 2. The accounting variables are described in the box.

where the \hat{r}_j^e are the fitted values from the sixty time series regressions of the portfolio returns on the macroeconomic state variables. Each equation is estimated for each month from July 1963 to December 1991 to obtain a time series of coefficient estimates, $\{\gamma_{ME}\}$, $\{\gamma_{BE/ME}\}$, and $\{\gamma_{D/ME}\}$.¹⁷

The time series averages of the coefficient estimates, $\bar{\gamma}_{ME}$, $\bar{\gamma}_{BE/ME}$, and $\bar{\gamma}_{D/ME}$, appear in Table 4. These coefficients represent the "prices," expressed as semi-elasticities, attached to each dimension of risk measured by $\ln(ME)$, $\ln(ME/BE)$, and $\ln(ME/A)$, respectively. The estimated $\bar{\gamma}_{ME}$ tells us that on average the expected monthly return (cost of capital) increases by 0.15 percent—15 basis points—as we decrease the market value of the firm by 1 percent. The estimated $\bar{\gamma}_{BE/ME}$ indicates that on average the cost of capital increases by 39 basis points as book-to-market equity increases by 1 percent. Finally, the estimated $\bar{\gamma}_{D/ME}$ implies that on average the cost of capital increases by 14 basis points as the debt-to-equity ratio increases by 1 percent. Although it is difficult to interpret the relative magnitudes of these numbers, the standard errors attached to the estimates suggest that they are estimated quite precisely.

How does the price of risk change over the business cycle? Panel A of Table 5 displays the average peak and trough values of the price of risk, with risk measured by our three criteria. At business cycle peaks,

investors require an additional 3 basis points in the expected monthly return to bear the risk of an additional 1 percentage point decline in the market value of a firm's equity. At recession troughs, however, a similar decrease in the value of a firm is associated with an additional 54 basis points in the monthly required return. In other words, investors have become more averse to size-related risk over the course of a recession. The other price-of-risk measures move similarly over the business cycle.

Conclusion

This article uses the expected rate of return on a firm's stock as a measure of the firm's cost of capital. To estimate the expected rate of return, we regress the realized real stock return of the firm on a parsimonious set of financial variables. The regression fit is a proxy for the firm's expected monthly rate of return, or its short-run cost of capital. The short-run cost of capital affects a firm's decision to postpone a capital project and is also related to the long-term cost of capital if the short-run required rates of return show some persistence.

The weight of evidence suggests that the business cycle has a differential impact on the costs of capital of firms grouped by size, distress, and financial leverage. From peak to trough of a recession, the premium in the cost of capital for the smallest over the largest firms—what we call the relative cost of capital—increases by 329 basis points on a monthly basis. From trough to peak of an expansion, the same premium declines by 366 basis points. Similar variations in the relative cost of capital are observed when firms are grouped according to other characteristics. For example, the premium

Footnote 16 continued

DE/ME provides a better specification of the relationship between these variables and average expected returns.

¹⁷The estimated γ 's remain approximately the same if, instead of the cost of capital \hat{r}_j^e , we use the raw return, r_j^e , as the dependent variable.

Table 5

The Cross-sectional Sensitivity of the Cost of Capital to Market Equity, Book-to-Market Equity, and Debt-to-Market Equity over the Business Cycle

July 1963-December 1991

Semi-elasticities	Sensitivity at Cyclical Peaks and Troughs	
	Average of Six Peak Months	Average of Five Trough Months
Semi-elasticity of expected return with respect to ME	-0.03	-0.54
Semi-elasticity of expected return with respect to BE/ME	0.40	0.46
Semi-elasticity of expected return with respect to D/ME	0.10	0.33

Notes: Construction of variables is described in the box. Peaks and troughs correspond to National Bureau of Economic Research reference cycles plus the 1966 credit crunch. Dates of peaks are: August 1966, December 1969, November 1973, January 1980, July 1981, and July 1990. Dates of troughs are: December 1966, November 1970, March 1975, July 1980, and November 1982.

of firms with negative earnings increases from peak to trough by 175 basis points and decreases from trough to peak by 205 basis points.

The change in the marginal firms' relative monthly cost of capital is attributable in part to a change in the cross-sectional sensitivity of the cost of capital to each of the three characteristics—market value, book-to-market equity, debt-to-equity ratio—used as proxies for risk in this study. This sensitivity can be thought of as the price of risk, with the quantity of risk captured by the accounting variables. At business cycle peaks, a 1 percent increase in market equity leads to an average reduction in the cost of capital of 3 basis points. At business cycle troughs, however, a 1 percent increase in market value elicits a 54 basis point reduction in the cost of capital. The positive elasticity of the cost of capital to the debt-to-equity ratio also varies considerably across the cycle, rising threefold from peak to trough. The sensitivity of the cost of capital to book-to-market equity follows a similar pattern, although its

variability is less pronounced.

Our regressions indicate that the asymmetric effects of the business cycle on marginal firms' cost of capital are not trivial. Therefore, it is appropriate to consider the broader economic consequences of these effects. First, such effects may be an important element in the propagation and duration of the business cycle. A sharp increase in the cost of capital to small, highly leveraged, or distressed firms could transform a decline in aggregate demand or some other shock to economic activity into a downturn large enough to be judged a recession. Second, the differential effect of the business cycle upon the cost of capital may influence industrial structure by promoting merger activity. Small, distressed, or highly levered firms that wish to overcome a competitive disadvantage in the market for capital during recessions may seek to merge so as to achieve a lower cost of capital. Such possible repercussions should prompt economists to look more closely at this issue.