Inflation and Corporate Financial Management

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I. Introduction

In this paper we discuss the principal implications of inflation for corporate financial management. We seek to acquaint practitioners of corporate finance with the lessons of the large though disparate body of academic literature dealing with the interactions between inflation, valuation, and corporate finance.

Our initial concern is: how does inflation change standard financial decisions? We concentrate on the principal corporate financial decisions: investment and financing. We also investigate the implications of inflation for corporate pension plans, an area of some controversy. To limit the scope of the paper to manageable proportions, issues involving inflation and working capital management, including inventory management, and the specialized problems of regulated firms are not addressed. Also, we will gloss over issues which are by now broadly agreed, to focus on those which are less well understood or controversial.

Tools developed in a world of stable prices can provide poor service when applied in a world of inflation if they are not properly reinterpreted and adapted. Inflation raises important questions of proper measurement. Inflation appears to be a potential source of mismeasurement by management and even by the securities markets, a potential mismeasurement which has, in turn, important feedbacks for corporate decisions.

Section II examines issues of investment and financing in a world of rational financial managers and markets. Section III investigates the possibility that inflation has produced distortions in market valuation and considers the implications of distortions for corporate financial decisions. Section IV addresses the nexus between inflation and corporate pension plans. Section V provides a brief summary.

II. Inflation and Corporate Investment and Financing

While finance textbooks are often not explicit as to how inflation considerations should be incorporated in capital budgeting decisions, the
academic literature is in general agreement with respect to the principal modifications that inflation requires be made in investment analyses. There is reason to believe, however, that corporate financial managers have frequently failed to take inflation considerations properly into account. In a master's thesis at M.I.T., Naugle [1980] conducted a questionnaire survey of the top 100 companies in the Fortune 500 aimed at ascertaining whether their capital budgeting procedures were rational in the face of increasing inflation. Thirty-one, or forty-seven percent, of the sixty-six firms from which he obtained valid responses appeared to fail to pass the test of rationality. A thorough discussion of the lessons of the academic literature in this area would therefore seem warranted.

Textbooks almost invariably argue that potential investments should be selected on the basis of net present value (NPV). The interesting question, however, is how inflation affects the net present value calculation.

Any present value reflects a future value and a discount rate or set of discount rates. The net present value of an investment opportunity represents the aggregate present value of all the relevant cash inflows and outflows, discounted at a rate usually referred to as the cost of capital.

In the presence of inflation, one must keep clearly in mind the distinction between nominal future net returns (or cash flows) and nominal discount rates (or cost of capital) on the one hand and real flows and discount rates on the other. Nominal future flows are, of course, simply the realized future cash flows. Real cash flows are returns expressed in terms of constant prices, or equivalently, deflated by a "general price index" (that is, by the price index of an appropriately defined broad basket of commodities). Similarly, the one-period nominal discount factor (one plus the discount rate)
measures the number of dollars the investors require next period for giving up one dollar this period, while the real discount factor measures the number of dollars of current purchasing power that investors demand next period per dollar invested now; put differently, it is the number of commodity baskets next period that investors require per initial commodity basket. The relation between the (short-term) nominal rate, say R, and the real rate, say r, is given by the well-known formula \((1+R) = (1+r)(1+p)\), where \(p\) is the rate of inflation over the period of the loan. This relation is commonly simplified to \(R = r + p\) by dropping the term \(rp\) which, for limited inflation, is very small compared to \(r+p\).

A basic proposition about capital budgeting, and, more generally, about valuation, in the presence of anticipated inflation is that there are two alternative warranted ways of proceeding. One way is to discount future nominal flows at the nominal discount rate (the nominal-nominal approach); the other is to discount future real flows at the real discount rate (the real-real method). (See e.g., Brealey and Myers [1981, pp. 86-88]). It can be readily verified that these two procedures will give the same answer if applied consistently—that is, provided the inflation rate implied by the relation between the nominal and real forecasted future flows is the same as the inflation rate implied by the relation between the nominal and the real rate. The net present values thus obtained will be the same because while the expected nominal flows (the "numerators") are raised in the nominal calculation, as a result of rising prices, this increase is precisely undone in the present value calculation when the inflation is reflected in the nominal discount rate (the denominator).

Inconsistencies in the estimate of inflation, explicitly or implicitly built into the numerator and denominator, on the other hand, will, generally, lead to wrong decisions. In particular, deflating nominal flows by real discount factors
will overstate the true net PV (if inflation is positive), while discounting real flows by nominal discount factors will lead to the opposite bias.

The fact that the two approaches consistently applied will give the same answer does not necessarily imply that one should be indifferent between the two methods. On the contrary, given the extreme unreliability of long-term inflation forecasts, strikingly confirmed by recent experience, there is much to be said in favor of approaches that can dispense from, or depend less critically on, forecasts of forthcoming inflation. We will suggest that, because generally effective planning requires, in any event, the development of forecasts of outputs, inputs, and earnings in constant prices, one can make a good prima-facie case for the real-real approach as the basic procedure. At the same time, in some instances the nominal-nominal approach may prove more effective. These propositions can be illustrated by some examples.

i) The case of pure equity financing

Consider the case where a firm is entirely equity financed. In the absence of inflation (and assuming further that the firm has no significant true growth opportunity), it is well-known that the required rate of (equity) return, say \( \rho \), can be inferred from the earnings-price ratio \( (E/P) \).

The appropriate measure of earnings for this purpose is sustainable, cyclically "noise-free" earnings, not simply the latest twelve months' earnings per share.\(^2\)

The same conclusion continues to hold under inflation except that \( E/P \) must now be recognized as the required real rate of return. This rate must be distinguished from the nominal rate of return from holding the security, say \( \rho_n \), which includes, in addition to the earnings, also any capital appreciation. Since earnings may be expected to rise at the rate of inflation (at least when inflation is neutral—see below), as long as \( E/P \) is constant, the price must also rise at the rate of inflation, producing a capital gain per dollar equal to the rate of inflation, \( p \). Thus, the nominal equity rate is \( \rho_n=\rho+p \).
Suppose, first, that after-tax profits can be taken as inflation neutral, that is, (roughly) proportional to the price level. (Note that this neutrality requires the absence of assets depreciable for tax purposes). In this case, it should be apparent that the NPV can be conveniently computed through the real-real approach by combining the forecast of the real cash flows, presumably already needed for other purposes, with the estimate of the required real rate of return, inferred from E/P. This approach eliminates altogether the need for a forecast of future inflation. Not only does this save costs, but it also avoids the danger, inherent in the nominal-nominal calculation, that different, and hence inconsistent, forecasts of inflation may be embedded in the estimation of flows and in that of the nominal required rate. This danger is particularly serious when those responsible for cash flow estimates differ from those responsible for choosing the required rate of return.

Consider next the case where inflation is not neutral in that future real flows depend on the future price level (or on the rate of inflation). Even in this case, it may be possible, through a variant of the real-real approach, to eliminate the need for an explicit forecast of inflation, notably where the non-neutrality derives from some component of the net nominal flow being fixed in nominal terms. An important illustration of this problem is provided by the depreciation tax shield, arising when net corporate income is taxed after deducting depreciation. In this case, since tax depreciation is based on historical acquisition cost, the depreciation deduction is fixed in nominal terms once the depreciable asset is acquired and placed in service. Accordingly, to compute the contribution to NPV from the present value of the depreciation tax shield, one should discount these flows at the nominal rate. (Note that this implies that inflation, by raising the nominal rate, reduces the value of the tax shield.) This would suggest the need for a forecast of inflation in order
to estimate the p term of the nominal discount factor, \( p_n = E/P + p \). In reality, a good case has been made in the finance literature that the depreciation flow should be discounted at the nominal "riskless" interest rate rather than at the equity rate, which generally includes a risk premium. This conclusion rests on the consideration of the relatively low level of uncertainty surrounding the realization of the depreciation tax shields, compared with other operating cash flows, especially given the opportunity to carry losses back three years for tax purposes. Opportunities to carry losses forward and to enter into sale and leaseback arrangements also serve to mitigate uncertainty associated with the eventual realization of these tax shields.

Now, an estimate of the nominal rate, and in fact of the whole term structure of nominal rates, can be conveniently derived from the yields in the markets for short-term nominal instruments and for bonds of various maturities. They reflect the market consensus about the future of nominal rates, and hence they can be used directly to discount fixed nominal flows like the depreciation tax shield. Thus, even when some flows, such as the depreciation deduction, are fixed in nominal terms, the NPV calculation can be carried out without relying on an explicit forecast of inflation. To this end, one would discount at the equity rate the (inflation-neutral) real cash flow before interest and taxes (EBIT), adjusted for taxes (by multiplying by one minus the tax rate), and then add on the depreciation tax shield discounted at the market interest rate.

To be sure, an internal forecast of future prices might reveal an apparent inconsistency with the implicit market forecast of the real rate and of inflation implicit in \( R \). It is important to remember that even in this case rational behavior calls for basing calculations on the market rate, rather than on that implied by the internal forecast. In other words, even if there is sufficient confidence in the internal forecast to conclude that the market will prove wrong, this information is most effectively used not for
calculating NPV but, if anything, to "speculate" against the market. Thus, if the market appears to understate future inflation and future rates, the firm could capitalize on this information by borrowing long and lending short.

ii) Nonneutral inflation and debt financing

Of course, the real value of future flows may depend on the rate of inflation (or, equivalently, the nominal value of future flows may not be proportional to the price level) for reasons other than the nominal fixity of the flows. Similarly, the required rate of return may be systematically related to the rate of inflation. This dependence may spring from many causes, such as regulation, features of tax laws, long-term contracts, "fixity" of exchange rates, etc. In such cases, it will generally not be possible to avoid a forecast of inflation, whether one uses the real-real or the nominal-nominal approach.

This same conclusion holds, in principle, when a firm is financed by a combination of equity and debt capital because the real cost of debt capital to a firm depends not only on the market nominal rate but also directly on the rate of inflation. Specifically, in the presence of corporate income taxes of the U.S. description, the real cost per dollar of debt, \( r_c \), can be expressed as:

\[
(1) \quad r_c = (1 - \tau)R - p = (1 - \tau)r - \tau p
\]

where \( \tau \) is the corporate income tax rate.

It will be seen from (1) that inflation should tend to reduce the cost of debt but for reasons entirely different from the traditional -- and largely erroneous -- view that it redistributes wealth from creditors to debtors. That redistributional gain can occur only when inflation is, at least partially, unanticipated. But when the inflation is fully anticipated, the nominal rate will tend to rise enough to compensate for the loss of real value of the principal, leaving the real rate unchanged (or possibly even raising it to maintain the real rate after
personal taxes). But equation (1) shows that, in the presence of corporate income taxes, inflation reduces $r_c$ even if the real rate is unchanged, the reason being that the income tax allows the deduction of all interest, including that part which compensates the creditor for inflation and is therefore in the nature of a repayment of principal.

Of course, what is relevant for capital budgeting is not the cost of debt funds but the overall real cost of capital, defined as the required tax adjusted EBIT per dollar of capital. The relation between $r_c$ and the overall real cost, say $\phi$, is conventionally expressed in terms of the so-called weighted average cost of capital:

$$\phi = i_{V} + r_{V} D_{V}$$  

Here, $i$ represents the required rate of return on equity capital;

$$i = \frac{(EBIT - RD)(1 - \tau) + pD}{S} = \frac{(EBIT)(1 - \tau) - r_cD}{S}$$

while the "weights" $S/V$ and $D/V$ represent the shares of equity and debt respectively in the overall capital structure. These weights, $S/V$ and $D/V$, should be interpreted as representing the target shares for the firm as a whole rather than the share existing at the moment, or contemplated for the particular investment.

It is readily apparent from the above formulae that, with a levered capital structure, consistent capital budgeting will unavoidably require a forecast of inflation. Indeed, in the real-real approach, one needs an estimate of the real required return given by (2). While an estimate of the equity component $i$ given by (3) might, in principle, be derived directly from current and historical market data, measuring the real cost of debt capital involves not only the observable long-term rate $R$ but also an explicit forecast of inflation. Nor can this requirement be avoided by relying on the
nominal-nominal approach. Indeed, in this case, one needs to measure the nominal required rate of return, which is obtained from (2) by adding the rate of inflation, \( p \), to both sides. Using (1), this yields:

\[
\rho_n = \rho + p = \frac{S}{V} + \frac{(1-T)R-p}{V} + p = \frac{(i+p)S}{V} + (1-T)R \frac{D}{V}
\]

In (4) the nominal cost of debt component, \( R \), can be read from the market, but the (nominal) cost of equity requires a forecast of \( p \). Furthermore, as already pointed out, that forecast should be the very same one that underlies the estimate of nominal flows.

However, the conclusion derived from (1) and (2), that even the real cost of capital depends on inflation needs to be properly qualified in that it assumes that \( r_c \) can change independently of \( i \). But this independence cannot be taken for granted. Indeed, according to the so-called Modigliani-Miller [1958] proposition, at least under certain conditions (absence of taxes and rational investors behavior), the relation between \( i \) and \( r_c \frac{D}{V} \) will be such that the overall cost of capital will be independent of leverage, and need not vary when \( r_c \) varies.

Recently, Miller, in a well-known contribution [1977] has argued that this conclusion is valid even allowing for taxes. Furthermore, his model would seem to imply that the conclusion would hold as well in the presence of inflation (see Hochman and Palmon [1983]). If he were right, then the overall cost of capital would be unaffected by leverage or by the rate of inflation, and could be inferred from the relation between market value and EBIT cash flow.

This conclusion, however, has been widely criticized. In particular, Modigliani [1982, 1983], taking into account the role of portfolio diversification neglected by Miller, has confirmed that, in the presence of taxes, (1) some leverage is valuable, tending to reduce the cost of capital, and that, (2) for given leverage, the cost of capital is further reduced by inflation.
result is consistent with the conclusion based on (1) and (2), although it should be recognized that the market expectation of inflation has also some indirect effects on the cost of capital through \(i\), depending on the extent to which inflation affects the real rate.

How, then, should one arrive at a forecast of (average) inflation over the life of the project? If one accepts the market long-term rate, \(R\), as the best available estimate of the future of nominal interest rates, then the problem is that of decomposing \(R\) into the expected real rate and expected inflation implicit in it. Under normal circumstances, a practical way to do that is that of estimating the real rate component. Such an estimate might be derived, without an explicit forecast of inflation, from the history of realized short-term real interest rates. While these rates have not remained constant, they have tended to fluctuate within a fairly narrow spread, resulting in a relatively stable moving average—at least until the last two, three years. One may therefore be able to put together an estimate of the prospective average real rate over the life of the project from past data, with proper adjustment for unusual developments, like the persistent large government deficits currently in prospect.

The estimate of the short real rate so derived might have to be further adjusted for term premium, i.e., systematic differences in yields between short and long maturities. (These premia, which can be in principle of either sign, would again have to be inferred from historical behavior and other considerations.) Subtracting the resulting estimate of the real long rate from the nominal rate, yields the implied market forecast of average inflation. Of course, the validity of this method depends now closely on the method followed by the market in projecting real rates resembling that described above. In any event, the resulting price forecast would have to be examined for reasonable—
ness and consistency with explicit inflation forecasts spread through the financial press.

Alternatively, the firm may be in a position to elaborate its own independent forecast from other methods and sources. If available, such a forecast can be used to advantage to improve investment decisions both in terms of measuring the cost of capital or hurdle rate, and in terms of choosing the financing package. The choices in this respect go from financing at a fixed long-term rate with no or minimal call provisions to financing through a sequence of short-term loans, or more realistically, through a longer-term loan, but with interest floating with a short-term rate.

Once we recognize that inflation over the life of the project is uncertain, it appears that the real cost of debt funds is itself uncertain and dependent on the form of financing chosen, as well as on the realization of inflation. We can illustrate this proposition in terms of the real cost of the two limiting types of borrowing mentioned earlier, long-term noncallable (L), and floating short-rate loans (S). From (1) we deduce:

\[
\tilde{L} = (1 - \tau)RL - \tilde{p}
\]

\[
\tilde{S} = (1 - \tau)RS - \tilde{p} = (1 - \tau)\tilde{r} - \tau\tilde{p}
\]

where the tilde denotes a stochastic (uncertain) variable. Capital budgeting must rely on a measure of expected cost. It is apparent from (5a) and (5b) that that measure depends both on the financial package adopted and on what forecast of inflation one is prepared to rely, the market's (implicit) expectations or the firm's own forecast.

We can throw light on the considerations relevant to a choice by considering alternative circumstances. Suppose, first, that the internal forecast is lower
than the implicit market forecast (and the difference is not compensated by a higher forecast of the real rate). Then, the internal forecast implies that, over the relevant period, the average value of the short-term rate, RS, will be lower than the current long-term rate (adjusted for term premium). In this case, a very good case can be made, insofar as a project is to be financed, for choosing a short term type of instrument. One can readily establish that this choice will reduce the expected real interest cost, \( r_c \), by \((1 - \tau)(p_m - p_f)\), where \( p_m \) is the implicit market forecast, and \( p_f \) the firm's forecast. Furthermore, if the uncertainty of future inflation is substantially larger than that of the real rate, as experience suggests, that choice will also reduce the uncertainty of the \( r_c \) outcome. Note, however, that because inflation reduces the cost of capital, the lower inflation expectation will also imply a larger value of \( r_c \) than implied by the market expectation, by an amount \( \tau(p_m - p_f) \). The cost of capital should be based on this higher cost rather than on the lower implicit market estimate.

Suppose, on the other hand, that the firm's forecast of inflation exceeds the market's. In this case, the minimization of expected \( r_c \) will call for long-term financing, especially if it can be made more flexible through call protection (although, as long as the difference in expectations is not large, a case can still be made for short-term financing in order to minimize risk). Supposing long-term financing is adopted, then the firm's higher expectation of inflation will imply a value of \( r_c \) lower than that corresponding to the market forecast. In this case, however, it is advisable to maintain the cut-off at the higher level of \( r_c \) implied by the market expectation. In other words, any project not having positive net present value for \( r_c \) based on market expectations should be rejected even if it has positive NPV at the lower \( r_c \) implied by the firm's expectation. The reason is that any funds borrowed could be expected to produce
a higher return through financial speculation, i.e., investing them in short loans, than by investing them in the project.

To summarize, we have shown that capital budgeting can be based indifferently on the real-real or nominal-nominal approach as long as they are applied consistently. We have suggested that, in view of the great difficulties in arriving at reliable projections of long-run inflation, one should give preference to approaches that do not require forecasts of inflation or do not lean heavily on such a forecast. We have illustrated a number of cases where some variant of the real-real approach appears to offer that advantage, though admittedly these are cases of limited practical relevance. We have further shown that the fact that inflation is typically more uncertain than real rates makes a good prima-facie case for preferring short- to long-term financing, although the choice should be influenced by the internal expectation of inflation relative to the market's as well as by the availability and cost of call clause and related arrangements.

The discussion of this section has been concerned with identifying rational managerial behavior in a world of rational investors and financial institutions. However, before one finds fault with firms that appear to behave irrationally with respect to inflation, such as those identified by Naugle, one must consider the possibility that the world is not one of rational investors and institutions. We examine the evidence on this question and its implications for corporate decisions in the following section. There are strong reasons to suppose that inflation may produce serious distortions in the value of the market as a basis for the calculation of required returns.
III. Inflation Induced Distortions in Market Valuation and Implications for Investment

A. Inflation and the Valuation of Common Stock

The economics of corporate finance has long been grounded in the normative view that the goal of firms' management should be the maximization of the firm's stock price. In this section we investigate the relationship between inflation and the value of corporate equity.

Common stocks have traditionally been thought of as a sound asset to hold in the presence of inflation, in contrast to assets fixed in nominal terms whose real value is eroded by inflation. This assessment rests on the consideration that stocks of nonfinancial corporations represent levered claims against real assets. If real assets' values tend to keep up with the price level under inflationary conditions, and creditors lose as a result of unanticipated inflation, then stockholders should gain in real terms to the extent that creditors lose. Actually, this popular view needs to be greatly qualified since, as indicated earlier, its validity is limited to the case when inflation is totally, or at least partially, unexpected. When it is fully anticipated, one may expect the nominal interest rate to rise in step with the inflation, leaving no special advantage for the borrower to reap. However, as was also indicated, despite Miller's contrary conclusion, there is reason to believe that inflation should benefit levered corporate enterprises, because of the corporate income tax which allows the deduction of all interest, including the inflation premium component (see Modigliani [1982, 1983]).

The traditional, as well as the tax angle view that inflation is good for corporate stock, has all but been shattered by the experience of the last three decades, particularly the last decade and a half. Numerous researchers have documented a negative relationship between stock prices, or
rates of return, and inflation (Lintner [1973], Bodie [1976], Jaffe and Mandelker [1976], Nelson [1976], Modigliani and Cohn [1979]).

The clearest way to view the association between stock prices and inflation is to examine the relationship between earnings-price (E/P) ratios and inflation. Because earnings are inherently a real variable, as was argued above in Section II, the E/P ratio is in principle a real rate. But Figure 1 shows an unmistakable positive correlation between the E/P ratio of the Standard & Poor's 500 stock index, based on reported earnings, and the inflation rate. Since the relationship between E/P ratios and inflation is a direct one, the relationship between the price-earnings (P/E) ratio and inflation is inverse.

Of course the question of earnings measurement must be raised in any discussion of the nexus between inflation and E/P ratios. Many are wary, and properly so, of errors induced by inflation in reported earnings as measures of true economic earnings in a period of inflation. There are three types.

Two of these measurement errors are well-known while one of them continues to be poorly understood. The two that are generally understood have to do with measuring the cost of goods sold for nonfinancial firms. First, firms that employ FIFO accounting for inventories tend, in a period of inflation, to expense a cost of goods sold that reflects less than the economically relevant replacement cost of inventories, which is essentially what would be reflected in the use of LIFO accounting. Another way of putting it is that the reported income of FIFO firms includes "paper" gains on inventories. Second, since depreciation is based on the historical acquisition cost of assets, reported depreciation tends to understate depreciation appropriately calculated on a replacement cost basis when there has been a significant increase in the general price level since a substantial fraction of the firm's depreciable assets was acquired. The effect of both these errors is to cause reported
income to exceed income adjusted for both biases, to which we will refer hereafter as adjusted income.

The third measurement error, the one that seems not to be generally understood, is important because it works in the opposite direction. Reported income per period is net of nominal interest; however, during the period inflation reduces the real value of the principal by pD, where p is the inflation rate. The pD component of interest, as implied in Section II, is, in real terms, a repayment of principal. True income should therefore be measured net of real interest, not nominal interest. Consequently, in fully adjusting reported income for the effects of inflation so as to produce a true figure, pD must be added back to adjusted income.

Interestingly, Modigliani and Cohn, hereafter referred to as M-C, and Pearce [1982] find that, in recent years, for the nonfinancial corporate sector taken as a whole, year by year, the overestimate of true income due to the first two reasons tends to offset the underestimate due to interest, so that reported income approximates true income fairly closely. While this result applies to the typical firm or to the firms in the stock market as a whole, and thus validates the E/P ratios presented in Figure 1, it need not obtain for any particular firm.

Another way in which to observe the real stock market debacle that has occurred since the onset of inflation in the mid-1960's is to examine what has happened to the ratio of the market value of net corporate debt and equity to the replacement cost of the underlying real assets. This ratio is usually referred to as Tobin's q. The q ratio has fallen from a level somewhat above one in 1964-65 to a level substantially below one, at least until the recent
drastic reduction in inflation.

One question raised by the increased E/P ratio in recent years is why corporate investment has not been depressed as a result of the corresponding rise in the cost of equity capital. One possibility is that corporate managers, in implementing the nominal-nominal approach discussed in Section II, employ a downward biased estimate of the weighted-average nominal cost of capital, one based on nominal interest rates on debt but E/P ratios for equity, rather than the correct nominal cost of equity. Naugle [1980] finds some support for this notion.

B. Why Has the E/P Ratio Risen?

The academic literature contains a number of potential explanations for the observed increase in E/P ratios. One such explanation is taxes. This culprit is cited by Feldstein and Summers [1979] and Feldstein [1980]. They point out that FIFO accounting produces paper gains for tax as well as financial reporting purposes. They also point out that tax deductible depreciation understates true depreciation. As a result of both the inventory and the depreciation effects, the effective tax burden on corporate income rises as a result of inflation, causing a fall in the market value of stock relative to true before-tax earnings, even if the true capitalization rate is unchanged.

This argument could also explain why E/P ratios seem to have risen as a result of inflation. For, at the same time as inflation lowers the value of stock, it also raises reported, relative to true, earnings, through the inclusion of paper profits on inventories and underdepreciation of capital assets, thus raising E/P.

There seems to be little empirical support for this argument. The reason is that the adverse tax effects of FIFO and underdepreciation are virtually completely undone by the offsetting effect of nontaxation of the pD component of earnings, which is deductible for tax purposes in computing corporate income.

Some argue theoretically (see, for example, Carr and Halpern [1981]) that there should be no offsetting tax gain from debt. The reason they give is that interest rates should rise in response to increases in expectations of inflation so as to preserve after-tax real costs of borrowing. They argue that with a corporate tax rate \( t \), the pretax nominal interest rate, \( R \), should be equal to \( \frac{r' + p}{1 - t} \), where \( r' \) is the after-tax real interest rate. Thus an increase of one percentage point in \( p \) would imply an increase in \( R \) of \( \frac{1}{1 - t} \) percentage points. But Summers [1983] provides ample evidence that interest rates have risen, at most, point for point with inflation, at least until recently.

Feldstein offers another tax related reason to explain the observed direct relationship between \( E/P \) and inflation. He correctly points out that investors are taxed at the personal level on paper capital gains stemming from inflation. He then argues that investors in stock demand higher \( E/P \) ratios under inflationary conditions so as to preserve their after-tax real rates of return. Two comments are in order. First, if this effect on \( E/P \) ratios exists, it is likely to be of an inconsequential magnitude. The reason is that the effective tax rate on capital gains at the personal level is extremely modest because of the ability of investors to defer this tax, to determine the timing of the realization of gains, and to escape the tax at death.

Another argument explaining the observed relationship between \( E/P \) ratios and inflation is the risk premium hypothesis of Malkiel (1979; see also his article in Boeckh and Coghlan [1982]) and Friend and Hasbrouck [1982]. They argue that the risk premium required by investors has been directly related to the rate of inflation, and therefore the equilibrium \( E/P \) ratio has also been related to inflation. Risk and inflation may go together because they are both
related to such real shocks as the various oil crises. Historically high and
variable inflation may also give rise to uncertainty, though such nonneutrality
is not necessarily rational. Of course, if inflation and risk go together,
they are impossible to distinguish.

Both Fama [1981] and Geske and Roll [1983] explain the observed negative
relationship between inflation and stock rates of return on the basis of real
shocks and their effects on corporate profitability. But neither approach
serves to explain the rise in E/P ratios.

While Fama does not really explain the link between shocks and inflation,
his results can be interpreted in one of two ways. Perhaps diminished rates of
return have resulted from decreased profitability, measuring assets at
replacement cost with the q ratio unchanged. But then the E/P ratio would
have fallen, not risen, and the real value of stock would not have fallen. Or
perhaps shocks have reduced profits while the E/P ratio has remained unchanged.
But this interpretation is not consistent with a rise in the E/P ratio either.

Geske and Roll tell a rather unconvincing story in an attempt to explain
the linkage between shocks and inflation. They see real shocks leading to a
fall in government revenue and therefore a rise in the deficit, which is in
turn monetized, thus producing inflation. A particularly weak link in this
story is that dealing with the monetization of the deficit. In recent years
Federal Reserve purchases of Treasury debt have fluctuated little around a
rising trend. While the deficit has increased over this period from a
negligible to a modest fraction of GNP, Federal Reserve purchases as a fraction
of Treasury new issues have fallen from as much as 50% in 1964, for example,
when the new issues were small, to 4-9% in the last few years (Sinai and
Rathjens [1983]). While Geske and Roll might have an explanation for a decline
in real profits, the empirical evidence does not support such a claim when
profits are measured properly, and their argument does not explain a rise in
the E/P ratio.

Another argument explaining the observed rise in the E/P ratio is
inherently untestable. This argument suggests that, because of real shocks, E
is transitorily high, and the true E/P ratio has not actually increased.

On the basis of a set of time-series tests, M-C concluded that inflation
illusion largely accounted for the observed relationship between E/P ratios and
inflation. They found that investors make two errors in valuing corporate
stock as a result of inflation causing nominal interest rates to exceed real
rates. First, investors capitalize earnings at a rate that follows the nominal
rate rather than the appropriate real rate. Second, investors capitalize
adjusted earnings rather than true earnings. This second error applies, of
course, only to levered firms. Both errors have the effect of driving stock
prices below their rationally warranted level.

The M-C hypothesis implies that E/P ratios are positively related to
nominal interest rates even though changes in nominal rates are largely
explained by changes in the expected rate of inflation over the period M-C
studied, 1953-77. The graph in Figure 2 pictures the relationship between
E/P ratios and nominal interest rates since 1963.

The aggregate stock market experience since 1977 would seem to accord
quite well with the M-C hypothesis that nominal interest rates move the market.
In particular, the rise in P/E ratios that began in August 1982 with the onset
of the current bull market and which continued through the first half of 1983
would seem largely related to the concurrent fall in nominal interest rates.
There is no prima-facie evidence that real interest rates fell during this
period. The decline in the rate of inflation over the period was approximately
the same as the decline in nominal interest rates. In fact, while nominal
Figure 2

Earnings-price ratio, Standard & Poor's 500 Stock Index (annual averages of quarterly data)

Moody's Aa corporate bond yield (annual averages)


*First half.
interest rates were fairly stable during the first half of 1983, inflation continued to fall.

M-C [1982] performed an extensive set of cross-sectional tests of Malkiel's and Friend and Hasbrouck's risk premium hypothesis. M-C reasoned that if the decline in the stock market as a whole resulted from a rise in the average required risk premium, then stocks with above-average risk premiums (as captured by beta) would experience a greater than average decline in their P/E ratios. What they found, however, was that high-beta stocks experienced below-average declines in their P/E ratios over the 1968-78 period, one characterized by increasing inflation and nominal interest rates. This result is inconsistent with the hypothesis of rising risk premiums for stocks unless the increases in risk premiums are unrelated to beta.

C. Implications for Investment and Financing

If one accepts the view that E/P ratios are only transitorily high and that the true E/P ratio has not risen, then inflation has had no real effect on the cost of equity capital. However, if one accepts the strong evidence for a substantial increase in the E/P ratio, then the real cost of equity capital has increased substantially. Investments that do not meet this new high criterion should, on the basis of traditional considerations, not be undertaken.

If the M-C hypothesis is correct, then the effect of inflation is to raise the real cost of debt as well as equity. The reason is that the valuation of levered firms is penalized as a result of investors capitalizing adjusted earnings. M-C found direct evidence for this penalty in their cross-sectional study [1982]. While Summers [1981] finds empirically that levered firms benefit from inflation, his results conflict not only with those of M-C but also with the difficulties researchers in recent years have experienced in trying to support the "debtor-creditor" or "nominal contracting" hypothesis,
the argument that net-debtor firms benefit from unanticipated inflation and unanticipated changes in expected inflation as a result of losses inflicted on creditors of firms (see Bloom et al. [1980] and French, Ruback, and Schwert [1983]).

If inflation causes the valuation of levered firms to suffer as a result of the inflation illusion cited by M-C, then corporate financial managers face a dilemma insofar as retained earnings are not sufficient: They can finance externally only by issuing undervalued equity or by increasing leverage, thereby threatening to make their equity even more undervalued.

But the M-C hypothesis is an inherently unstable view of the valuation process. The undervaluation implied by the hypothesis will tend to disappear over time as inflation and interest rates stabilize. The reason is that if inflation and interest rates cease rising, E/P ratios will stop falling. If then earnings continue to keep up with the price level, which, history indicates, is a reasonable expectation, then investors will find themselves earning an unexpectedly high nominal rate of return equal to the E/P ratio (in the case of the "no true growth" firm) plus the rate of inflation. This return is in excess of expectations as, according to the hypothesis, shares were priced to yield an expected nominal rate of return equal to the E/P ratio. The excess return in turn should make the undervaluation apparent and cause it to disappear. If inflation and interest rates actually fall, this process will be speeded up, for the E/P ratios will also fall.

This scenario of eventual revision implies that firms may wish to consider investments based on their values in the event of such a revision. If the M-C hypothesis is correct, real asset values as reflected in the values of claims in the financial markets are irrationally depressed as a result of investors capitalizing income at nominal rates. Managers can then make real investments which will eventually be vindicated when the undervaluation comes to an end.
The capital gains will accrue to the firm's shareholders over the period during which the undervaluation diminishes.

To be sure, this argument favors firms obtaining financing for new investment from their internal cash flow rather than new equity issues. New issues would dilute eventual per share gains. For the same reason, debt financing is to be preferred to new equity financing.

One way to raise the amount of cash flow available internally would be to decide not to increase dividends over time as earnings per share, properly measured, increase. Shareholders should further gain from a reduction in the target payout ratio owing to the adverse tax implications of dividends (Modigliani [1982]).

If a firm perceives that it does not have worthwhile real investment opportunities, even based on an elimination of undervaluation, it may wish to consider purchasing shares of other firms. It may also want to consider a repurchase of its own stock.

IV. Inflation and Corporate Pensions

Inflation has profound but widely misunderstood implications for corporate pension plans. Today the typical corporate pension plan is a single-employer, trusteed, noncontributory, final-average defined benefit plan. Munnell [1982, pp. 173-174] cites a Bankers Trust Company study showing that 76 percent of conventional defined benefit plans, those that base benefit promises on compensation as well as length of service, determined benefits solely on the basis of final-average pay during the period 1975-79. By 1979, 83 percent of these plans calculated average pay on the basis of the last five years of employment.

Participants in such plans probably view their claims as at least partially hedged against inflation. Workers presumably anticipate that the compensation on which their pensions will be based will tend to keep up with
the general price level.

If employees' expectations are rational, then one would anticipate that at least part of pension plan assets would be invested so as to produce a stable real rate of return over time. One would anticipate that the managers of pension plans would seek inflation hedges as investments, at least to the extent such investments could be deemed prudent.

It is probably the failure of stocks and bonds to serve as inflation hedges in recent years that has caused corporate pension plans to become increasingly interested in real estate equities as investments. But this route is not the only one that should be considered.

Values of short-term debt securities are affected adversely by unanticipated increases in expected inflation, but not very much. If a one percentage point increase in the expected rate of inflation causes the nominal rate to rise, say from 10% to 11%, the fall in the security's value would be approximately one-quarter of 1%. The corresponding fall in the value of a twenty-year 10% bond whose yield to maturity rose to 11% would be approximately 3%. Short-term debt instruments by their very nature provide much more stable (inflation invariant) real rates of return, even under conditions of variable inflation, than long-term bonds.

The market for short-term debt instruments may be such, however, that lenders are willing to pay a premium for liquidity and for inflation hedging, resulting in somewhat lower interest rates (though in the recent inflation the premium has actually been negative). Most pension plans today probably have little need for liquidity. Not only do they enjoy highly predictable short-term cash flows, but many of them also anticipate that they will experience net cash inflows for several years to come. On this account, they may find short-term instruments unattractive.
These considerations suggest that long-term but variable- or floating-rate debt instruments should prove to be an appealing investment for pension plans. Such a demand would probably elicit a corresponding supply.

One can fairly easily imagine a good bit of the demand for mortgage credit being met by pension plans using floating-rate instruments. What would seem to be needed for this purpose, however, is not the standard variable rate mortgage, which has proved to be fairly unpopular among borrowers, but a mortgage which provides a more attractive stream of payments for the borrower.7

A particularly appealing candidate for this purpose is what has come to be known as the M.I.T. flexible graduated payment mortgage. This instrument provides the lender with a rate of interest tied to a short-term reference market interest rate, but offers the borrower a relatively low monthly payment at the start. The reason is that the payment is determined on the basis of a fixed annuity factor, based on the real short-term interest rate, applied to the remaining balance. For a fuller discussion of this type of mortgage instrument, see Modigliani and Lessard [1975]. Such an instrument, when properly understood, is likely to be appealing to both lenders and borrowers.

Another issue we propose to review is the controversial one about the appropriate way of computing pension plan liabilities in the presence of inflation. Accounting disclosure for corporate pension plans in the United States is governed by the Financial Accounting Standards Board's Statements of Financial Accounting Standards Nos. 35 and 36. These statements require disclosure of the present value of accrued benefits together with the assumed rate of return on investment. It is this rate which is used as the discount rate in determining the present value of accrued benefits. The interesting issue is whether accrued liabilities should be discounted to the present using basically a nominal or a real rate. Economic common sense suggests that the second answer is the broadly correct one. The
reason is that under a final-average pay plan, the pension actually paid will
depend on terminal wages, and it seems reasonable, for both accounting and planning
purposes, to expect wages and salaries to tend to keep up with the price level.
The effect of such an assumption on projected pension benefits is profound.
If, e.g., inflation is no more than 5% per year, then even if real wages are merely
constant, the pension actually paid to someone retiring 30 years from now would
exceed the current liability to him by something like four and half times. In
essence, the pension fund liability is a real liability that keeps up with the price
level. Accordingly, to compute the present value of the liability, one should
either take the future nominal value and discount it at the nominal rate, or take
the future real liability (i.e., in today's prices) and discount it at the real
rate; but the future real liability is simply today's accrued liability.
The only course that would seem patently wrong is to discount today's accrued
liability at the nominal rate; the result would be a serious underestimation of the
reserves needed to fund liabilities already incurred.

This seemingly obvious conclusion has, in fact, been challenged recently,
notably by Bulow [1981]. He argues that final-average plan liabilities are, at
any point in time, strictly nominal in nature because the employer can discharge
the employee or terminate the pension plan at any time and that such liabilities
should therefore be discounted at the nominal rate. He points out that the
employer pension liability to any employee participating in a final-average
plan at the end of any period is, in effect, a pension based on his past final-
average salary. Therefore, the present value of what is owed at retirement is
the present value of what is owed currently upon retirement. It follows that to
measure reserves needed against liabilities incurred by a fund, the currently
accrued liabilities should be discounted at the nominal rate. His view has
obtained a good bit of support among financial economists; see, for example,
Bodie and Shoven [1983].
Bulow is aware that the promised pension will rise if the employee's final-average salary increases in nominal terms as a result of continued employment. Because pensions in a final-average scheme are based on years of service as well as final-average pay, inflation induces an increase from year to year in the pension promised at retirement that is larger than the inflation rate. Specifically, the linkage to final-average pay causes continued employment to raise the real value of employees' benefits, by preventing inflation from downgrading it. The linkage, in effect, revalues past compensation to the most recent average level.

This analysis seems to imply that in the presence of inflation, under the typical pension contract, the real compensation provided to the worker in the form of an increment in matured real pension rights increases with the number of years of service. Bulow focuses on this particular and peculiar aspect of the impact of inflation on pension arrangements. He suggests that if the employer does not fire the worker in order to save himself the growing cost of updating the pension, associated with longer tenure, then one must conclude that that cost should be regarded as incurred in future years as the employee is retained. Therefore, it should not be included in the currently outstanding liabilities, a conclusion justifying the discounting of accrued liabilities at the nominal rather than at the real rate.

But Bulow's approach fails to recognize the multiperiod nature of implicit labor contracts. Employees expect to be rewarded for loyal continuing service, and employers expect to reward them for their loyalty. One of the oft-stated and widely recognized goals of pension plans is to reward and encourage employee loyalty. Employees presumably do consider the cost in terms of the ultimate pension reduction before they voluntarily resign to seek employment elsewhere.
But once the employment relationship is viewed in terms of implicit contracts, it is not the case that older workers generally cost the employer more, as Bulow's view would suggest. We suggest, therefore, that Bulow's view is legalistic and swayed by the form rather than the substance of pension arrangements. What matters for the issue at hand is not whether employers have the power to fire workers and thereby freeze their nominal obligation, but whether inflation leads them to significantly greater use of this power. This conclusion is supported by the following considerations. Assume, first, a world without inflation: then all would presumably agree that a firm's obligation should be measured by discounting currently accrued liabilities at the nominal rate, which, of course, is the same as the real rate. Next, suppose there is steady (neutral) inflation but that the pension rules are such that all pensions are fully indexed: to wages for those who remain employed, and to the general price level for those that quit or are fired before retirement. It is apparent that, under these conditions, the liability of the fund must be basically the same as in the absence of inflation. But this clearly means that currently accrued liabilities must be discounted at the same rate as before, namely the real rate.

Next, suppose that the pensions of those who are fired or separated for other reasons are not indexed, but suppose, at the same time, that, in fact, nobody is separated. In this case the cash flows confronting the pension fund are identical to those of the previous two cases. It would, therefore, seem appropriate again to discount the accrued liabilities at the real rate and to reject Bulow's prescription of discounting them at the nominal rate, with a drastic decline in the assessed liabilities of the fund. Of course, in reality there will be some separations. However, in the absence of evidence that inflation has brought about a radical increase in the dismissal of older workers or in the relation between wage rate and age, the best way to handle the problem is to apply nominal discounting only to
the liabilities accrued for those who have left. But for those who are working, accrued liabilities would be discounted at the same real rate as without inflation, though some allowance should be made for the prospective rate of attrition. In addition, of course, allowance should also be made for the fact that the pension, once it begins, tends to remain fixed in nominal terms. Note that because of the two "nonneutralities" just mentioned, inflation does tend to reduce somewhat pension liabilities resulting from a given contract, but nowhere as severely as implied by Bulow's recommended approach.

To conclude, though Bulow's argument is ingenious and stimulating, his conclusion that pensions, based on past service, should be discounted at the nominal rate must be rejected on factual and practical grounds. To a first approximation, and abstracting from changes in real wages, the nominal liabilities at any point in time of a final-average plan are in the nature of real liabilities and therefore should be discounted at the real rate.

V. Summary

In a world of rational investors and financial institutions, corporate managers should analyze investment opportunities either by discounting the relevant nominal flows at an appropriate nominal rate or by discounting the corresponding real flows at the corresponding real rate. Capital budgeting analyses are complicated by inflation because of the following sources of real effects: Taxes, debt, and other long-term contracts. An estimate of the securities markets' expectation of inflation is usually needed in order to implement either the real-real or the nominal-nominal approach. A comparison of the manager's expectation of inflation with the markets' can provide important implications for investment and the desired maturity structure of debt financing.
An examination of the effects of inflation on earnings-price (E/P) ratios provides impressive evidence that the world is not one of rational investors. Inflation appears, through its effects on nominal interest rates, to increase irrationally E/P ratios, with the resulting effect of raising the real cost of equity capital, as well as perhaps the real cost of debt. There is reason to suspect, however, that these effects will prove to be transitory, and managers may want to consider investment and financing decisions that would benefit their shareholders in the event of a decline in E/P ratios.

Inflation has important implications for final-average pension plans. To a first approximation, the liabilities of such plans are real in nature, rather than nominal. They should be valued as such, and managers of assets of such plans should, accordingly, consider investing, to some extent, in an inflation-hedged fashion.
FOOTNOTES

1 Let $Sx$ be the nominal and $x$ the real forecasted flow for next period; then, consistency requires $x = \frac{Sx}{(1+p)}$. Using the nominal-nominal approach, the PV is:

$$\frac{Sx}{1+R} = \frac{Sx}{(1+r)(1+p)} = \frac{x}{1+r}$$

and the last expression corresponds to the real-real calculation.

2 Earnings should be measured on a fully inflation adjusted basis, a concept discussed at length in Section III below.

3 Specifically, it is shown in Modigliani [1982, 1983] that, abstracting from the effect of dividend policy and assuming that the present value of the capital gain tax is not appreciably different from zero, the cost of capital to a levered firm can be expressed as:

$$\rho = \rho^*(1 - \lambda \frac{D}{V}) \quad \lambda = \frac{R}{\rho^*} (\tau_c - \tau_p)$$

Here, $\rho^*$ measures the required return for an unlevered firm with the same risk characteristics, and $\tau_p$ is the average "marginal" personal tax rate, which may be taken as appreciably smaller than $\tau_c$.

4 The tax advantage would exist even if the real rate rose with inflation enough to maintain unchanged the after-personal-tax real rate.

5 Why many corporations, in effect, voluntarily pay taxes on inventory profits must be accounted a great mystery. The usual argument is that corporate managers are reluctant to report lower profits using LIFO than would be shown using FIFO or average-cost. But strong evidence exists that investors are not fooled by this reported earnings effect (Sunder [1975]).

6 Much recent merger activity involving acquisitions financed by cash has been based on the idea that the stock market has been undervaluing assets.

REFERENCES


