# EFFECTS OF INFLATION ON CAPITAL STRUCTURES AND THE COST OF CAPITAL IN THE 1980's

Eugene F. Brigham and Dilip K. Shome*

As we enter the decade of the 1980's, inflation is a foremost concern in the minds of most financial experts. The purpose of this paper is to consider how inflation in the 1980's might influence the following:

1. The cost of short-term and long-term debt.

2. The cost of common equity.

3. The optimal maturity structure of corporate debt.

4. The optimal debt-equity mix.

Our major conclusions are as follows: (1) If inflation rates remain high, then the yield curve will tend to slope upward more steeply than in the past (or slope downward less steeply when the yield curve is inverted). (2) This yield curve situation will lead firms to shorten the average maturities of their liabilities, even though this will expose them to greater risks of earnings fluctuations or even bankruptcy. (3) The cost advantages to having a stronger financial posture and higher rated bonds will probably increase if inflation remains high in the 1980's. (4) Contrary to the conventional wisdom of the 1960's and earlier years, the risk premium of stocks over bonds seems to increase as the rate of inflation rises. This suggests that a high and rising rate of inflation might cause firms' optimal capital structures to shift toward more debt and less equity. However, the statistical basis for this conclusion is not strong, and it also is in disagreement with Point (3) above. Accordingly, we are unable to make any strong statements about how inflation affects the optimal debt-equity mix.

*University of Florida.

## EFFECTS OF INFLATION ON INTEREST RATES

Irving Fisher many years ago demonstrated that the nominal interest rate at time t on a default-free security is approximately equal to a real rate of return plus a premium which reflects the average expected inflation rate over the security's life:

$$RF = RRF + I_a. \tag{1}$$

RF is the yield to maturity on the security, RRF is the real risk-free rate, and $I_a$ is the average expected inflation rate over the life of the security. Table 1 defines these and other terms in more detail, and Equation 1 is called the Fisher Equation.

Given a set of expectations about the inflation rate in each future year, $I_t$, and an estimate of the (constant) real risk-free rate, RRF, we could estimate the set of expected future rates on Treasury bonds of different maturities. It can easily be shown that if the expected rate of inflation rises then interest rates will rise by approximately the same amount:

$$\Delta RF_{t,n} = \Delta I_{a(t,n)}. \tag{2}$$

This phenomenon of interest rates' changing with changes in the expected inflation rate is the now-familiar "Fisher Effect."

One could, conceptually, test Equations 1 and 2, but data on expected inflation would be necessary. There is a series on expected inflation (the Livingston series), but these data reflect only expectations going out fourteen months. Thus, they can only be used to test the Fisher Effect for relatively short-term debt. Fama [6] has studied this question, and he finds that the Fisher Effect is indeed present.

An alternative test involves examining realized holding period returns (HPR) rather than expected returns. In essence, one could run this regression:

$$HPR_t = a_0 + a_1 I_t + a_2(AI_t - I_t). \tag{3}$$

Here $a_0$ is an intercept term which should be equal to RRF [or RRF + a risk premium (RP) if the HPR refers to a risky security]; $I_t$ is the expected inflation during Period t, and $(AI_t - I_t)$ is the actual inflation minus the expected

## Table 1. LIST OF DEFINITIONS

| | |
|---|---|
| $RF_{t,n}$ | = Yield to maturity (YTM), or nominal rate of interest, on U.S. Treasury securities bought at t and maturing in n years. Examples: $RF_{0,1}$ = rate today on 1-year bills; $RF_{1,1}$ = rate expected next year on 1-year bills (forward rate); $RF_{0,5}$ = YTM today on 5-year bonds. |
| RRF | = Real risk-free rate on U.S. Treasury securities. RRF depends on (1) the propensity to save and (2) the productivity of capital. Ex post, RRF varies over time. Ex ante, it seems to be a constant in the vicinity of 2 to 2½ percent. |
| $AI_t$ | = Actual inflation experienced during Period t. |
| $I_t$ | = Expected rate of inflation in Year t. $I_t$ is thought to be a distributed lagged function of past inflation, plus other factors (e.g., elections, energy supplies). |
| $I_{a(t,n)}$ | = Average expected inflation rate over the Period t to n. |
| $RP_I$ | = Risk premium associated with capital losses resulting from unanticipated inflation. |
| $RP_0$ | = Risk premium associated with default losses. |
| DP | = Default premium. DP is equal to the PV of expected default losses on a secutiy. |
| $L_{0,n}$ | = Liquidity risk premium at time 0 for bonds that mature in year n. This liquidity premium reflects, primarily, the risk of capital losses on outstanding bonds if interest rates rise. Since the risk of capital losses (interest rate risk) is greater the longer a bond's maturity, liquidity risk premiums increase as maturity increases. |

inflation, or the unanticipated inflation during Period t. If $a_1 = a_2 = 1.0$, then the bond would represent a perfect hedge against inflation. Fama and Schwert [7] tested Equation 3, and they found $a_1 \simeq 1.0$ but $a_2 \simeq 0$, indicating that bonds do offer a hedge against expected inflation, but that they do not offer a hedge against unexpected inflation.

If expectations for future inflation increase, then current interest rates will rise, and if current interest rates rise, then the prices of outstanding bonds will decline. Further, the longer the maturity of the bond, the greater will be its capital loss. Thus, whereas all bonds are subject to the risk of purchasing power losses if inflation rates are greater than anticipated, long-term bonds are exposed to additional capital loss risks caused by rising inflation rates and interest rates. This "interest rate risk" inherent in long-term bonds gives rise to liquidity risk premiums, which cause the yield curve to have more of an upward slope (or less of a downward slope when the yield curve is inverted) than would be true under the pure expectations theory. Figure 1 illustrates this point. The liquidity risk premium, $L_n$, increases with maturity, and this premium is added to the yield curve based on the expectations theory to produce the actual observed yield curve.[1]

As noted above, there have been numerous attempts to test for the determinants of yield curves. The evidence is clear that expectations about future inflation and interest rates do have a pronounced influence on the yield curve, and the evidence also supports the liquidity premium hypothesis.

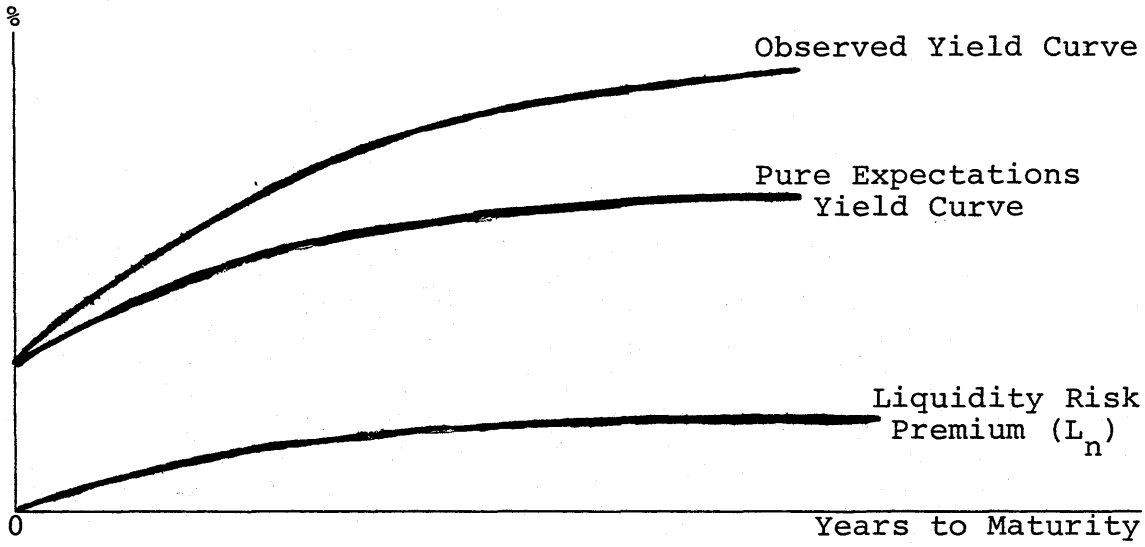
## Effects of Inflation on Liquidity Preferences and the Slope of the Yield Curve

As noted above, realized inflation can be divided into two components: (1) expected (or anticipated) and (2) unexpected (or unanticipated). Expected inflation is built into interest rates as calculated by the pure expectations theory, while unexpected inflation affects liquidity premiums. To see why this is so, consider the following:

1. Inflation in the U.S. in the 1950's and early 1960's was generally in the 1 to 2 percent range. Year-to-year changes in the rate were small, so there were no large, unanticipated increases in inflation which

[1] Based on our studies of the literature, we can find no strong support either for or against the Market Segmentation, or supply-demand, hypothesis.

Figure 1. EFFECT OF LIQUIDITY RISK PREMIUMS ON THE YIELD CURVE




might have caused dramatic increases in the interest rate. Since there were no large, unanticipated increases in interest rates, there were no large capital losses on long-term bonds.

2. The trend in actual inflation rates since the mid-1960's has been upward. The apparent cause of inflation has been debated (cost-push versus demand-pull, labor unions versus corporations, energy, cost-of-living adjustments in wage and other contracts, government deficits, excessive growth in the money supply, and so on), but whatever the basic reasons, the inflation rate has been increasing.

3. Expectations regarding future inflation seem to be based in large part on past realized inflation rates. In the 1950's and early 1960's, investors expected future inflation rates to fall in the 1 to 2 percent range, and they seemed to be fairly confident about this range. Thus, we can think of the expected annual inflation rate for the period 1960-1964, viewed from the beginning of 1960, as being about 1½ percent and having a small standard deviation ($\sigma_I$).

4. If $\sigma_I$ were zero, then all inflation would be anticipated and built into the structure of interest rates, government bond prices would be highly predictable, and there would be essentially no losses on bond portfolio holdings. On the other hand, if $\sigma_I$ were large, then actual inflation rates would often be

quite different from expected rates, interest rates would change dramatically over time, and the prices of long-term bonds would experience wide fluctuations. Thus, the interest rate risk inherent in long-term bonds is directly dependent on uncertainty about future inflation, $\sigma_I$. Therefore, the liquidity premium should increase as uncertainty about inflation increases.

5. As we show later in the paper, it has been demonstrated that uncertainty about future inflation increases as the level of actual, current inflation rises. This suggests that liquidity premiums should be higher today than they were in earlier years. This, in turn, has important implications for the yield curve in the future: in periods when inflation, hence the short-term interest rate, is expected to rise, the yield curve will slope up more sharply than in the past because of the now higher liquidity premiums, and when inflation and short-term interest rates are expected to decline, the (inverted) yield curve will be flatter than it would have been in times with less uncertainty about inflation.

## Effects of Inflation on Corporate Interest Rates

The yield to maturity, or "promised yield," on corporate debt of a given maturity is generally regarded as consisting of the interest rate on a Treasury security of the same maturity plus (1) a default premium equal to the present value of expected default losses, (2) a premium that reflects any differences that may exist in call provisions on government and corporate bonds, (3) a marketability premium which reflects the lack of marketability of certain corporate bonds, and (4) a pure risk premium which reflects risk aversion.[1] Changes in the expected rate of inflation could affect any or all of these types of premiums. For example, higher inflation rates and greater uncertainty about inflation might increase the probability of default, hence default premiums. This, in turn, might lead to higher risk premiums on corporate debt.[2]

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[1] See Ferri [8] for an example of a study which decomposes the spread between corporate and government bonds into the different types of premiums discussed above. The call premium effect seems easiest to isolate, but the task of separating default premiums, marketability premiums, and pure risk premiums seems virtually impossible.

[2] There is some evidence which suggests that higher inflation rates reduce bankruptcies; in effect, inflation covers up poor management. However, it still seems likely that the ex ante probability of default is increased if $\sigma_I$ increases.

This line of reasoning suggests that during times when there is a great deal of uncertainty about the future level of inflation, yield spreads between Treasury and corporate debt, and between different classes of corporate bonds (for example, the spread between Aaa and Aa), should widen. An examination of yield spreads over time does show that the spread widens when inflation rates are rising.

## EFFECTS OF INFLATION ON EQUITY RETURNS

The required rate of return on an average share of common stock ($k_M$) is generally thought to consist of a required rate of return on a default-free security (RF) plus a risk premium (RP):

$$k_M = RF + RP. \tag{4}$$

RF, as we have just noted, consists of a real risk-free rate (RRF) plus a premium for expected inflation ($I_a$), and, for long-term government bonds, a liquidity risk premium ($L_t$) which reflect the risks of unexpected inflation:

$$RF = RRF + I_a + L_t. \tag{5}$$

Therefore,

$$k_M = RRF + I_a + L_t + RP, \tag{6}$$

or, lumping the liquidity premium into the pure risk premium,

$$k_M = RRF + I_a + RP. \tag{7}$$

### Theoretical Studies

The question of whether or not stocks actually provide a good hedge against inflation has been studied both theoretically and empirically. Three of the most important theoretical studies were the ones by Alchian and Kessel [1], Van Horne and Glassmire [14], and Lintner [10].

Alchian and Kessel concluded that inflation transfers wealth from net creditors to net debtors. (Net debtors have monetary liabilities which exceed their monetary assets.) Unanticipated inflation benefits the common stock of firms that have made more long-term commitments to pay fixed nominal amounts than to receive them.

Working with a single security valuation model, Van Horne and Glassmire show that, in the event of unanticipated inflation, the dominant factor affecting changes in the value of common stock is whether prices of goods sold by the firm lead or lag wages and other costs. If prices, wages, and costs change exactly in keeping with inflation, share value is unaffected by operating earnings. In this situation, any change in value due to unanticipated inflation will be determined by whether the firm is in a net

debtor or creditor position, and by adverse tax impacts from "phantom profits" which result from understated depreciation and cost of goods sold. These factors are, however, less important than the leads or lags in prices relative to wages and other costs.

Lintner [10] argues that even in the absence of net debtor-creditor effects and the tax effect of phantom profits, the holding period return on stocks would decline with increasing unanticipated and anticipated inflation. He shows that even if a firm's sales (through pricing flexibility) increased with inflation so as to maintain real profit margins and growth rates in sales, the real rate of return on equity (hence stock prices) would decline during the period because of the necessary dependence on increased external funds due to increased inflation. With increasing sales volume, cash balances and accounts receivable balances would increase, causing an increase in the need for external funds. If these external funds were obtained as debt, the after tax cost of debt not otherwise required would reduce real returns to equity owners even though the companies' real profits were maintained. If the added financing were obtained as new equity, the equity base would increase and the return on equity would decrease. This would be true for unanticipated (transient) increases in inflation and also for anticipated inflation. In fact, the impact would be larger for increased anticipated inflation since there would be a whole stream of future "dead weight" costs if higher inflation rates were to continue.

Empirical Studies

Several major empirical studies have examined the effects of inflation on returns on common stocks. Included are the papers by Fama and Schwert [7], Jaffe and Mandelker [11], Bodie [3], Nelson [15], and Hong [10]. Fama and Schwert studied the extent to which various types of assets have provided hedges against both the expected and unexpected components of inflation during the period 1953-1971. They regressed holding period returns against expected and unexpected inflation:

$$HPR_t = a_0 + a_1 I_t + a_2 [AI_t - I_t]. \qquad (8)$$

Here $a_0$ is equal to the real risk-free rate plus a risk premium, $I_t$ is the expected inflation rate during Period t, and $AI_t - I_t$ is the unexpected inflation rate in t. Equation 8 is, of course, the same equation as was used to test the extent to which debt securities provide a hedge against inflation. As before, if $a_1 = a_2 = 1.0$, then the security

(now a stock) provides a hedge against both expected and unexpected inflation.

In the case of debt, Fama and Schwert found $a_1 \simeq 1.0$ but $a_2 \simeq 0$, which indicates that debt provides a hedge against expected but not unexpected inflation. In the case of stocks, however, both $a_1$ and $a_2$ were negative, indicating that stocks not only fail to rise to offset expected and unexpected inflation but, in fact, stock returns decline as inflation increases. Jaffe and Mandelker, Bodie, and Nelson, using somewhat different data and procedures, reached essentially the same conclusions as Fama and Schwert, namely, stocks do not provide a hedge against inflation.[1]

Whereas the other empirical papers looked at the relationship between aggregate common stock returns and inflation, Hong's study examined the differential effects of inflation on the market values of individual firms. Under a number of simplifying assumptions, the author develops and tests a model of wealth transfer. He concludes that inflation affects stock prices through additional tax burdens borne by the firm. The "inflation tax effects" vary widely across firms due to different degrees of understating of depreciation and cost of goods sold. Hong's work does not necessarily lead to the conclusion that stocks are, in general, a poor hedge against inflation, but his study is certainly consistent with this proposition.

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[1] A recent paper by Ang, Chua, and Desai [2] suggests that stocks may provide a hedge against anticipated, but not unanticipated, inflation. These authors do not, however, suggest that stocks are a hedge against unexpected inflation.

## EFFECTS OF INFLATION ON COMMON STOCK RISK PREMIUMS

A number of researchers, including Soldofsky and Max [16], have examined holding period returns on stocks and on bonds, and the spreads between stock and bond yields. Although these spreads are at times called risk premiums, they are certainly not risk premiums as we use the term. A common stock risk premium in the economic sense of the word is the difference between the expected future return on a stock and the expected future return on a riskless bond. Common stock risk premiums in our sense can be used to help estimate the cost of equity by adding the estimated risk premium to the riskless rate of interest. If the risk premium on a particular stock is thought to be reasonably constant, then the cost of equity for the company can, at any point in time, be estimated as the sum of the current bond rate plus the risk premium.

Both theory and empirical evidence support the view that bonds provide a hedge against expected but not against unexpected inflation. The conventional wisdom of the 1960's and earlier years suggested that stocks provide a hedge against both expected and unexpected inflation. If this were true, and if uncertainty about future inflation increases with the level of inflation, then the required rate of return on bonds should rise relative to required returns on stock during periods of high expected inflation. This means that higher rates of inflation would lead to declining stock risk premiums. Indeed, Gordon and Halpern [9] prove this point analytically, demonstrating that under the assumption that stocks are a perfect hedge against both expected and unexpected inflation, then the stock risk premium should decline as the rate of inflation increases.

However, as noted in the preceding section, there is overwhelming theoretical and empirical evidence that the old conventional wisdom is wrong--common stocks in general do not provide a very good hedge against either expected or unexpected inflation. In fact, most empirical studies show a negative correlation between realized returns on stocks and both expected and unexpected inflation, and Lintner, especially, presents a convincing argument as to why this situation exists. If stocks are indeed a poorer hedge against inflation than bonds, then the stock-bond risk premium should rise as the rate of inflation increases.

Two studies of forward-looking risk premiums (as opposed to past holding period returns) are available: Malkiel [14] and Brigham-Shome [4]. Both studies estimated risk premiums as follows:

$$RP_t = k_{Mt} - RF_t.$$

Here $RP_t$ is the risk premium on an average share of stock at time t; $k_{Mt}$ is the expected rate of return on an average share of stock at t; and $RF_t$ is the yield to maturity on long-term Treasury bonds at t. Malkiel used as his proxy for "the market" the thirty Dow Jones industrial stocks, and he established $k_t$ for each of the companies in the index as the dividend yield at t plus the future growth rate estimated by Value Line and reported at t, but adjusted by Malkiel to decay over time and in the long-run to equal the forecasted GNP growth rate. Brigham-Shome examined the Dow Jones and the S&P Industrial stocks, and they used Value Line growth forecasts as well as growth forecasts based on expected retention rates and ROE's, fitted to both a constant growth ("Gordon") model and a nonconstant ("supernormal") model. Risk premiums varied somewhat depending on the company sample and on the estimating technique, but there was a high degree of correlation among the different estimates. Table 2 gives estimates of risk premiums on the S&P Industrial Index stocks over the period 1964-1979, based on the constant growth model.

The theoretical and the empirical studies have shown stocks to be a poor hedge against both expected and unexpected inflation. Further, experience, common sense, and studies by Gordon-Halpern [9], Logue-Willet [13], and Cukierman-Wachtel [5] indicate that (1) the expected level of future inflation and (2) uncertainty about future inflation rates are both correlated with the level of current inflation. All of this suggests that risk premiums on stocks should, logically, increase as the current rate of inflation rises. Indeed, as Table 3 shows, there is a slight positive relationship between inflation and risk premiums. The relationship is neither strong nor statistically significant at a high level--a 1 percentage point increase in the rate of inflation is associated with only a 0.17 increase in the market risk premium, the t value of the regression coefficient is only 1.77, and the low $r^2$ value indicates that variations in risk premiums over time are influenced more by other factors than by inflation. Nevertheless, the apparent effect of inflation on risk premiums is positive.

Table 2. RISK PREMIUMS FOR THE S&P INDUSTRIALS

| Beginning of Year | Expected Dividend Yield ($Y_M$) | Expected Growth Rate ($g_M$) | Expected Return ($k_M=Y_M+g_M$) | 20-Year Gov't Bond Yield (RF) | Risk Premium ($RP_M=k_M-RF$) | 5-Year Moving Average RP |
|---|---|---|---|---|---|---|
| 1964 | 3.30% | 6.19% | 9.49% | 4.19% | 5.30% | -- |
| 1965 | 3.19 | 6.67 | 9.86 | 4.18 | 5.68 | -- |
| 1966 | 2.96 | 7.65 | 10.61 | 4.50 | 6.11 | -- |
| 1967 | 3.61 | 8.41 | 12.02 | 4.76 | 7.26 | -- |
| 1968 | 2.85 | 8.48 | 11.33 | 5.59 | 5.74 | 6.02% |
| 1969 | 2.83 | 8.56 | 11.39 | 5.88 | 5.51 | 6.06 |
| 1970 | 3.14 | 8.42 | 11.57 | 6.91 | 4.66 | 5.86 |
| 1971 | 3.13 | 7.70 | 10.83 | 6.28 | 4.55 | 5.54 |
| 1972 | 2.72 | 7.79 | 10.51 | 6.00 | 4.51 | 4.99 |
| 1973 | 2.38 | 8.34 | 10.72 | 5.96 | 4.76 | 4.80 |
| 1974 | 3.17 | 9.63 | 12.81 | 7.29 | 5.52 | 4.80 |
| 1975 | 5.00 | 10.78 | 15.78 | 7.91 | 7.87 | 5.44 |
| 1976 | 3.80 | 10.52 | 14.32 | 8.23 | 6.09 | 5.75 |
| 1977 | 3.71 | 10.71 | 14.42 | 7.30 | 7.12 | 6.27 |
| 1978 | 5.02 | 10.50 | 15.52 | 7.87 | 7.65 | 6.85 |
| 1979 | 5.32 | 10.72 | 16.03 | 8.91 | 7.12 | 7.17 |
| Average | 3.51% | 8.82% | 12.33% | 6.36% | 5.97% | |

Source: Brigham-Shome [4].

Note: The estimated risk premiums are as of the beginning of each year.

Table 3. RELATIONSHIP BETWEEN INFLATION AND RISK PREMIUMS

| Year | Inflation in the Preceding Year (AI) | Risk Premium at the Start of the Year ($RP_M$) |
|---|---|---|
| 1964 | 1.21% | 5.30% |
| 1965 | 1.31 | 5.68 |
| 1966 | 1.72 | 6.11 |
| 1967 | 2.86 | 7.26 |
| 1968 | 2.88 | 5.74 |
| 1969 | 4.20 | 5.51 |
| 1970 | 5.37 | 4.66 |
| 1971 | 5.92 | 4.55 |
| 1972 | 4.30 | 4.51 |
| 1973 | 3.30 | 4.76 |
| 1974 | 6.23 | 5.52 |
| 1975 | 10.97 | 7.87 |
| 1976 | 9.14 | 6.09 |
| 1977 | 5.77 | 7.12 |
| 1978 | 6.45 | 7.65 |
| 1979 | 7.60 | 7.12 |

$$[RP]_M = \underset{(0.5519)}{5.1103} + \underset{(0.0978)}{0.1727}[AI].$$

$$r^2 = 0.1820.$$

Standard errors are in parentheses.

## IMPLICATIONS FOR CORPORATE FINANCIAL POLICY

What are the implications of the preceding analysis for corporate financial policy in the 1980's? First, if government policy makers are able to control inflation and reduce it to the level of the 1950's and early 1960's, or even to the 3-6 percent range of the late 1960's and early 1970's, then we would forecast no major changes in corporate policy. However, if inflation continues at the double digit level, then certain shifts can be expected.

### Maturity Structure of Corporate Debt

In late 1979 and early 1980, many Wall Street observers were predicting a total collapse of the long-term bond market, and a movement toward shorter maturities and floating rates. Our analysis supports this view. If the rate of inflation remains high, then the yield curve will tend to become more steeply upward sloping (or less steeply downward sloping when the curve is inverted), and this cost disadvantage to long-term debt will cause borrowers to shift more toward short- and intermediate-term credits, and to offer floating interest rates.

This change, if it occurs, would of course shift much of the risk of inflation from lenders to borrowers, so corporate risks would increase. Corporations whose operating income adjusts most flexibly with inflation could be expected to lead the shift into short maturities and variable rate debt. Companies whose income does not adjust for inflation, but which are nevertheless forced into short-term debt by lenders' reluctance to lend on a long-term, fixed rate basis, will be exposed to serious dangers, and many such firms might simply refuse to expand, with adverse consequences for the economy.

### The Debt-Equity Mix

Several considerations lead to the conclusion that, if inflation remains high in the 1980's, firms should increase the proportion of equity in their capital structures: (1) Using more short-term and floating rate debt increases firms' risk exposure; this suggests that equity ratios should be increased. (2) Our analysis indicates that risk premiums on lower-rated bonds rise as the rate of inflation increases. This suggests that to the extent that firms do continue to use long-term debt, they should strive to have their bonds highly rated, and this, in turn, suggests that they should increase their equity ratios.

On the other hand, the evidence suggests that stocks do not provide investors with a good hedge against inflation, and, accordingly, the risk premium on common stocks

rises with the level of inflation. This, in turn, suggests that the cost disadvantage of equity rises with the rate of inflation, and that suggests that the overall cost of capital might be reduced by using more debt and less equity.

Where does all this leave us? It leaves us convinced that we simply have no basis for generalizing about whether a high inflation rate in the 1980's should lead to higher or lower debt/equity ratios. It seems to us that the optimal capital structure for firms in the 1980's will remain, just as in the 1970's and in earlier years, a judgmental matter that must be analyzed by each firm on the basis of its own circumstances.

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