

The Impact of Inflation on Stock Prices

By Douglas K. Pearce

The rapid and variable inflation experienced since the late 1960s has caused wealthholders to seek to protect themselves against increases in the general price level. At the beginning of this period of inflation, it is likely that common stock—which represents a claim on real capital—was recommended as such a hedge. However, those who followed such advice and placed funds in a broad portfolio of stocks in 1968 have seen the real value of their holdings fall by about 50 percent. This surprising result has spurred considerable research on the relationship between inflation and the stock market. While no consensus has yet emerged on the theoretical nexus between inflation and equity prices, several empirical studies have confirmed that inflation and stock returns have been negatively related in the postwar period.¹

It is important to investigate the reasons for this anomalous finding given the significance of the stock market. Movements in share prices are viewed as a prime indicator of the private sector's evaluation of current and future business conditions. Moreover, the stock

market is thought to have a substantial influence on the consumption behavior of households and the investment decisions of business firms.² A fall in the real value of stocks is likely to reduce consumption demand since households hold about one-sixth of their net worth in common stock.³ Lower stock prices should also discourage investment spending because they signal firms that the market places

¹ Studies reporting a negative relationship between returns and inflation include John Lintner, "Inflation and Common Stock Prices in a Cyclical Context," *NBER 53rd Annual Report*, September 1973; Zvi Bodie, "Common Stocks as a Hedge Against Inflation," *Journal of Finance*, May 1976, pp. 459-70; Jeffrey F. Jaffe and Gershon Mandelker, "The 'Fisher Effect' for Risky Assets: An Empirical Investigation," *Journal of Finance*, May 1976, pp. 447-58; Charles R. Nelson, "Inflation and Rates of Return on Common Stocks," *Journal of Finance*, May 1976, pp. 471-83; and Eugene F. Fama and G. William Schwert, "Asset Returns and Inflation," *Journal of Financial Economics*, November 1977, pp. 115-46.

² For a detailed discussion of the stock market and the economy, see Barry Bosworth, "The Stock Market and the Economy," *Brookings Papers on Economic Activity*, 1975:2, pp. 257-90.

³ The role of wealth in the consumption function is stressed in the influential life-cycle hypothesis of saving. See Franco Modigliani and Richard Brumberg, "Utility Analysis and the Consumption Function," in *Post-Keynesian Economics*, ed. by Kenneth K. Kurihara, New Brunswick, N.J.: Rutgers University Press, 1954; and Albert Ando and Franco Modigliani, "The 'Life Cycle' Hypothesis of Savings: Aggregate Implications and Tests," *American Economic Review*, March 1963, pp. 55-84.

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a lower value on their capital stock, and thus should encourage mergers rather than the purchase of new capital equipment and structures.⁴ If there is a negative, causal relationship running from inflation to stock prices, inflation will reduce the growth of the corporate capital stock and thus have direct, adverse effects on productivity and output.

The purpose of this article is to analyze the possible connections between stock prices and inflation to see if such a causal link exists. The first section briefly reviews the traditional model of stock price determination. The second section presents the historical record of stock prices, stock returns, and inflation. The third section surveys the major alternative hypotheses which have been put forth to explain the negative relationship between equity prices and inflation. The fourth section investigates the plausibility of these explanations by examining how well they accord with the empirical evidence. The final section summarizes the findings of the article.

INFLATION AND THE PRESENT VALUE MODEL OF STOCK PRICES

The effect of inflation on stock prices and stock yields can be analyzed using the traditional model for asset prices, the present value model. This model asserts that the price of a share of stock is the discounted, or present, value of all future dividends. For simplicity, it is assumed that all corporate profits are paid out so that the terms profits, earnings, and dividends are interchangeable. If real dividends

⁴ James Tobin has emphasized the ratio of the market value of a firm to the replacement cost of its capital stock, the q ratio, as the primary determinant of investment spending. See James Tobin, "A General Equilibrium Approach to Monetary Theory," *Journal of Money, Credit, and Banking*, February 1969, pp. 15-29. A more recent paper which finds that a model emphasizing stock prices yielded forecasts superior to those from several alternative frameworks is Robert F. Engle and Duncan K. Foley, "An Asset Price Model of Aggregate Investment," *International Economic Review*, October 1975, pp. 625-47.

are expected to be constant and inflation is zero, the stock price of a debt-free (unlevered) corporation can be computed using a simple formula:⁵

$$S_t = \frac{D^e}{r} \quad (1)$$

where S_t = the price of the stock at the beginning of period t

D^e = the expected dividend to be received at the end of each period

r = the real rate of return required by stockholders.

For example, if the required real rate of return is 5 percent and the corporation is expected to earn \$5 per share every year, the stock should sell for $(\$5/.05)$, or \$100. Stock price movements, according to this model, reflect some combination of changes in the expected dividend stream or the required rate of return. This required rate is assumed to equal the real interest rate on a default-free security plus a risk premium, due to the uncertainty of dividend payments. The one-period yield on the stock is defined as

$$\text{Stock yield } t = \frac{D^e + S_{t+1}}{S_t} - 1 \quad (2)$$

and thus the expected yield is r , the required rate of return.⁶

In this model, inflation will cause nominal

⁵ The present value model for share prices is generally associated with John Burr Williams, *The Theory of Investment Value*, Cambridge: Harvard University Press, 1938. The general expression for the present value of dividends is:

$$S_t = \sum_{i=0}^{\infty} \frac{D^e_{t+1}}{(1+r)^{i+1}}$$

which can be expressed as equation (1) when all dividends are assumed to be equal.

⁶ If D^e is constant,

$$\begin{aligned} \text{Stock yield } t &= \frac{D^e + D^e}{r} - 1 \\ &= \frac{2D^e}{r} - 1 \\ &= r \end{aligned}$$

stock prices to rise at the same rate as the general price level, leaving real stock prices constant, unless inflation changes expected real dividends or the required rate of return. If inflation is neutral in the sense that all prices rise at the same rate, firms will see their revenues and costs increasing at this same rate so that nominal profits and dividends also rise at the rate of inflation. When inflation is at rate p (and is fully anticipated), the equation for the nominal price of stock becomes:⁷

$$S_t = \frac{D^e(1+p)^t}{r} \quad (3)$$

Thus, for the example above, if inflation is 10 percent per year, nominal dividends would be expected to be \$5.50 at the end of the first year, \$6.05 at the end of the second year, and so on. The initial stock price, S_0 , would still be \$100, but the price at the beginning of the next year, S_1 , would be $(\$5.50/.05)$, or \$110, and S_2 would be $(\$6.05/.05)$, or \$121. The real price of the stock would remain unchanged since the nominal stock price increases just match the increases in the general price level. The nominal one-period yield on the stock would be approximately $r + p$, leaving the real yield unaltered.⁸ Hence, inflation has no real effects on stock prices or yields unless it changes the real profitability of the corporation's capital, D^e , or the return demanded by shareholders, r .

This analysis assumes a firm which has no debt. If the firm raised some of its funds

⁷ To see this result, note that

$$S_0 = \frac{D^e(1+p)}{(1+r)(1+p)} + \frac{D^e(1+p)^2}{(1+r)^2(1+p)^2} + \dots$$

$$\text{and } S_1 = \frac{D^e(1+p)^2}{(1+r)(1+p)} + \frac{D^e(1+p)^3}{(1+r)^2(1+p)^2} + \dots$$

$$\text{thus } S_1 = (1+p)S_0 = \frac{(1+p)D^e}{r}$$

A similar development would show $S_2 = (1+p)^2S_0$ and so on.

⁸ The actual nominal yield is $r + p + rp$, but the last term is generally negligible.

through issuing bonds or other debt, inflation might raise real equity prices. While inflation should not change the real market value of the firm—that is, the real value of all claims on the firm—if it is unexpected it will benefit shareholders (debtors) and hurt bondholders (creditors), thus raising share prices in real terms.⁹ Again, this prediction is based on the assumption that inflation neither affects the profitability of capital nor raises the required rate of return.

It should be noted that the validity of the present value model is not unquestioned. Keynes, for example, considered this model of share prices only a convention.¹⁰ Doubting that movements in stock prices were dominated by the long-run expectations embedded in equation (1), he considered short-run speculation to be the primary force. Speculators in the stock market, Keynes asserted, spend the majority of their time guessing the preference of other speculators instead of evaluating the future earnings of firms. While other critiques of the model have also appeared, the present value model remains the predominant tool for analyzing stock prices.¹¹

⁹ For a more detailed discussion of this argument, see Lintner. Support for the hypothesis that inflation raised the stock prices of net debtor firms was found by Reuben A. Kessel, "Inflation-Caused Wealth Redistribution: A Test of a Hypothesis," *American Economic Review*, March 1956, pp. 128-41.

¹⁰ John Maynard Keynes, *The General Theory of Employment, Interest and Money*, New York: Harcourt Brace, 1936, p. 152.

¹¹ For recent applications of this model, see Roger E. Brinner and Stephen H. Brooks, "Stock Prices," in *How Taxes Affect Economic Behavior*, ed. by Henry J. Aaron and Joseph A. Pechman, Washington, D.C.: Brookings Institution, 1981; and William C. Brainard, John B. Shoven, and Laurence Weiss, "The Financial Valuation of the Return to Capital," *Brookings Papers on Economic Activity*, 1980:2, pp. 453-502. For critiques of the model based on its apparent inability to account for the volatility of stock prices, see Stephen F. LeRoy and Richard D. Porter, "The Present Value Relation: Tests Based on Implied Variance Bounds," *Econometrica*, May 1981, pp. 555-74; and Robert J. Shiller, "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?" *American Economic Review*, June 1981, pp. 421-36.

THE HISTORICAL PERFORMANCE OF COMMON STOCKS

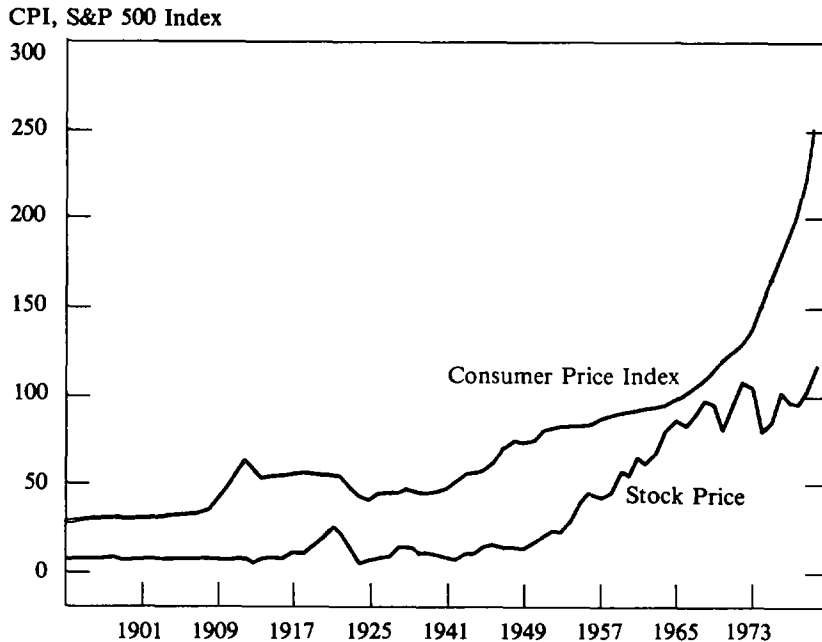
The history of nominal stock prices is presented in Chart 1 along with the general price level for the 1901-80 period. The stock price index employed is Standard and Poor's Composite Index of 500 (S&P 500) of the largest stocks (measured by their market value) with the weights of each stock corresponding to the relative market value of the stock. The general price level is measured by the Consumer Price Index (CPI). While the two series are not closely related, they moved broadly together until the mid-1960s. From then on, however, the general price level has spurted sharply upward while nominal stock prices remained

roughly constant. Chart 2 dramatizes this recent divergence by plotting the real value of stocks over the last 30 years.

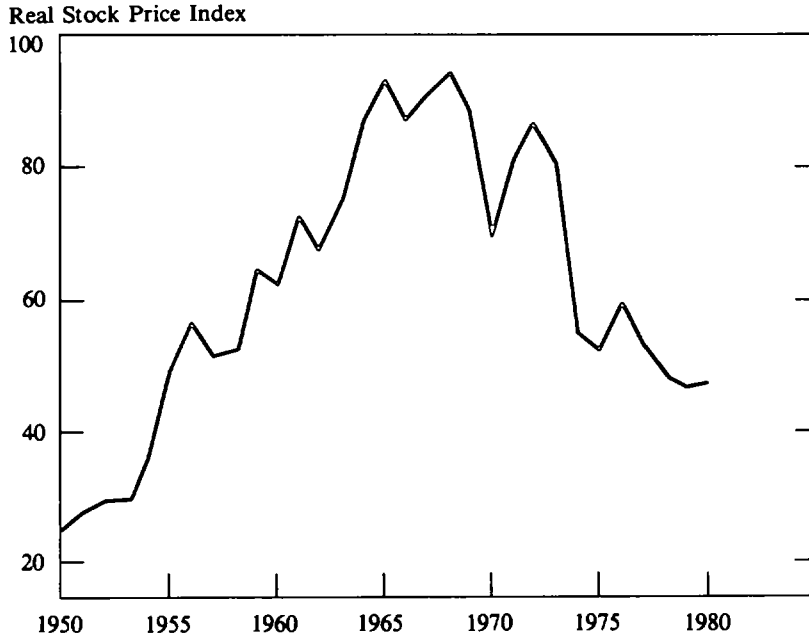
As mentioned above, the constant purchasing power value of common stock peaked around 1968 and has since fallen to about 50 percent of that level. It is this dramatic plunge in real equity prices which has puzzled analysts.

The pattern of real stock prices is mirrored by the behavior of stock yields. Table 1 reports the nominal and real yields on the S&P 500 portfolio and the inflation rate for 1926-80 and subperiods. Over the entire period, investors enjoyed a 9.4 percent nominal yield and a 6.5 percent real yield on this portfolio. While similar yields occurred during the last 30 years, the last two columns of Table 1 indicate that

Chart 1
STOCK PRICES AND THE GENERAL PRICE LEVEL



**Chart 2
REAL STOCK PRICES**



there were two distinct eras. From 1951 to 1965, stocks earned high nominal returns while inflation averaged less than 2 percent per year. However, from 1966 to 1980, the nominal yield

was well below the historical mean while inflation was rapid, producing real returns that were negative. Thus, these data also suggest that recent inflation has had a substantial, adverse ef-

**Table 1
NOMINAL AND REAL YIELDS ON COMMON STOCKS**
(Amounts in percent)

	<u>1926-80</u>	<u>1926-50</u>	<u>1951-80</u>	<u>1951-65</u>	<u>1966-80</u>
Nominal Compound Yield on Standard and Poor's 500 Stock Portfolio	9.4	7.7	10.9	15.2	6.7
Inflation Rate (CPI)	2.9	1.3	4.2	1.6	6.9
Real Yield on Standard and Poor's 500 Stock Portfolio	6.5	6.4	6.7	13.6	-0.2

Note: The yields are computed assuming all dividends are reinvested and that the portfolio was held for each period.
Source: R. G. Ibbotson and R. A. Sinquefeld, *Stocks, Bonds, Bills, and Inflation: Historical Returns (1926-1978)*, Financial Analysts Research Foundation, 1979. Updated to 1980 by the authors.

fect on the stock market.

WHY INFLATION HAS HURT THE STOCK MARKET: ALTERNATIVE VIEWS

The failure of stock prices to rise with the general price level and nominal yields to keep up with inflation during the last 15 years has stimulated several researchers to seek an explanation for this anomaly. The present value model indicates that the fall in real stock prices signals a reduction in expected real earnings and thus real dividends, or an increase in the required rate of return on stock.

This section reviews two arguments why inflation might reduce expected earnings—namely, that inflation raises the real tax burden on corporate capital and that inflation causes investors to underestimate the returns to shareholders. Following this discussion is an examination of why inflation might raise the rate of return required by stockholders by either increasing returns on alternative assets, increasing perceived risk, or confusing investors into misapplying the present value model.¹²

Inflation and Expected Corporate Earnings

Tax Effects. Much of the discussion concerning the poor performance of stocks during periods of inflation has centered on the role of taxes. Several researchers believe that inflation substantially increases the real tax rate on corporate profits and, therefore, that expected in-

flation causes investors to revise downward their forecasts of real after-tax corporate earnings.¹³

Inflation is thought to raise the effective tax rate faced by corporate capital because of the tax treatment of depreciation charges and inventory changes. When computing its taxable profits, a corporation deducts the amount of depreciation of its physical assets. This deduction helps the firm to maintain its capital stock. During inflation, however, the replacement cost of equipment and structures rises with the general price level. Because the depreciation deductions are based on the historical cost of the assets, they no longer reflect the amount required to keep the capital stock intact. Since inflation swells nominal revenues but does not increase the depreciation charges, nominal profits rise and overstate the true profits of an ongoing firm. With taxes based on nominal income, the real tax burden on the corporation is enlarged and real after-tax earnings are reduced.

A similar argument is relevant to the treatment of inventories. During an inflationary period, firms selling goods from inventory realize nominal gains which are taxed as ordinary income. These gains arise because the firm can only deduct the original cost of buying goods rather than the current cost of replenishing the inventory. Again, an ongoing firm has made no real gains, but its real tax bill has increased. This problem is exacerbated by the still prevalent use of the first-in, first-out (FIFO) accounting method.¹⁴ A rise in inflation

¹² A recent paper by Eugene F. Fama, "Stock Returns, Real Activity, Inflation and Money," *American Economic Review*, September 1981, pp. 545-54, gives a fourth explanation for the negative correlation between stock returns and inflation. Fama argues that this finding is really the result of omitting the effects of real activity from the analysis. He contends that stock returns are positively related to expected real activity, while inflation is negatively related to expected real activity. This produces the negative contemporaneous correlation between stock returns and inflation. A key assumption of his model, which many analysts may question, is that commodity prices are flexible enough to keep the money market in equilibrium even when the period of analysis is monthly.

¹³ Richard Kopcke, "Are Stocks a Bargain?" *New England Economic Review*, May-June 1979, pp. 5-24; and Martin Feldstein, "Inflation and the Stock Market," *American Economic Review*, December 1980, pp. 839-47.

¹⁴ Firms could reduce their tax liability (assuming inflation continues) by switching to the last-in, first-out (LIFO) method, yet only about one-quarter of inventories were under LIFO accounting in 1977. See Martha S. Scanlon, "Postwar Trends in Corporate Rates of Return," in *Public Policy and Capital Formation*, Board of Governors of the Federal Reserve System, 1981, pp. 75-87.

Table 2
EFFECT OF INFLATION ON ACCOUNTING PROFITS

Initial Conditions of Firm: Equity = \$1,000 Debt = \$1,000
Initial Economic Conditions: Nominal Interest Rate (i) = 0.05
Inflation (p) = 0

Period	Revenue	Labor Cost	Interest Cost	Accounting Profit	Dividends	Change in Debt	True Profits
0 (p = 0)	200	100	50	50	50	0	50
1 (p = 100)	400	200	1,100	-900	100	1,000	100
2 (p = 100)	800	400	2,200	-1,800	200	2,000	200
3 (p = 0)	800	400	200	200	200	0	200

Note: When expected inflation is 100 percent, the nominal interest rate rises from 5 percent to 110 percent in order for the real interest rate to be unaffected. The equation for this relationship is $i = r + p + r \cdot p$ where i is the nominal interest rate, r is the real interest rate, and p is inflation.

will thus raise taxable profits and therefore taxes, even when real profits have not increased, with the result that real after-tax earnings fall.

Gains From Debt. It has been argued that inflation reduces real corporate debt and that such gains offset much or all of the impact of taxes on corporate earnings. However, some economists believe that shareholders ignore the gain from debt in evaluating their equity and thus underestimate true profits and undervalue the supporting stocks. This argument assumes a kind of money illusion on the part of investors because they fail to adjust reported profits adequately for all the effects of inflation.¹⁵

Table 2 illustrates why gains from debt should be added. Assume a firm initially has a net worth of \$1,000 and debt of \$1,000. The debt is in the form of one-period bonds paying 5 percent. Inflation is known to be zero, there are no taxes, and equity also yields a real return of 5 percent. Line one gives the initial revenues, costs, and profits, with all profits distributed as

dividends. Line two shows the effects of 100 percent inflation, completely anticipated. Revenues and labor costs double, but interest expense rises to \$1,100 because the nominal interest rate fully reflects expected inflation. Accounting or book profits are now negative (-\$900), but the firm can still pay the same real dividend and cover the increased interest expense by borrowing \$1,000. All the firm is doing is maintaining the same real debt. Thus, accounting profits provide a misleading guide to the true picture of the firm since inflation is actually neutral. There are no effects on real dividends, real debt, or the debt-equity ratio. The correct measure of profits in the last column equals accounting profit plus the gain on real debt—that is, the inflation rate times nominal debt.

Inflation and the Required Rate of Return on Stocks

Even if it had no effect on expected profits, inflation would cause real stock prices to fall if it raised the required rate of return on stocks. This might occur if inflation increased the after-tax real returns on alternative assets or if

¹⁵ The money illusion argument is made by Franco Modigliani and Richard A. Cohn, "Inflation, Rational Valuation and the Market," *Financial Analysts Journal*, March-April 1979, pp. 24-44.

investors believed that stocks had become riskier because of inflation and thus demanded a higher risk premium. Also, investors might mistakenly use the nominal interest rate, which moves with inflation, to discount real earnings.

Return on Alternative Assets. Some analysts have attributed much of the fall in real stock prices to the exceptionally high real returns that owner-occupied housing has provided during recent inflationary times.¹⁶ This asset enjoys two tax advantages when the general price level rises. The main return is the rental services of the house for which the owner, in effect, pays himself. Since this imputed return rises with inflation but is not taxed, the real, after-tax earnings of the house rises relative to other assets. Second, unlike common stock, realized nominal capital gains largely can be avoided by reinvestment in houses until age 55. The adjustment of portfolios by wealthholders results in housing prices being bid up and in stock prices falling, so that comparable real after-tax returns might be reestablished.

Greater Risk. An alternative reason for a rise in the required rate of return is a rise in the perceived riskiness of corporate profits. If increases in the risk premium for stocks are associated with higher inflation rates, inflation would reduce share prices even if it left expected earnings unaffected. It has been argued that much of the decline in stock prices can be attributed to added uncertainty about corporate earnings and that inflation is a primary cause of this uncertainty.¹⁷

¹⁶ Patric H. Hendershott and Sheng Cheng Hu, "Inflation and Extraordinary Returns on Owner-Occupied Housing: Some Implications for Capital Allocation and Productivity Growth," *Journal of Macroeconomics*, Spring 1981, pp. 177-203; and Lawrence H. Summers, "Inflation, the Stock Market and Owner-Occupied Housing," *American Economic Review*, May 1981, pp. 429-34.

¹⁷ See Burton G. Malkiel, "The Capital Formation Problem in the United States," *Journal of Finance*, May 1979, pp. 291-306. Increased risk has also been emphasized by William Fellner, "Corporate Asset-Liability Decisions in View of the Low Market Valuation of Equity," in *Contemporary Economic Problems 1980*, Washington, D.C.: American Enterprise Institute, 1980.

There are several reasons why inflation might make corporate profits less predictable. There is evidence that a rise in the level of inflation is accompanied by an increase in both the variability and the dispersion of relative price movements.¹⁸ Either of these factors will tend to make the profits of any firm less certain. For example, an unpredictable inflation rate imposes real efficiency losses as economic agents scramble to protect themselves by using shorter contracts. In addition, a volatile inflation rate makes it more difficult to distinguish relative price movements from changes in the overall price level, possibly resulting in incorrect allocation decisions.

A higher level of inflation, even without more variability, may also cause corporate earnings to be less certain if agents anticipate corrective measures by the government. Investors may fear the imposition of wage-price controls with their inherently arbitrary effects on profits. Similarly, rapid inflation is likely to bring on some form of restrictive monetary or fiscal policy which may not only dampen profit expectations but, given the unknown nature of the exact policies that will be undertaken, make planning an even more hazardous task.

Finally, energy-related inflationary jumps may add to the unpredictability of profits. Over the 1970s, the two largest jumps reflected steep increases in energy prices. Uncertainty about future energy prices and supplies coupled with the existence of production techniques and capital equipment geared to low energy prices is likely to have reduced the perceived stability of corporate earnings. Thus, the inflation rate may serve as a proxy for the riskiness assigned to returns to corporate capital. Therefore, increases in inflation may lead investors to re-

¹⁸ For a review of this literature, see John B. Taylor, "On the Relation Between the Variability of Inflation and the Average Inflation Rate," in *The Costs and Consequences of Inflation*, Carnegie-Rochester Conference Series on Public Policy, ed. by Karl Brunner and Allan H. Meltzer, Amsterdam, Netherlands: North-Holland, 1981.

quire higher returns on stock.

Incorrect Discount Rate. A third reason why inflation could raise the required rate of return on stocks is the use by investors of a nominal interest rate rather than a real interest rate to discount future real profits.¹⁹ This is roughly equivalent to shareholders comparing the earnings-price ratios of stocks to the nominal interest rate on bonds when making portfolio decisions. As discussed earlier in the paper, inflation should raise earnings and the price of stocks at the same rate, leaving the earnings-price ratio unchanged. In other words, the earnings-price ratio is a real yield. Thus, the correct comparison is the earnings-price ratio to the real rate of interest, the nominal rate less expected inflation. If investors do commit the error of looking at nominal interest rates, then as inflation pushes up nominal interest rates, stock prices would have to fall to provide comparable yields.

EMPIRICAL EVIDENCE ON STOCK PRICES AND INFLATION

This section reviews empirical evidence on the possible connections between inflation and stock prices. The first part examines both whether inflation has reduced the expected profitability of corporate capital through raising effective tax rates and the impact of ignoring the gains from debt on the return on equity. The second part of the section investigates the proposition that inflation has raised the required return on stock which, if true, would force stock prices down.

Inflation and Expected Corporate Earnings

Tax Effects. The tax effects hypothesis asserts that inflation reduces real after-tax cor-

¹⁹ This is the second part of the money illusion theory of Modigliani and Cohn.

porate profits because it raises the effective tax rate. This view implies that the after-tax profitability of corporate capital should be inversely related to inflation and that the before-tax profitability should be unrelated to inflation. If inflation has little or no impact on real after-tax profitability, the tax effects theory would not account for the fall in real stock prices.

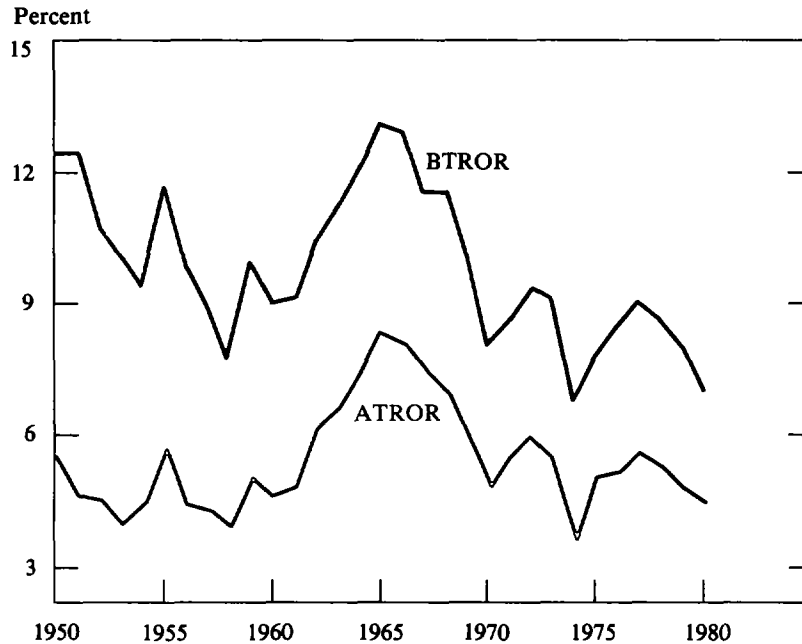
The before-tax rate of return on nonfinancial corporate capital (BTROR) is defined here as the ratio of profits plus net interest paid to the replacement cost of the nonfinancial corporate stock. The after-tax rate of return (ATOR) is similarly defined but with corporate income taxes subtracted from the numerator. The profits in both measures are adjusted for the effect of inflation on inventory and depreciation charges.²⁰

Chart 3 plots the BTROR and the ATOR for the last 30 years. The series follow a similar pattern, peaking in 1965 and dropping sharply to lower levels thereafter. Since the difference between the two measures, which reflects corporate income taxes, narrowed over the whole period, it would seem that inflation has not raised the tax burden on capital. However, the impression from Chart 3 may be misleading since other factors such as fluctuations in the economy also affect tax liabilities.

To isolate the effect of inflation on the rates of return, a model was estimated in which the

²⁰ The correction for the understatement of inventory costs is the Inventory Valuation Adjustment (IVA) which essentially removes the distortion arising from firms using FIFO accounting. The impact of inflation on depreciation allowances is measured by the Capital Consumption Adjustment (CCA) which converts reported depreciation into true depreciation by taking into account both the accelerated depreciation allowed by tax laws, which overstates depreciation, and the difference between replacement cost and historic cost. For a detailed discussion of these adjustments, see John B. Shoven and Jeremy I. Bulow, "Inflation Accounting and Nonfinancial Corporate Profits: Physical Assets," *Brookings Papers on Economic Activity*, 1975:3, pp. 557-98; and Phillip Cagan and Robert E. Lipsey, *The Financial Effects of Inflation*, National Bureau of Economic Research, Cambridge, Mass.: Ballinger, 1978.

Chart 3
BEFORE AND AFTER-TAX RETURNS ON CORPORATE CAPITAL



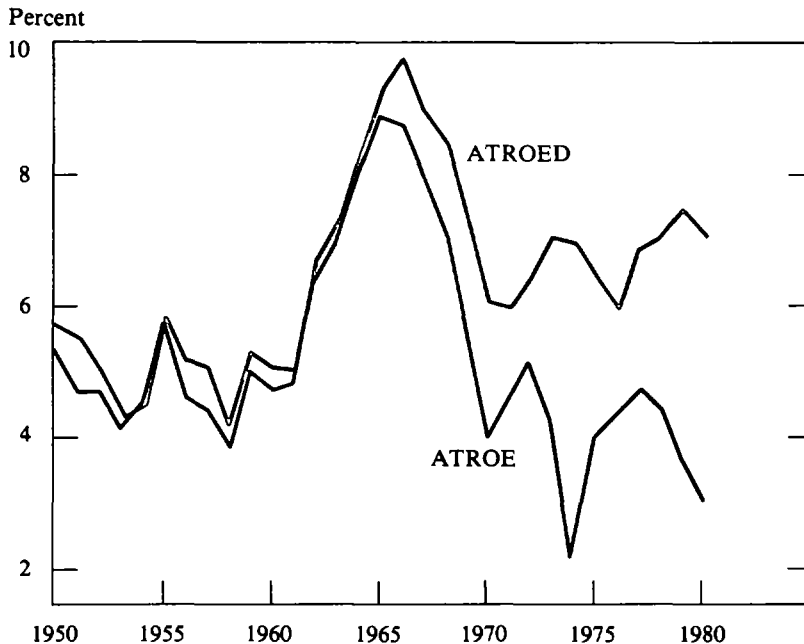
rate of return depends on inflation and the level of economic activity as measured by the percentage gap of actual real GNP from full employment real GNP.²¹ As expected, both the BTROR and the ATORR were found to be sensitive to movements in the real economy with the before-tax rate falling about 0.3 percent and the after-tax return about 0.17 percent for every 1 percent rise in the GNP gap. The estimated impacts of inflation on the rates of return give weak support for the tax effects theory. No

²¹ The estimated models are reported in Table A of the Appendix. The models allow for the intercept and time trend to differ for 1951-65 and 1966-80, following the study by Richard W. Kopcke, "The Decline in Corporate Profitability," *New England Economic Review*, May-June 1978, pp. 36-60.

statistically significant relationship was found between the BTROR and inflation, but inflation was found to have a negative effect on the ATORR, although the level of statistical significance is somewhat low. While the results are consistent with the tax effects view, the estimated reduction in the ATORR is only 0.1 percent for a 1 percent rise in inflation. Since the ATORR has fallen about three percentage points since 1965 while inflation has risen about eight percentage points, inflation accounts for only 0.8 percentage points of the drop in the ATORR.²²

²² Nicholas J. Gonedes also found little support for the tax effects hypothesis. See his "Evidence on the 'Tax Effects' of Inflation Under Historical Cost Accounting Methods," *Journal of Business*, April 1981, pp. 227-70.

Chart 4
RATES OF RETURN ON STOCKHOLDERS' EQUITY



Gains From Debt. To evaluate the proposition that inflation causes investors to underestimate the returns on equity by ignoring the gains from debt, it is necessary to look at the rate of return on stockholders' equity, with and without these gains. The rate on stockholders' equity is defined as adjusted profits divided by the net worth of the corporation (the replacement cost of the capital stock less the value of net debt). Chart 4 gives two measures of the return on equity. One is the after-tax return (ATROE), which includes an adjustment of profits for the effects of inflation on inventory and depreciation charges but ignores gains from debt due to inflation. The other measure is the after-tax rate of return (ATROED), which includes gains from debt. The latter

measure assumes investors make all relevant adjustments for inflation while the former assumes that investors do not recognize the full effects of inflation on corporate earnings.

As Chart 4 illustrates, the ATROE has fallen dramatically to less than half its 1965 peak. The ATROED has also decreased substantially, but the drop is about 25-30 percent from the peak return. To assess the contribution of inflation to these decreases, the same model employed above for the return on capital was estimated.²³ While both measures of the return on equity fall significantly when the economy weakens, the impact of inflation on these returns differs.

²³ The estimated models are given in Table A of the Appendix.

As predicted by the tax effects theory, inflation has a negative effect on the ATROE, similar to that found above for the ATROR. The ATROED, however, is positively related to inflation which suggests that the benefits inflation produces by reducing real debt outweigh the costs coming from higher taxes. If investors ignore these benefits, inflation does appear to decrease the return on equity, although the size of this effect can account for only a small portion of the observed total decline.

To sum up, the rate of return on both corporate capital and stockholders' equity was substantially lower in the 1970s compared with the mid-1960s. The poor performance of capital does not, however, appear to be due primarily to inflation since empirical evidence indicates that the tax effects hypothesis cannot account for most of the fall in the after-tax return on capital. The fall in the return on stockholders' equity, the return relevant to the determination of stock prices, can account for a little over one-half of the decrease in real stock prices, but this lower rate of return cannot be attributed to inflation if investors correctly compute this return.²⁴

The Required Rate of Return on Stocks and Inflation

The analysis above suggests that inflation has not caused real stock prices to fall by lowering the return on equity if shareholders include the gains from debt in this return. Nevertheless, inflation may have depressed real share prices by increasing the required rate of return on stocks. This argument is supported by the pattern of the earnings-price ratio given in Chart 5. As discussed in the beginning of the paper, if inflation does not raise the required rate of return

on stocks, earnings and the price of stocks should both rise at the inflation rate, leaving the earnings-price ratio unaffected. However, as Chart 5 illustrates, the earnings-price ratio for the S&P 500 rose substantially as inflation worsened.²⁵ Assuming that the gains from debt are taken into account by investors, the required rate of return on stocks has increased. This section considers evidence on the three alternative factors mentioned earlier by which inflation may have caused a rise in the required rate: higher returns on alternative assets, higher perceived risk on stock returns, and the incorrect use of the nominal interest rate to discount real earnings.

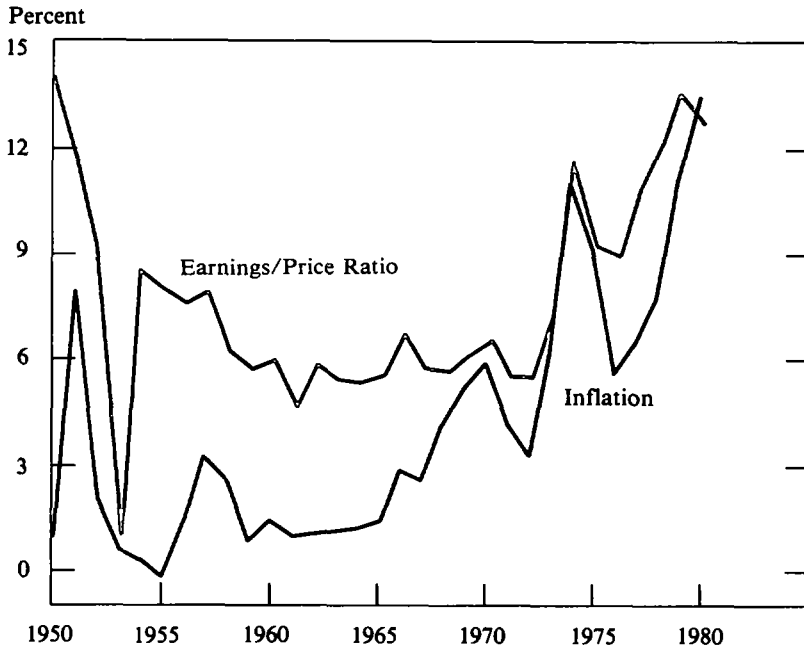
Return on Alternative Assets. Because fixed income financial assets exhibited negative real returns over the last 15 years, they seem unlikely candidates for attracting investors away from stocks.²⁶ A more plausible possibility is owner-occupied housing. Imputed nominal rents rise with inflation but are untaxed, and the tax liability on nominal capital gains can generally be avoided. Hence, inflation should increase the relative return to houses, and investors should react to higher inflation by bidding up housing prices. It has been estimated that the escalating inflation rate of the 1970s reduced the real rental cost of owner-occupied housing to close to zero for higher income

²⁵ Since the earnings figure in this ratio is reported after-tax profits unadjusted for any effects of inflation, the higher ratios may have resulted from investors correcting these earnings for inflation distortions. This conjecture is not supported by a comparison of reported earnings to earnings which incorporate the IVA, CCA, and gains from debt since the two series move together quite closely, generally differing by less than \$5 billion in the post-1965 period. In those years when the difference was greater, adjusted profits were greater than book profits, so earnings-price ratios should have fallen rather than increased.

²⁶ From 1966 to 1980, the real yield on U.S. government long-term bonds was -4.3 percent while U.S. Treasury bills had a real yield of -0.5 percent. R. G. Ibbotson and R. A. Sinquefeld, *Stocks, Bonds, Bills, and Inflation: Historical Returns (1926-1978)*, Financial Analysts Foundation, 1979.

²⁴ A major negative effect of inflation is found by Richard Kopcke, "Are Stocks a Bargain?" while a smaller impact is reported by Marcelle Arak, "Inflation and Stock Values: Is Our Tax Structure the Villain?" *Quarterly Review*, Federal Reserve Bank of New York, Winter 1980-81, pp. 3-13.

Chart 5
EARNINGS-PRICE RATIO AND INFLATION



families and that much of the fall in real stock prices can be attributed to investors reacting to this low real cost of housing by diverting funds from the stock market to the housing market.²⁷ Additional support for this view comes from the finding that the return to housing, unlike that for corporate equity, rises with expected inflation.²⁸ This hypothesis is also consistent with the rise in the median price of existing homes by 9.8 percent per year for the 1969-80 period—over 2 percent more than inflation—which occurred while stock prices fell

²⁷ See Hendershott and Hu.

²⁸ See Summers.

relative to the general price level.

Greater Risk. The second factor which may have raised the required rate of return on stocks is higher perceived risk. If corporate profits are less predictable in an inflationary environment, risk-averse wealthholders will place a lower value on them. Past work has found a statistically significant negative effect of risk on the market value of firms, although the size of the effect was generally small.²⁹

Was the decade of the 1970s a period of increasing risk to investment in corporate capital? One traditional measure of risk is the actual

²⁹ Brainard, Shoven, and Weiss.

Table 3
VARIABILITY OF PROFITS AND MACROECONOMIC ACTIVITY

Variable	Standard Deviations*					
	Time Period					
	1951-55	1956-60	1961-65	1966-70	1971-75	1976-80
Percentage Change in Real Book Profits	20.5	16.3	8.5	9.9	12.5	11.2
Percentage Change in Adjusted Real Profits (IVA + CCA)	20.1	19.9	9.8	11.8	39.9	15.1
Percentage Change in Adjusted Real Profits Including Gains From Debt	21.3	17.9	11.7	9.8	11.4	11.1
Percentage Growth in Real GNP	3.6	2.3	1.4	2.3	3.3	2.4
Inflation (CPI)	3.3	1.0	0.2	1.4	3.3	3.3

*Standard Deviation for a variable x is defined as

$$S.D. = \left[\frac{1}{n-1} \sum_{i=1}^n (x - \bar{x})^2 \right]^{1/2}$$

where n = number of observations
 \bar{x} = arithmetic mean of x.

variability experienced. Table 3 reports one gauge of variation: the standard deviation for the annual growth rates of three real profit measures, real GNP, and the CPI for five-year intervals, 1951-80. These data indicate that variation in these variables generally declined over the first 15 years and then rose again over the last 15. However, the only dramatic rise in variability of profits was for adjusted profits excluding gains from debt for the 1971-75 interval. Moreover, the last half of the 1970s exhibited less variability than the first half, and yet real stock prices continued to fall. Thus, these data suggest that rising variability in the economy may have contributed to lowering real share values, but it cannot be the whole story.

On the other hand, actual variability may be a poor measure of perceived risk. Another suggested measure of the change in risk is the differential between medium grade bonds and U.S. government bonds.³⁰ More uncertainty

about corporate earnings is expected to raise this differential, which has grown substantially from an average of just under 1 percent for 1951-65 to about 1.65 percent for 1966-80. If higher expected inflation is an important contributor to higher risk, the interest differential should be positively related to expected inflation. This proposition is supported by the data, using lagged inflation to proxy expected inflation, with a one percentage point increase in expected inflation being associated with an increased differential of about 0.16 percentage points.³¹ While this evidence is supportive of the risk hypothesis, the differential, while higher in the 1970s, does not trend upward and

H. Hendershott, "The Decline in Aggregate Share Values: Taxation, Valuation Errors, Risk, and Profitability," *American Economic Review*, December 1981, pp. 909-22.

³¹ The estimated relationship was:

$$\text{Interest Differential}_t = .077 + .156 I_{t-1}$$

(4.633) (5.978)

$R^2 = .59$ $SEE = .00028$ $DW = 1.82$ $\hat{\rho} = .554$
Time Period 1954-80 annual observations

where I_{t-1} = inflation rate lagged one period
 $\hat{\rho}$ = estimated autocorrelation coefficient
t-statistics in parentheses.

Additional lagged inflation rates do not alter the results.

³⁰ Malkiel. The use by Malkiel of a bond series which included low yielding "flower" bonds was criticized by Patric

thus cannot explain the downward trend in real share prices.

Incorrect Discount Rate. A third possible reason for a higher required rate is the comparison by investors of the earnings-price ratio with the current nominal interest rate on bonds. Since the correct comparison is with the real interest rate, use of the nominal interest rate, which rises roughly with inflation, means stock prices have to fall steeply, relative to earnings, in order for the earnings-price ratio to rise.

This hypothesis is difficult to test directly. One study of it employed a model in which stock prices depended mainly on expected earnings and the real interest rate.³² The latter variable was measured by the nominal interest rate and expected inflation proxied by lagged inflation. Accordingly, if investors did not suffer from money illusion and thus used the real interest rate to discount real earnings, the coefficients on the nominal interest rate and expected inflation should have summed to zero. However, it was found that the coefficient on expected inflation was negative in sign and statistically insignificant from zero, which was interpreted as evidence of money illusion. Other investigators reported results which also can be construed as consistent with this view. It has been calculated that the discount rate required to equate the present value of future earnings to the market value of firms roughly doubled from 1968 to 1977.³³ This latter result is also consistent with rising risk. The unanswered question is why investors would confuse nominal and real rates of return. Since evidence suggests that bondholders demand compensation for inflation and households see the inflation-induced benefits of homeowner-

ship, it is puzzling why investors would be confused by inflation only in the stockmarket.³⁴

SUMMARY AND CONCLUSIONS

Over the last 15 years the real value of common stock has fallen about 50 percent, coincident with a generally rising inflation rate. If inflation is to blame for the dismal performance of stocks, then it must reduce expected real corporate profits or raise the required rate of return on stocks, according to the traditional model of stock prices. This paper has examined several arguments as to why inflation may have had these consequences.

One prominent theory asserts that inflation reduces expected profits by raising the real tax burden on corporate earnings through nonindexation of inventory and depreciation charges. An alternative proposal is that inflation confuses investors, causing them to undervalue corporate profits by failing to take account of the inflation-induced fall in the real debt of corporations. On the other hand, it has been argued that inflation may have increased the required rate of return on stock by raising the return on owner-occupied housing, by creating more uncertainty about corporate profits, or by misleading investors into using too high a discount rate.

The analysis of this article indicates that the crucial issue is whether investors take into account the gains from debt which accrue to corporations when inflation occurs. The rate of return on stockholder equity when these gains are ignored has dropped by about half since the mid-1960s, consistent with the belief that lower stock prices reflect lower earnings. However,

³² Modigliani and Cohn. For an alternative explanation of these results, namely, that the lagged inflation rates are an inadequate proxy for expected inflation and are really picking up the negative tax effects of inflation, see Arak.

³³ Brainard, Shoven, and Weiss.

³⁴ Hendershott, "The Decline in Aggregate Share Values," argues that the inflation illusion argument of Modigliani and Cohn implies lower nominal interest rates when inflation occurs rather than lower share values, an implication which does not accord with experience.

this decline in returns seems to have been due primarily to the low return on corporate capital, before as well as after taxes, reflecting perhaps the rise in energy costs and regulatory activity which characterized the period. Rising real tax burdens on corporate capital could not account for this fall in the rate of return.

Assuming investors correctly include the gains from debt when estimating corporate profits, the fall in real stock prices was caused in part by a higher rate of return required by stockholders. This conclusion is supported by

the observed rise in the earnings-price ratio. Evidence indicates that inflation has been an important determinant of the increase in the required rate by producing large returns on homeownership, by increasing the perceived risk attached to stock, and by deceiving stockholders into using the nominal rather than the real interest rate to discount earnings. Thus, while inflation cannot account for all of the decrease in real stock prices which has occurred in the last 15 years, it has been a significant factor in the decline.

Appendix
Table A
ESTIMATED RATE OF RETURN EQUATIONS: 1951-80
(Rate of Return Measure)

	<u>BTROR</u>	<u>ATROR</u>	<u>ATROE</u>	<u>ATROED</u>
Constant	.102 (10.623)	.040 (6.130)	.046 (4.442)	.034 (4.380)
PCGAP	-.338 (-4.149)	-.149 (-2.683)	-.153 (-2.228)	-.228 (-4.856)
Inflation	-.043 (-.460)	-.100 (-1.556)	-.173 (-2.177)	.123 (2.255)
Time	.0007 (.793)	.002 (3.171)	.002 (1.900)	.003 (3.959)
Time * D66	-.002 (-1.15)	-.003 (-2.217)	-.003 (-1.767)	-.004 (-3.037)
D66	.019 (.709)	.034 (1.836)	.045 (1.599)	.055 (2.665)
R ²	.582	.534	.509	.623
SEE	.0087	.0059	.0074	.0051
DW	1.80	1.87	1.83	1.63
$\hat{\rho}$.541	.548	.685	.725

Notes: PCGAP = (Full employment real GNP-actual real GNP)/Actual real GNP
 Inflation = Rate of change in the CPI
 Time = time trend with 1951 = 1
 D66 = 0 for 1951-65
 = 1 for 1966-80
 SEE = standard error of estimate
 DW = Durbin-Watson statistic
 $\hat{\rho}$ = estimated autocorrelation coefficient