

THE EFFECT OF INFLATION ON STOCK PRICES:  
INTERNATIONAL EVIDENCE

by

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## I. Introduction

The last decade has been characterized by historically high rates of inflation virtually the world over. Of particular concern to financial economists have been the effects of inflation on corporate profits and stock prices. This paper provides a consistent investigation of these effects for the United States and for a number of other countries over this period. While the nature of hypothesis testing in finance is such that the jury must always be out, the results would seem to suggest that money illusion may characterize valuation in more than one national security market.

The plan of the paper is as follows. Section II provides a brief, selective review of the relevant literature and correlation evidence. Section III provides regression evidence and Section IV a summary.

## II. Stock Prices and Inflation: Prior Work

### A. Review of the Literature

Bodie [1] found that in the United States during the period 1953-1972, common stocks failed to serve as hedges against either anticipated or unanticipated inflation. These perhaps surprising results (common stocks are claims on real assets) are consistent with those of Reilly et al. [17], Lintner [12], Jaffe and Mandelker [9], Nelson [16], and Fama and Schwert [7]. Branch [2] and Cagan [3] present findings from a number of foreign countries which suggest that the inability of stock prices to keep up with the general price level is not a phenomenon restricted to the United States.

### B. The Modigliani-Cohn Hypothesis

In an attempt to explain the anomalous failure of common stocks to perform as inflation hedges in the United States during the post-1952 period, Modigliani and Cohn [14] examined the valuation of common stocks in

relation to an estimate of "noise-free," or long-run, profits. They found that inflation had a negative effect on value given the effect of inflation on profits, and they inferred that their findings resulted from two continuing valuation errors committed by the market. One error was a failure to realize that, in a period of inflation, part of interest expense is not truly an expense but rather a repayment of real principal. The second and more serious error was the capitalization of long-run profits, a real variable, not at a real rate but rather at a rate that varied with nominal interest rates.

This paper seeks to examine whether evidence of market behavior in other countries is consistent with the Modigliani-Cohn hypothesis for the United States. It focuses on the valuation of equity in relation to a measure of noise-free earnings, explicitly attempting to control for the effects of real economic factors on share values over the period studied.

#### C. Relationships Between Stock Prices and Inflation in Other Countries.

Negative correlations between stock prices and inflation or nominal interest rates are characteristic of most major industrialized countries. Table I shows the correlations of stock prices, earnings yields (latest twelve months' earnings/current price), and dividend yields (latest twelve months' dividend/current price) with long-term interest rates and inflation in the eight largest countries by stock market capitalization for the 1970 to 1979 period.<sup>1</sup>

Anomalous (positive, since price is in the denominator) relationships hold for earnings and dividend yields for most countries as well. However, given that reported earnings themselves are biased estimates of true earnings as a function of interest and inflation rates, a careful study of this phenomenon requires adjusting for these effects.

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<sup>1</sup>Sources of data are discussed below in Section III-B.

Table I

Correlations of Stock Prices, Earnings Yields, and Dividend Yields with Long-term Interest Rates and Inflation -- Quarterly Observations 1970-1979

		Inflation <sup>a</sup>	Stock Price	Earnings Yield	Dividend Yield
Canada	Interest Rate	.74*	.13	.83*	.68*
	Inflation	--	.12	.84*	.62*
France	Interest Rate	.86*	-.46*	.30 <sup>b</sup>	.77*
	Inflation	--	-.44*	.63*	.67*
Germany	Interest Rate	.78*	-.82*	-.17	.03
	Inflation	--	-.58*	-.25	-.09
Italy	Interest Rate	.73*	-.24	.42 <sup>*c</sup>	.16
	Inflation	--	-.25	.46*	.01
Japan	Interest Rate	.88*	-.26	.17	.16
	Inflation	--	-.16	.03	-.02
Netherlands	Interest Rate	.26	-.62*	.67*	.55*
	Inflation	--	-.54*	-.06	.19
U.K.	Interest Rate	.73*	-.51*	.82*	.88*
	Inflation	--	-.31	.46*	.53*
U.S.	Interest Rate	.87*	-.58*	.76*	.77*
	Inflation	--	-.60*	.81*	.73*

\* Significant at the .05 level.

<sup>a</sup> % change in CPI over past year.

<sup>b</sup> 1971:3 to 1979:4

<sup>c</sup> Price to cash earnings. While Capital International Perspective [4] presents information about cash earnings for Italy, it does not provide data on earnings.

### III. Model Specification and Estimation

#### A. Regression Specification

The basic regression specification that we adopted in order to try to test the Modigliani-Cohn hypothesis for our sample countries is similar to that in [14]. We can view the valuation process in the following manner:

$$P = \frac{E}{k - \theta g}, \quad (1)$$

where  $P$  represents the price of a share,  $E$  the contemporaneous level of fully adjusted noise-free expected earnings,<sup>2</sup>  $k$  the market's required real rate of return, and  $\theta g$  a term that reflects the present value of the firm's true growth opportunities. By "true" growth is meant anticipated real growth in earnings per share resulting from opportunities to invest at a rate of return greater than  $k$  rather than simply from the investment of retained earnings at the rate  $k$ . The true growth rate, the rate at which earnings would be expected to grow if all earnings were paid out as dividends, is represented by  $g$ , and the coefficient  $\theta$  is designed to reflect the length of time such true growth is expected to persist. In the no-growth case  $\theta$  would be zero, and in the extreme case of perpetual growth  $\theta$  would be equal to unity.

In order to develop a test equation amenable to regression analysis, we took logarithms of both sides of (1), obtaining

$$\ln P = \ln E - \ln (k - \theta g). \quad (2)$$

To emphasize that the focus of our investigation is an attempt to explain  $P/E$  rather than  $P$ , we rewrote (2) as

$$\ln (P/E) = -\ln (k - \theta g). \quad (3)$$

Invoking Modigliani-Miller [15] and assuming neutral taxation,  $k$  is equal to  $\rho + (\rho - r) d$ , where  $\rho$  represents the unlevered cost of equity,  $r$  the real rate of interest and  $d$  the firm's target debt-equity ratio. Letting  $p$  represent the long-run anticipated rate of inflation and noting that  $\rho$  can be written as  $a + br$  [14] and  $r$  as  $R - p$ , where  $R$  is the long-term nominal rate of interest,  $k$  can be expressed as

$$k = A + B (R - p),$$

where  $A = a(1+d)$  and  $B = [b(1+d) - d]$ .

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<sup>2</sup>If  $E$  is partially adjusted noise-free earnings, that is, fully adjusted noise-free earnings less the debt adjustment, a concept discussed below, then the capitalization rate would be  $k - \theta g - pd$ , where  $p$  is defined below as the long-term anticipated rate of inflation and  $d$  as the firm's target debt-equity ratio.

Thus the capitalization rate for earnings becomes

$$k - \theta g = A + B(R-p) - \theta g,^3 \quad (4)$$

and can be rewritten as

$$k - \theta g = A \left( 1 + \frac{B(R-p) - \theta g}{A} \right). \quad (5)$$

Taking logarithms of both sides of (5),

$$\ln(k - \theta g) = \ln A + \ln \left( 1 + \frac{B(R-p) - \theta g}{A} \right). \quad (6)$$

It is reasonable to presume that  $B(R-p) - \theta g$  is small in relation to  $A$ , and therefore the second right-hand-side term of (6) can be approximated as

$$\frac{B}{A}(R-p) - \frac{\theta}{A}g.$$

Taking advantage of this approximation, (3) can be rewritten as

$$\ln(P/E) = -\ln A - \frac{B}{A}R + \frac{B}{A}p + \frac{\theta}{A}g. \quad (7)$$

Our basic test equation, based on (7), is

$$\begin{aligned} \ln(P/E)_t = & a_0 + a_1 R_t + a_2 \sum_{\tau=1}^{\infty} p(t-\tau) + a_3 \text{PREM}_t \\ & + a_4 g_t + a_5 \sum_{\tau=1}^{\infty} \text{LF/Emp}_t(t-\tau) + a_6 (\text{DIV/E})_t + u_t. \end{aligned} \quad (8)$$

The last two independent variables represent an attempt to improve upon our estimate of  $E$  by trying to capture the effect of the business cycle on actual earnings and also the "information content" of dividends.

With respect to the business cycle, it can be reasonably hypothesized that investors, in assessing the information content of past earnings in forming expectations of long-run earnings, adjust actual earnings from cyclically depressed periods upward and from periods of above-normal activity downward. The  $a_5$  term, a distributed lag of  $\text{LF/Emp}$ , the ratio of labor force to employment, was designed to capture this cyclical effect by, in essence, multiplying  $E$  by an exponential function of labor force to employment. The  $a_6$  term,  $\text{DIV/E}$ , defined as the percentage increase in the

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<sup>3</sup>It becomes  $k - \theta g - pd = A + BR - (B+d)p - \theta g$  in the case of partially adjusted  $E$ .

current dividend payout ratio over the average of that of the current year and that of the immediately preceding one, represented an attempt to capture the dividend information content notion.<sup>4</sup>

Our measure of  $R$  was the same as that which we used in estimating the correlation coefficients in Section II, the source of which is discussed below. Our estimate of the long-run expected rate of inflation was a distributed lag of past rates of change in the national consumer price index. The  $a_3$  term, PREM, was designed to capture systematic changes over time in the market's required risk premium. It was measured as a moving eight-quarter average deviation in the labor force unemployment rate from the eight-quarter mean.<sup>5</sup>

The growth term was estimated as an eight-quarter annualized trend growth rate in the national index of industrial production. The  $u$  term represents the residual.

Assuming that the relevant variables are measured correctly, rational valuation would imply a positive value for  $a_0$  and a negative value for  $a_1$  since  $R = r + p$  and the coefficient of  $r$  should be negative. Rational valuation implies that the coefficient of the  $p$  term should be equal in absolute value but opposite in sign to that of the  $R$  term,  $a_1$ .<sup>6</sup> An algebraically lower value for the coefficient of  $p$  would tend to lend support to the Modigliani-Cohn hypothesis that the capitalization rate is directly related to the nominal interest rate. The coefficients of the

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<sup>4</sup>If expected earnings are developed as  $E(\text{Current payout}/\text{Average payout})$ , then the logarithm of expected earnings can be viewed as  $\ln E + \ln(\text{Current payout}/\text{Average payout})$ . The logarithm of  $(\text{Current payout}/\text{Average payout})$  is approximately  $\text{DIV}/E$ .

<sup>5</sup>We have no a priori notion as to the normal unemployment rate for the countries in question and were reluctant to assume that the normal rate was not subject to change.

<sup>6</sup>If  $E$  is only partially adjusted, the coefficient of the inflation term should be greater in absolute value than  $a_1$  so as to reflect the fact that partially adjusted  $E$  falls as  $p$  rises.

growth, business cycle, and dividend payout terms should be positive while that of the risk premium term should be negative.

#### B. Sources of Data

Stock price, earnings, dividend, and depreciation data were obtained from Capital International Perspective [4] on a quarterly basis for the period 1969 to 1979. The data for each country are capitalization-weighted aggregates of the relevant data for individual firms listed on the major domestic stock exchanges and, hence, are representative of the corporate sector as a whole. This is reassuring since data on certain other variables were available only for the entire corporate sector and were incorporated with appropriate proportional transformations.<sup>7</sup>

#### C. Adjustments to Earnings

The Modigliani-Cohn hypothesis requires a test of the impact of inflation on the ratio of stock prices to "noise-free" long-run earnings. With inflation, reported earnings computed according to generally accepted accounting principles in the U.S. are biased estimates of "true" earnings. The principal sources of bias are 1) the understatement of depreciation relative to actual capital consumption, 2) the potential understatement of the cost of goods sold when there is a significant lag between the purchase of inputs and the sale of finished goods and 3) the overstatement of financial charges by the extent to which nominal interest rates reflect a premium for anticipated inflation, a premium which should be viewed as a repayment of real principal rather than interest. According to Modigliani and Cohn's findings for the U.S., it would appear that in valuing shares, investors make the necessary adjustments for two of these effects,

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<sup>7</sup>Capital International reports for each country a stock price index, an aggregate price to earnings ratio, an aggregate price to cash earnings (earnings plus depreciation) ratio, and a dividend yield. Earnings, dividends and depreciation were derived from these ratios. Only stock price data are available before 1969.



understated depreciation and cost of goods sold, but fail to make the third.

In examining the impact of inflation on stock prices in other countries, it must be recognized that not only may the adjustments necessary to remove inflation-induced biases in reported earnings differ across countries, but the extent to which investors make these adjustments may differ as well.

Depreciation Adjustment (CC): With inflation, historical cost depreciation understates economic depreciation as a function of the age and composition of the capital stock and cumulative inflation for level of each category of assets. However, the asset life used in computing book depreciation is often shorter than economic life. Although in the steady state this difference in lives would not affect depreciation charges, it will affect the required inflation adjustment.<sup>8</sup>

Inventory Adjustment (INV): The second impact of inflation on reported earnings is the understatement of the cost of goods sold when there is a lag between the purchase or production of goods and their sales, and hence a positive inventory stock. If first in-first out (FIFO) accounting is used, the bias is substantial, whereas if last in-first out accounting (LIFO) is used, it usually is insignificant. Assuming FIFO accounting, the

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<sup>8</sup>The adjustments for inflation biases required data available only for the entire non-financial corporate sectors of each country, a sample that differs from the one for which we have price, earnings, and book depreciation data. However, differences in the proportions of capital stock dating from a given year should not be too great since our indexes are weighted by market capitalizations and, thus, should closely match the entire economy. Annual additions to non-residential structures and machinery, the two principal components of corporate investment, were obtained from the UN Yearbook of National Income Accounts [22] as were the implicit deflators for both classes of assets. The asset life used in computing book depreciation was inferred from a comparison of the ratio of book depreciation to the stock of depreciable fixed assets for the non-financial corporation sector in each country relative to a true ratio computed from the age and composition of the capital stock of each country. Data on book depreciation relative to the stock of depreciable fixed assets were obtained from OECD Financial Statistics [17].

adjustment to earnings consists of the percentage change in the wholesale price index multiplied by inventory holdings.<sup>9</sup>

Debt Adjustment (DBT): The third source of bias in reported earnings is the interest overstatement. This bias can be corrected by adding  $pD$  to profits adjusted for depreciation and inventories, where  $p$  is the long-run expected rate of inflation built into nominal interest rates<sup>10</sup> and  $D$  the net debt per share of the index for which earnings are being measured, and net debt refers to the difference between nominal liabilities and nominal assets.

We estimated  $p$  as the difference between a measure of the nominal interest rate ( $R$ ) on long-term bonds<sup>11</sup> and an estimate of the real rate ( $r$ ). In order to match the debt adjustment to the interest charges reflected in earnings, always measured for the previous twelve months, the mean end-of-quarter  $R$  for the current and previous four quarters was used.

The real rate, ( $r$ ) was estimated as the average difference over the full 1969-79 period between end-of-quarter values of  $R$  and annualized quarterly rates of change in the consumer price index. Our estimated values of  $r$  for the countries in our sample are presented in Table 2.<sup>12</sup>

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<sup>9</sup>Estimates of the size of inventory holdings were derived from balance sheet and income statement data for national non-financial corporate sectors reported in OECD Financial Statistics [17]. This inventory figure was transformed into a figure appropriate to our sample by first taking a ratio of inventory to depreciation for the OECD sample and then multiplying it by depreciation for our sample.

<sup>10</sup>In any particular period realized inflation will differ from this rate. There will be a windfall gain either to the net debtor firm or to its creditors. But this windfall gain is by nature transitory and therefore is not part of noise-free profits.

<sup>11</sup>For  $R$ , we used secondary market yields to maturity on medium to long-term bonds from OECD Financial Statistics [17] for the period 1969:1 to 1972:4 and from Morgan Guaranty Trust Company's World Financial Markets [23] for 1973:1 to 1979:4.

<sup>12</sup>The value of  $R$  for Italy is not so low as it would seem. Tax on interest income in Italy is usually withheld at the source, and the yield series we used represents after-tax yields.

Table II

## Interest Rates and Inflation - 1970:1 - 1979:4

	Average Nominal Rate (R)	Average Inflation (p)	Average Real Rate (r)
Canada	9.65%	7.61%	2.05%
France	10.31	9.19	1.11
German	8.24	4.97	3.27
Italy	10.72	13.00	-2.28
Japan	8.34	9.06	-0.71
Netherlands	8.39	7.31	1.07
U.S.	8.47	7.38	1.09
U.K.	12.97	13.37	-0.40

D was estimated from annual balance sheets and income statements for the nonfinancial corporate sectors of the sample countries as published in OECD Financial Statistics. These data were not available for Canada and the Netherlands. First net nominal liabilities for each remaining country for each year from 1969 through 1979 were calculated from balance sheet data. To obtain a leverage measure that could be related to our share price index, net nominal liabilities were then divided by depreciation as indicated by the corresponding year's income statement. Multiplying the resulting ratio of net debt to depreciation by depreciation per share of our price index, measured as the difference between cash earnings and earnings, gave us our value of D. Finally, we adjusted the already partially adjusted earnings by adding to it our estimated pD.

#### D. Which Earnings Do Investors Capitalize?

If we knew precisely which rules were used for computing profits in each country and were sure that investors were rational in making the appropriate adjustments, there would be no ambiguity regarding appropriate earnings adjustments. However, in most countries some variety in accounting practices is allowed and used; hence the rules themselves are ambiguous.

In order to decide on adjustments to earnings for use in our regressions, we examined the correlations between various sets of partially (depreciation and inventory adjustments only) and fully (including debt adjustments) adjusted earnings and share prices. Two alternative earnings smoothing procedures were considered, two and three year averages adjusted for changes in the CPI, and quarterly average as well as end-of-quarter stock prices were used.

Correlations between stock prices and alternative measures of earnings vary considerably. That measure resulting in the highest correlation and, thus, the lowest variability of PE ratios should be the best estimate of true earnings. However, great care must be taken in drawing inferences about the measure of earnings that investors capitalize since there is substantial interaction among the various adjustments and, thus, the apparent magnitude and even the observed direction of certain adjustments depend on which others are considered simultaneously. Of the eight countries considered earlier, complete data for earnings adjustments were available only for five: France, Germany, Japan, the U.K., and the U.S.

Given the differences across countries in the measures of earnings most closely associated with stock prices, it would be misleading to assert that a particular earnings definition is the appropriate one for inclusion in our regression model. Therefore, we estimate two models for each of the five countries for which we have complete data: one using reported

earnings and one using fully adjusted earnings (partially adjusted earnings plus the debt adjustment).<sup>13</sup> We also estimate our model with the ratio of price to dividend (the inverse of dividend yield) as the dependent variable on the presumption that dividends can be viewed as a fraction of noise-free profits.<sup>14</sup>

Of all our assumptions regarding accounting principles used in computing earnings in various countries, the assumption that FIFO is used throughout is the most questionable. Even in the U.S., a large proportion of firms use LIFO. To the extent that LIFO is used, the computed inventory valuation adjustment will produce a downward biased measure of partially or fully adjusted earnings.

In an attempt to overcome this difficulty, we developed a specification which allowed reported earnings to be adjusted by a fraction of the inventory valuation adjustment (INV). We changed the dependent variable to  $\ln [P/(E_R - CC + DBT)]$  and included  $\ln [1 - INV/(E_R - CC + DBT)]$  as an additional independent variable, where  $E_R$  represents reported earnings.<sup>15</sup>

<sup>13</sup>We were unable to estimate equations for partially adjusted earnings since our measure of them results in negative earnings in some periods for most countries.

<sup>14</sup>If dividends are a constant fraction of noise-free earnings, then  $a_0$  in equation (8) will incorporate the logarithm of this fraction.

<sup>15</sup>What we wanted was a specification which allowed us to estimate the fraction of our measure of INV which the stock market used in adjusting reported earnings for the effects of inflation. Instead of writing

$$E_A = E_R - INV - CC + DBT, \quad (12)$$

where  $E_A$  represents fully adjusted earnings, we chose the more general expression

$$E_A = (E_R - CC + DBT) \left(1 - \frac{INV}{E_R - CC + DBT}\right)^\gamma, \quad (13)$$

where  $\gamma$  can be presumed to take on some value from the interval (0,1). The case in which  $\gamma = 0$  can be thought of either as a situation in which all firms in the market use LIFO, in which case no inventory adjustment is required, or less believably as one in which market participants make the full required inflation adjustments to earnings with respect to depreciation and interest but no adjustment for inventory valuation. A value for  $\gamma$  of unity would be consistent with all firms employing FIFO accounting. Taking logarithms of both sides of equation (13), we can add  $\ln \left(1 - \frac{INV}{E_R - CC + DBT}\right)$  to both sides of our test equation. The dependent variable thus becomes  $\ln [P/(E_R - CC + DBT)]$  while  $\ln \left(1 - \frac{INV}{E_R - CC + DBT}\right)$  becomes an additional independent variable.

### E. Regression Results.<sup>16</sup>

Price/Dividend Model: The results of using the logarithm of the ratio of average price to dividend as the dependent variable are reported in Table 3. The cyclical term is not included, since dividends presumably reflect noise-free earnings. Also, the dividend/earnings term is not included since it is not relevant to this regression. The results fail to contradict the simple correlations reported in Table I. In all cases, the ratio of price to dividends is negatively related to interest rates, although this effect is statistically significant only for the United Kingdom. However, in no case is the signs of the coefficients of the inflation variable positive, although the coefficients are significant only for the United States.<sup>17</sup>

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<sup>16</sup>Our preliminary regressions used end-of-quarter price in constructing the dependent variable. In an attempt to reduce noise in our price series, we employed a measure of average price for the quarter in our final runs. While this measure of price resulted in a somewhat better fit, the results presented in this section are not qualitatively different from those we obtained using end-of-quarter prices. In all cases, the  $a_2$  and  $a_5$  terms in equation (8) were treated as distributed lags over the current and previous seven quarters. The coefficients were estimated by a second-degree Almon polynomial. The values for these terms presented below in Tables III and IV represent the sums of current and lagged coefficients. Because the hypothesis that the change in stock price is a martingale implies first-order serial correlation of the residuals, we employed generalized least squares in estimating equation (8).

The values which appear in parentheses are t-statistics.

<sup>17</sup>Regressions including growth and risk premiums were run, but the coefficients of these variables were generally insignificant. These results are not reported owing to space limitations.

Table III  
Price to Dividend Regressions -- 1970:1 - 1979:4

Log (Price/ Dividend)	$a_0$	R	INFL <sup>a/</sup>	Rho	Standard Error	Durbin- Watson
Canada	3.52 (13.77)	.00 (.09)	-.04 (2.10)	.86	.065	1.37
France	3.59 (11.89)	-.03 (.85)	-.04 (1.58)	.85	.078	1.40
Germany	3.49 (11.80)	-.05 (2.02)	-.00 (.01)	.96	.075	1.39
Italy	3.64 (24.50)	-0.01 (.33)	-.01 (.64)	.27	1.64	2.00
Japan	3.88 (.03)	-.04 (1.83)	-.01 (1.30)	1.00	.080	.98
Netherlands	3.05 (12.01)	-.02 (1.33)	-.01 (.26)	.94	.072	.92
United Kingdom	3.75 (18.05)	-.06 (5.09)	.00 (.27)	.87	.088	1.36
United States	3.84 (13.46)	-.04 (1.12)	-.04 (1.81)	.94	.067	1.51

<sup>a/</sup> 8-quarter, second-degree distributed lag.

Price-Earnings Regressions: The results of regressions using the ratio of price to two alternative measures of earnings are reported in Table IV.<sup>18</sup> The general picture which emerges, like that from Table III, is not strongly supportive of rational valuation. The coefficients of the inflation variable generally fail to "undo" the coefficients of the nominal interest rate term.

<sup>18</sup> The two earnings measures employed are reported earnings and fully adjusted earnings. None of the measures could be computed for Italy since earnings data corresponding to our index are not available and only reported-earnings regressions were run for Canada and the Netherlands since no depreciation figures were available for those countries.

The equations for fully adjusted earnings include the inventory valuation adjustment term, on the right hand side, whereas the equations for reported earnings do not include this variable. In order to avoid having to take logarithms of a negative inventory adjustment term, it was necessary to multiply the estimated adjustment by a fraction (.25). This procedure changes the magnitude of the estimated coefficient of INV but not its sign.<sup>19</sup>

For Canada, both formulations show insignificant (at the .05 level) negative signs for nominal interest rates and significant negative signs for inflation. For France, the coefficient of the interest rate term is near zero and insignificant in both regressions, but the coefficient of inflation is significantly negative in both cases. The INV term appears to have an insignificant impact on valuation, suggesting either that most French firms use LIFO accounting or that investors overlook the necessary adjustments. We found near-zero coefficients for the INV term for all of the countries in our sample except the United Kingdom and the United States.

In the case of Germany, the coefficients for the nominal interest rate and inflation are negative although insignificant with both earnings measures. In the case of Japan, with respect to both reported and fully adjusted earnings, the coefficient for nominal interest rates is negative and nearly significant while the coefficient for inflation is significantly negative.

For the Netherlands, we present results only for reported earnings since needed depreciation data were not available. Because current cost

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<sup>19</sup> Again, the full regression model was run for each country but the coefficients of business cycle, growth, risk premium, and DIV/E were generally insignificant and only abbreviated results are presented here owing to space limitations.



accounting is commonly employed in the Netherlands, reported earnings can be thought of as measures of partially adjusted earnings. Again, interest rates have a significantly negative impact on the price-earnings ratio which is not offset by the coefficient of the inflation term. For the United Kingdom, there is a significant negative relationship between price-earnings ratios and interest rates accompanied by a negative but insignificant relationship with inflation.<sup>20</sup>

Finally, the results for the U.S. are consistent with the earlier findings of Modigliani and Cohn. For both reported and fully adjusted earnings, the coefficient of the nominal interest rate variable is negative although insignificant and the coefficient of inflation is negative and significant.

#### IV. SUMMARY

Taken together, the results presented in this paper for the decade of the 1970's are consistent with the initial indications that stock prices are negatively related to nominal interest rates and inflation in a number of countries. However, given the difficulty of specifying precisely which adjustments to reported earnings should be made and which adjustments are taken into account by investors, it is difficult to trace these results to a specific view of investor behavior. The results do serve to challenge the traditional view that equities are real instruments whose values are unaffected by inflation. The interesting question for further exploration is whether the observed relationship between interest rates, inflation and stock prices is the result of systematic errors in valuation on the part of

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<sup>20</sup>This finding is of particular interest in light of Feldstein's [8] argument that much of the negative effect of inflation on stock prices in the U.S. can be traced to tax effects. In the U.K. there are no negative tax effects at the corporate level since capital expenditures can be written off in one year as can changes in inventory holdings (Revzin [18]). Therefore, some other effect must be operating.

Table IV  
Price to Earnings Regressions -- 1971:1 - 1979:4

Log (Price/ Dividend)	a <sub>0</sub>	R	INFL <sup>a/</sup>	INV	Rho	Standard Error	Durbin- Watson
<u>Canada</u> --							
Reported Earnings	3.01 (10.82)	.01 (.29)	-.10 (4.36)	--	.94	.062	1.15
<u>France</u> --							
Reported Earnings	3.48 (6.19)	.01 (.19)	-.12 (2.97)	--	.82	.118	2.09
Fully Adjusted Earnings	2.51 (5.14)	.00 (.06)	-.10 (2.82)	.12 (.94)	.90	.097	2.06
<u>Germany</u> --							
Reported Earnings	2.63 (9.36)	-.00 (.17)	-.05 (1.01)	--	.92	.090	1.71
Fully Adjusted Earnings	2.68 (10.85)	-.01 (.32)	-.04 (.95)	.23 (.86)	.78	.092	1.69
<u>Japan</u> --							
Reported Earnings	3.01 (1.47)	-.03 (1.29)	-.04 (3.27)	--	1.00	.081	.85
Fully Adjusted Earnings	2.22 (.05)	-.03 (1.21)	-.04 (4.20)	-.10 (.25)	1.00	.076	1.11
<u>Netherlands</u> --							
Reported Earnings	2.60 (6.41)	-.09 (2.70)	.01 (.18)	--	.88	.129	1.00
<u>United Kingdom</u> --							
Reported Earnings	3.09 (8.88)	-.07 (4.10)	-.00 (.10)	--	.94	.117	1.30
Fully Adjusted Earnings	3.01 (11.95)	-.06 (4.34)	-.00 (.31)	1.25 (2.46)	.89	.102	1.32
<u>United States</u> --							
Reported Earnings	3.18 (10.29)	-.01 (.31)	-.08 (3.61)	--	.93	.073	1.60
Fully Adjusted Earnings	3.33 (12.38)	-.01 (.34)	-.07 (3.50)	1.85 (.76)	.75	.072	1.70

<sup>a/</sup> 8-quarter, second-degree distributed lag.

investors or linkages between structural causes of inflation and factors that reduce long-term earnings potential for firms.

At the very least, the results suggest that during the decade, rising (falling) inflation tended to coincide with a fall (rise) in stock prices beyond that accounted for by a decline (an increase) in after-tax profits. Under rational valuation, the major factors in addition to changes in the risk-free rate that affect the capitalization rate applied to long-run earnings are changes in the risk premium and changes in expected true growth. Our findings reflect an admittedly crude attempt to control for these factors. While inflation may be proxying for some set of real variables which is producing the effects we observe, it is tempting to conclude that systematic errors in valuation are made when there is significant inflation.

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