Differential Effects of Inflation

by

James E. Walter*

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RODNEY L. WHITE CENTER
FOR FINANCIAL RESEARCH

University of Pennsylvania

The Wharton School

Philadelphia, Pa. 19174

I. Introduction

Inflation affects aggregate corporate values in several ways. One, the real growth of the economy may be raised or lowered thereby. Two, the share of income going to the corporate sector may increase or decrease. Three, the market risk premium, systematic risk and the risk-free rate (or its equivalent) are all subject to change.

Inflation also alters the structure of individual share values. Given unanticipated variations in the rate of price change, corporations enter each inflationary period with chance differences in age of plant and equipment, capital structure, and excess capacity. Companies further differ in their continuing needs for funds,in the character of their production processes, and in other ways.

To the end of assessing the effects of such interfirm diversity, the present study develops a plausible valuation model and applies this model to selected corporate environments. Our supposition is that corporations - confronted with accelerated price change - modify their game plans only as inflation and competition dictate. Chance, interfirm differences enter the picture partly as initial values to the model and partly as elements influencing behavior patterns. Quality of reported earnings is treated separately.

Our concern with aggregate, as opposed to differential, effects is confined largely to matters relating to required rates of return or discount factors. Suffice it is to say that the ratio of corporate profits (after inventory valuation adjustment) to national income (P) varies directly, but not at all impressively, with the relative change in the GNP deflator (D). The observed least-squares relationship was (based on data from 1940-1973):

$$(1) \quad P_t = .1134 + .0116\ D. \qquad R^2 = \text{negligible.}$$

No attempt has been made to evaluate the effect of inflation upon real growth.

Our findings point to the highly discriminatory character of inflation. For one thing, share values of firms whose operating policies remain unchanged react differently to uniform, across-the-board inflation. Some share values rise; others fall. For another thing, share values are highly sensitive to differential rates of price change. In addition, ratios of earnings adjusted for purchasing power changes to reported earnings differ markedly among corporations even under the conditions of moderate inflation that characterized 1973 and earlier.

II. Basic Model

Consistent with prevailing thought, corporate share value (P_o) in the longer-run is presumed to equal:

$$(2) \quad P_o = \sum_{t=1}^{H} D_t (1 + r)^{-t} + M_H \cdot E_H (1 + r)^{-H},$$

where D_t represents dividends per share in the t^{th} period, H is the number of periods during which inflation or differential price change is expected to continue, M_H refers to the terminal price-earnings multiplier at the end of H periods, E_H represents earnings per share at time H, and r is the anticipated rate of return required by investors for investing in the company in question. Other generalized equations include:

$$(3) \quad D_t = D_{t-1} + \alpha_1 (p^* \cdot E_t - D_{t-1}) ,$$

where p* is the target payout ratio and α_1 represents the speed of adjustment;

$$(4) \quad E_t = [1-T_t] \cdot \left[S_t \left(1-k\left\{\frac{1 + \Delta_2}{1 + \Delta_1}\right\}^t\right)-FC_o \left(1 + \frac{\Delta GP}{GP} + \Delta_3\right)^t - Dp_t - I_t\right] ,$$

where T_t is the corporate tax rate in period t, S_t is sales in period t, k represents the variable cost ratio at time 0, FC_o refers to fixed cost at time 0, Dp_t is depreciation in period t, I_t is interest in period t, $\Delta GP/GP$ is the ratio of change in gross plant (ΔGP) to gross plant (GP), and Δ_1, Δ_2 and Δ_3 relate respectively to rates of price change for sales, variable costs and fixed costs;

$$(5)\quad Dp_t = Dp_{t-1} + \alpha_2 \,(CE_t - Dp_{t-1}) \,,$$

where CE_t represents capital expenditures in period t and α_2 is depreciation rate on net new investment;

$$(6)\quad CE_t = \alpha_3 \lambda^t \, S_t + \alpha_4 \lambda^t \, \Delta S_t \,,$$

where α_3 and α_4 are respectively the replacement and new investment factors, and λ is the ratio of one <u>plus</u> the capital-outlay rate of price-change to one <u>plus</u> the rate of change in productivity <u>plus</u> Δ_1.[1]

Equation (3), cast in the familiar mold of delayed adjustment to target ratio, possesses sufficient flexibility to encompass a wide range of corporate dividend policies. The least-squares form used to estimate α_1 and p* was:

$$(3')\quad D_t = a + b\, E_t + c\, D_{t-1} \,,$$

where b equals $\alpha_1 \cdot p^*$ and c equals one minus α_1.[2]

Equation (4) is partly definitional and partly behavioral in character. It stipulates that the variable cost ratio varies over time in accordance with $\left(\frac{1 + \Delta_2}{1 + \Delta_1}\right)^t$, while fixed costs vary directly with the relative change in gross plant and the rate of inflation in fixed costs. The notion that fixed costs move with capacity-related expenditures seems eminently reasonable.

Equation (5) presupposes that depreciation is a linear function of the difference between capital outlays and last period's depreciation. As such, incremental depreciation is related to changes in net plant and equipment. Equation (6) in turn depicts capital outlays as being partly replacement and partly incremental capacity-oriented. Interperiod changes in sales are presumed to be the basis upon which management evaluates needs for greater capacity. As in equation (4), allowance is made for differential rates of price change (not to mention productivity changes).

Equations (2) through (6) fall somewhat short of a complete system of equations. First, the rate of growth in sales (without price adjustment) is presumed to be determined exogenously, as are the diverse rates of price change. Second, determination of the interest component necessitates the incorporation of a fund flow analysis to assess possible requirements for additional debt. To this end, an additional equation that relates working capital to sales is required. Third, the discount rate (r) remains unspecified.

While the discount rate (r), or required rate of return, is less than fully explained in theory, certain propositions appear reasonable as a basis for estimating r. Specifically, investors are presumed to demand a rate of return at least equal to some base rate, e.g., the risk-free real rate, plus a linear function of the market risk premium that takes account of relative sensitivity to market-wide phenomena plus the expected rate of price change.

III. Application to Sample

Firms selected for experimentation with inflation effects under given corporate behavior patterns (policies) include three acknowledged growth companies, three nongrowth corporations, and one intermediate growth situation. The sample includes:

Company	Five-year Growth Rate (Least Squares)*		Estimated Company Beta
	Per Share Sales	Per Share Earnings	
Burroughs	9%	16%	1.20
Dow Chemical	12	14	.90
Eastman Kodak	9	11	.74
Standard(Ind.)	11	9	.94
Goodrich	7	-2	1.26
Republic Steel	6	-12	1.45
Scott Paper	5	-5	1.07

* 1968-73, as reported in Financial Dynamics.

As dictated by the basic model, least square regression equations applicable to each of the seven sample companies included:

$$(7) \quad OC_t = f\ (S_t,\ GP_t)\ ,$$

where OC_t refers to operating costs before depreciation in period t;

$$(8) \quad Dp_t = f\ (CE_t,\ Dp_{t-1});$$

$$(9) \quad CE_t = f\ (S_t,\ S_{t-1});$$

$$(10) \quad D_t = f\ (E_t,\ D_{t-1});$$

$$(11) \quad T_t = f\ (EBT_t)\ ,$$

where EBT_t refers to earnings before taxes in period t;

$$(12) \quad WC_t = f\ (S_t)\ ,$$

where WC_t is working capital in period t. Other symbols are, as noted previously. Per share data employed in the regression analyses were obtained from Compustat files. To test for the stationarity of regression parameters, regressions were run for both the period 1954-72 and 1952-70.

As distinct from the earlier set of regressions (1952-70), which included cost of sales and selling and administrative expense both regressed on sales, the later set (1954-72) featured operating costs regressed on sales and gross plant. The thought was that the regression coefficient for gross plant might better capture the fixed component of costs than did the regression constants associated with cost of sales and selling and administrative expenses as a function exclusively of sales.

Variations in regression parameters between the two sets of regressions merited attention in two instances. The dividend regression equation for Republic Steel, based upon 1952-70 time series data,

featured high reaction and high target payout coefficients (both in excess of 90%). The corresponding equation, based upon 1954-72 data, was characterized by a sizable negative regression constant that gave rise to decreasing cash dividends per share in the face of rising earnings per share. The difference was attributable to sharply diminished dividends in 1971 and 1972. Since the regression parameters derived from the more recent data lead to behavior that is patently inconsistent with that hypothesized for firms in cyclical industries, the earlier regression equation was utilized in the analysis of inflation effects.

Capital expenditure regression patterns revealed sign changes, associated with lagged sales, between the two overlapping time periods in four of seven cases. Factors that may have contributed to the sign changes are noted below. Suffice it is to say that the regression results remain usable despite ambiguity of sign.

Estimated behavior patterns, shown in Appendix A for the seven firms, reveal certain inconsistencies with the hypothesized relationships. First, Burroughs and Standard (Indiana) feature operating costs that vary directly with sales and inversely with gross plant. The basis for this anomaly may rest with the nature of the underlying industries. Burroughs' gross plant, for example, includes equipment leased to others. It may also hinge upon interaction between the two explanatory variables.

Second, capital expenditures tend to vary directly with current sales, but their association with lagged sales lacks uniformity. Not only does collinearity between S_t and S_{t-1} present problems for interpreting the regression coefficients, but also the behavior model can be viewed as either:

(a) $CE_t = a_1 + b_1 S_{t-1} + c_1 (S_t - S_{t-1})$, or

(b) $CE_t = a_2 + b_2 S_t + c_2 (S_t - S_{t-1})$.

In short, it is unclear whether the sign of S_{t-1} should be positive or negative. Earlier regressions (1952-70) run on the same variables yielded a consistently negative sign for lagged sales; a two-year lag was employed in the earlier regressions.

Third, Republic Steel--contrary to expectations--shows depreciation that varies inversely with capital expenditures. The cause may be Republic's switch from accelerated to straight line depreciation in the late sixties. Republic Steel also features working capital that moves negatively with sales. The regression coefficient is, however, small and the t-value insignificant.

IV. Results

The regression equations, summarized in Appendix A-1, together with the presumed growth in real sales, the hypothesized interest rate and certain other items, form the basis for generating D_t and E_H. Other necessary inputs to the share value model (equation 2) include the horizon (H), the required rate of return (r), and the terminal multiplier (M_H). Although alternative values may well be equally plausible, the horizon and the terminal multiplier were taken to be respectively five years and 15. The required rate of return was set at .05 plus the beta value times .04 plus the supposed rate of price change. The interest rate in turn was placed at the 1972 ratio of fixed charges to long-term debt plus an added two per cent for each incremental five per cent in the inflation rate. Finally, growth in real sales was assumed to parallel its growth in the five years ending 1973.[3]

Table 1 shows present value per share, change in debt and four-year growth rates for selected items under three rates of price change (0%, 5%, and 10%). The no-price-change assumption really implies continuation of such price changes as are already embedded in the historical data. The other rates represent increments to the embedded rate.

Interestingly enough, the seven sample firms fail to react uniformly to inflation despite our initial presumption that product

TABLE 1.

Share Values and Selected Growth Rates for Seven Companies under Three Assumptions of Price Change

Company & Price Change	Present Value	Debt Change	Four-Year Growth Rates: Sales	Fixed Expense	Deprec.	Earnings	Dividends	Cap. Exps.
Eastman Kodak								
0	57.22	(1.648)	.090	.098	.118	.086	.084	.096
.05	57.13	.476	.145	.170	N.A.	.135	.116	N.A.
.10	56.43	3.842	.199	.244	.175	.182	.148	.209
Dow Chemical								
0	30.47	11.48	.12	.098	.119	.121	.049	.127
.05	34.95	13.61	.176	.167	.140	.227	.071	.186
.10	38.84	15.91	.232	.238	.163	.326	.096	.244
Burroughs								
0	64.21	20.77	.090	.132	.173	.091	.022	.123
.05	91.75	37.94	.145	.219	.185	.242	.072	.189
.10	120.59	56.45	.199	.310	.198	.381	.131	.251
Standard Oil(Ind.)								
0	98.60	15.64	.110	.080	.079	.082	.109	.111
.05	114.21	27.04	.166	.153	.101	.176	.184	.167
.10	129.97	40.05	.221	.230	.124	.268	.260	.223
Goodrich								
0	62.62	17.12	.07	.078	.078	.050	.157	.096
.05	66.01	25.36	.124	.145	.084	.119	.204	.166
.10	68.31	34.79	.177	.213	.091	.183	.251	.234
Republic Steel								
0	40.66	N.A.	.060	.063	.959-1	.066	.065	.088
.05	38.52	35.73	.113	.128	.933-1	.111	.087	.161
.10	35.62	45.82	.166	.195	.903-1	.146	.107	.231
Scott Paper								
0	20.68	(.15)	.05	.048	.040	.070	.106	.036
.05	19.10	2.27	.103	.114	.051	.104	.132	.079
.10	16.50	5.46	.155	.183	.063	.114	.144	.126

prices, costs, and capital costs all vary at the same rate. The share values of one growth firm (Eastman Kodak) and two non-growth companies (Republic Steel and Scott Paper) vary inversely with the rate of inflation; those of the remainder move directly with the rate of price change.

Differential rates of price change, together with varying horizons, can, of course, produce a variety of share value configurations. Substitution of a 10-year duration (horizon), for instance, gives rise to share values of $66.09 (0 inflation), $61.82 (.05 inflation) and $54.40 (.10 inflation) for Eastman Kodak. With a one-year duration, the share value with .10 inflation becomes $49.81.

As illustrative of the range of possible variation, rates of change in wholesale prices for five of the seven industries to which the sample firms belong (together with factory construction costs) are given below:

Interval Twelve Months ending	Iron & Steel	Chemicals & Allied Products	Petroleum Products Refined	Tires & Tubes	Paper	Commercial & Factory Construction
July, 1974	40.1%	33.9%	84.3%	24.0%	22.6%	12.2%
July, 1973	5.9	6.3	19.1	.8	4.8	6.3
July, 1972	5.3	(.2)	1.8	(.2)	1.8	8.1
Seven-year Geometric Mean (ending July, 1974)	9.7	5.8	13.3	4.6	6.0	8.3

Source: Survey of Current Business, August, 1972, 1973 & 1974.

Average annual rates of price change for the 59 divisions and subdivisions that comprise the wholesale price index are distributed as follows (7-year geometric mean for period ending July, 1974):

Rate	Number	Cumulative Percent
Negative	1	100.0%
0 - 2.5%	2	98.3
2.5 - 5.0	16	94.9
5.0 - 7.5	19	67.8
7.5 - 10.0	14	35.6
10.0 - 15.0	5	11.9
over 15.0	2	3.4
	59	

On the supposition that the rates of price change observed during the recent past are expected to prevail for some time, the following rate mixes were applied to Dow Chemical:

		Rates of Price Change for:				
Observed Rates for:	Sales[1]	Variable Costs[2]	Fixed Costs[2]	Capital Expenditures[3]	CPI	Rate Combination
12 mos.ending July, 1974	.339	.204	.204	.122	.118	A
24 mos.ending July,1974	.193	.162	.162	.087	.087	B
7 yrs. ending July,1974	.058	.071	.071	.083	.058	C

[1] Wholesale prices for Chemical and Allied Products.

[2] Wholesale prices for all commodities.

[3] Commercial and factory construction.

Simulation results are given below for Dow Chemical. Each combination of actual price changes (A, B, or C) is presumed to persist for the period of years stipulated under Horizon.

Rate Combination	Horizon	Share Value	Change in Debt	Growth Rates for: Sales	Fixed Costs	Depreciation	Earnings	Dividends	Capital Expenditures
A	5	430.98	(99.81)	.500	.452	.143	.948	.541	.272
A	2	123.16	(6.79)	.500	.366	.103	1.268	.363	.277
B	5	139.01	(12.90)	.336	.341	.136	.632	.256	.230
B	2	58.38	.84	.336	.298	.106	.766	.159	.234
C	7	15.40	41.44	.185	.201	.160	.009	.040	.222

The conclusion that differential price-change expectations have major implications for share value seems inescapable. The fact that share value for Dow Chemical, with given behavior patterns, can range from $15.40 to $430.98 under seemingly reasonable price-change, horizon assumptions highlights the sensitivity of share values to such expectations. Adverse stock market behavior under conditions of uncertain inflation is not at all surprising.

V. Inherent Versus Chance Factors

Equation two, the basic share-value model, depicts value as the weighted sum of (a) cash dividends distributed over H periods and (b) a terminal share value derived by multiplying earnings per share in period H by the then prevailing multiplier. Should the quality of per-share earnings be affected by the inflationary environment, the influence of such quality changes might well be reflected in the terminal multiplier. As indicated by the following figures, appreciable departures from five and ten year median multiplier relatives already exist.

	Ratio of Individual Multipliers to Average for Seven Companies		
	Year-end Medians		
Company	1968-73	1964-73	November 7, 1974
Burroughs	1.85	1.77	2.97
Eastman Kodak	1.60	1.58	2.37
Dow Chemical	.97	.97	1.42
Scott Paper	.83	.92	.83
Standard (Indiana)	.68	.68	.83
Goodrich	.58	.63	.59
Republic Steel	.49	.44	.36
Group Average Multiplier	20.57X	20.57X	8.43X

The failure of the basic model to take explicit account of factors conditioning earnings' quality necessitates a separate analysis of inherent and chance variations among firms, as such differences pertain to the relationship between reported earnings and profits adjusted to show the ravages of rapid inflation. Inherent (or industry-wide) considerations include (1) the ratio of depreciation to earnings, (2) the production period as measured by the level of inventory turnover, and (3) the relative magnitude of net monetary assets and of long-term debt. Chance elements comprise (1) the age of plant and equipment as measured by the ratio of accumulated to current depreciation, (2) the timing and maturity schedule of long-term debt issues, and (3) random departures from basic patterns.

Interfirm differences

As evidence of their potential impact upon earnings and share values, Table 2 shows, for 23 companies as of the end of 1973, ratios to earnings of (a) net monetary assets, (b) long-term debt, (c) inventory and (d) depreciation, together with inventory turnover and accumulated depreciation divided by current depreciation. Although the sample encompasses eleven industries, no conscious attempt was made to draw companies from either the least or most affected industries.

TABLE 2.

Selected Ratios for Twenty-three Companies (December 31, 1973)

Industry and Company	Cost of Sales to Inventory	Accumulated Depreciation to Depreciation	Net Monetary Assets	Ratio to Earnings of: Long-term Debt	Inventory	Depreciation
Chemicals						
Dow Chemical	3.95	5.78	.210	4.522	1.837	.970
Drugs						
Eli Lilly	1.50	7.59	1.023	.039	1.350	.172
Merck	1.48	7.19	.522	.129	1.363	.224
Food						
General Foods	3.28	8.48	(.519)	2.267	4.845	.461
Iron and Steel						
Armco	4.66	13.00	.645	5.478	4.179	.833
Bethlehem	7.69	16.07	1.065	3.209	2.144	.949
Republic	6.73	15.81	.219	3.472	3.010	.916
U.S.	9.28	17.32	(.144)	4.359	1.931	1.099
Machinery						
Heavy Equip. Internat. Harvester	2.70	9.77	(3.667)	4.649	11.974	.727
Construction & Materials Handling Rexnord	2.52	9.19	.385	4.615	9.462	.638
Office Equip.						
Burroughs	1.63	4.15	.707	1.922	3.141	1.152
Paper						
Scott Paper	4.76	10.37	.603	3.422	2.145	.821
Petroleum						
Exxon	7.16	9.14	.516	1.093	.911	.465
Gulf	7.05	9.26	1.056	2.010	.836	.783
Mobil	7.92	9.15	(.457)	1.280	1.121	.581
Royal Dutch	4.42	8.02	.444	1.794	1.639	.595
Standard(Calif.)	8.95	9.41	.725	1.261	.780	.482
Standard(Ind.)	6.52	6.27	.528	2.416	.990	1.068
Texaco	6.02	6.80	.282	1.376	1.052	.464
Photographic						
Eastman Kodak	2.62	8.29	1.250	.135	1.128	.297
Retail Trade						
J.C.Penney	3.87	5.17	(2.902)	1.182	6.115	.328
Tire and Rubber						
Firestone	3.32	7.37	.807	3.166	3.972	.725
Goodrich	3.05	9.76	.840	6.118	6.504	1.089
Overall Median	4.66	9.15	.528	2.416	2.144	.727

The range of variation is substantial. Depreciation ranges from 17.2% to 115.2% of earnings; inventory, from 78% to 1,197.4%; long-term debt, from 3.9% to 611.8%; and net monetary assets, from -366.7% to 106.5%. When taken in conjunction with the estimated age of plant and equipment, which varies from 4.15 to 17.32 years, it appears that adjustments to depreciation--designed to recognize interperiod price change--exert the greatest influence upon earnings. Long-term debt and inventory come next in line as partially offsetting factors.

Adjusted earnings

Following the British [2] which now require supplemental statements summarizing the effects of inflation, the 1973 reported earnings of the 23 companies mentioned above were adjusted for changes in the GNP deflator. Adjustment procedures were, as follows:

1. Adjusted depreciation equaled reported depreciation (1973) multiplied by the ratio of the GNP deflator at the end of 1973 to its value at the average purchase date of plant and equipment. The average purchase date was measured by the ratio of accumulated depreciation at the end of 1973 to annual depreciation for 1973.

2. Beginning and ending inventories were each multiplied by the ratio of the GNP deflator at the end of 1973 to its corresponding index value at the average date of inventory acquisition. The average age of inventory was taken to be one-half of 12 divided by the inventory turnover.

3. All other income and expense items, calculated by adding depreciation to and subtracting the change in inventories from earnings, were multiplied by the GNP deflator at year-end divided by its mid-year equivalent.

4. Net monetary assets (defined as quick assets minus current liabilities) held at the year's outset were multiplied by the ratio of the year-end GNP deflator to its index value at the start of the year. The change in net monetary assets was multiplied by the ratio of the year-end GNP deflator to its mid-year figure.

5. Long-term debt was adjusted in the same manner as net monetary assets.

Earnings adjusted for purchasing power changes thus equaled other income-and-expense items (as adjusted) minus depreciation (as adjusted) plus the change in adjusted inventories minus the loss connected with net monetary assets plus the gain associated with long-term debt. The loss from holding net monetary assets was estimated as the difference between net monetary assets (as adjusted) held at the year's outset plus the interim change in net monetary assets (as adjusted) and net monetary assets on the books at the end of 1973. The gain from holding debt was derived in analogous fashion.

Results given in Table 3 show the median ratio of adjusted to reported earnings to be .79; the range is from .49 to .93. The lowest ratios occur, for the most part, in the iron and steel and capital equipment areas. Here, the large depreciation adjustment, combined with sizable inventory changes, overwhelmed the debt gain. At the upper end of the ratio scale, J. C. Penney matched a large inventory adjustment against a major gain in net monetary assets (as explained by the fact that current liabilities exceeded quick assets).

TABLE 3.

Reported Earnings Versus Adjusted Earnings for Twenty-three Companies, 1973

Industry and Company	(1) Reported Earnings (1973) (000,000)	(2) Adjusted Earnings (1973) (000,000)	Ratio of (2) to (1)	Ratio to Reported Earnings (1973) of: Depreciation Adjustment	Inventory Adjustment	Other Income and Expense Adjustment	Net Monetary Assets Adj.	Long-term Debt Adj.
Chemicals	$	$						
Dow Chemical	271.1	249.5	.92	-.334	-.100	+.063	-.013	+.304
Drugs								
Eli Lilly	155.5	129.5	.83	-.073	-.068	+.033	-.063	+.004
Merck	178.3	151.9	.85	-.086	-.069	+.035	-.038	+.010
Food								
General Foods	119.5	90.40	.76	-.203	-.235	+.020	+.029	+.145
Iron and Steel								
Armco	99.3	69.7	.70	-.441	-.261	+.059	-.047	+.392
Bethlehem	206.6	102.2	.49	-.590	-.157	+.079	-.052	+.215
Republic	87.7	47.9	.55	-.569	-.227	+.082	-.009	+.276
U.S.	325.8	171.3	.53	-.749	-.170	+.096	+.030	+.319
Machinery								
Heavy Equip. Internat. Harvester	106.9	59.3	.55	-.345	-.653	+.009	+.224	+.320
Construction & Materials Handling								
Rexnord	13.0	6.6	.51	-.300	-.438	-.015	-.069	+.323
Office Equip.								
Burroughs	115.9	90.9	.78	-.268	-.178	+.078	-.046	+.198
Paper								
Scott Paper	56.4	44.8	.79	-.395	-.137	+.064	+.035	+.227
Petroleum								
Exxon	2,443.3	2,047.4	.84	-.210	-.048	+.046	-.028	+.077
Gulf	800.0	599.2	.75	-.345	-.056	+.065	-.072	+.157
Mobil	849.3	709.0	.83	-.263	-.074	+.055	+.026	+.091
Royal Dutch	1,070.9	952.3	.89	-.253	-.087	+.049	-.024	+.204
Standard (Calif.)	843.6	706.8	.84	-.220	-.040	+.048	-.038	+.088
Standard (Ind.)	511.2	379.6	.74	-.396	-.058	+.072	-.036	+.160
Texaco	1,292.4	1,158.4	.90	-.175	-.040	+.039	-.014	+.087
Photographic								
Eastman Kodak	653.5	513.6	.79	-.129	-.057	+.043	-.081	+.010
Retail Trade								
J.C.Penney	186.1	172.5	.93	-.096	-.344	+.031	+.253	+.083
Tire and Rubber								
Firestone	164.9	114.3	.69	-.281	-.230	+.053	-.070	+.221
Goodrich	59.5	31.5	.53	-.518	-.370	+.057	-.076	+.435
Medians			.79	-.300	-.157	+.055	-.038	+.204

The petroleum area (oversampled because of the special attention focused upon this group) featured ratios of adjusted to reported earnings that were generally above the median ratio. Adjustments for both depreciation and inventory tended to be below median figures for the 23 companies.

The significance of the diverse adjustment factors conforms with our initial suppositions. Depreciation is most significant, followed by long-term debt, inventory, other income and expense items, and nonmonetary assets.

Whether earnings multipliers are conditioned by the varying quality of earnings as reflected in the ratio of adjusted to reported earnings is difficult to say. All that can be said at this juncture is that, with the notable exception of the petroleum group, the higher multiple shares of companies listed in Table 3 tended to show ratios of adjusted to reported earnings that equaled or exceeded the median value. A study of 137 British Companies [2] found the correlation coefficient between multipliers and ratios of adjusted to reported earnings to be an unimpressive figure of +0.3.

Indeed, whether the adjustments recorded above are entirely appropriate is itself open to some question. Utilization of a general price index, such as the GNP deflator or the CPI, simply expresses historical book values in current-dollar terms. No recognition is given to changes in the actual value of specific items. Yet, the quality of earnings is certainly affected more by

the magnitude of reinvestment required to perpetuate such earnings than by the adjusted level of historical investment.

Adjustment for specific price changes

To ascertain specific price effects, inventories of 20 companies were adjusted for changes in individual wholesale price indices.[4] Depreciation in turn was modified in accordance with variations in the producer's durable index. Other items were handled in the same manner as in Table 3.

Results provided in Table 4 show the revised median ratio of adjusted to reported earnings to be .71; the range is from .07 to 1.02. Apart from the extreme value featured by General Foods (.07), the lowest ratios lie in the petroleum area. The inventory adjustment factor, which nearly doubled in general significance, rose from .056 (median) for the petroleum group when the GNP deflator was used to .271 (median) when the petroleum price index was employed.

It follows from the comparison of Tables 3 and 4 that the application of specific price adjustment factors, markedly increases the range of variation in the ratio of adjusted to reported earnings. It also appears that price earnings multipliers take varying account of earnings quality, as reflected in the ratio of adjusted to reported earnings.

In any event, the increasing preference shown for Lifo serves both to lessen the disparity between adjusted and reported earnings and to allow for explicit--as opposed to general--price changes.[5] Under inflationary conditions, Lifo elevates inventory turnover

TABLE 4.

Reported Earnings Versus Earnings Adjusted to Reflect Specific Price Changes for Twenty Companies, 1973

Industry and Company	(1) Reported Earnings (1973) (000,000)	(2) Adjusted Earnings (1973) (000,000)	Ratio of (2) to (1)	Ratio to Reported Earnings (1973) of: Depreciation Adjustment	Inventory Adjustment	Other Income and Expense Adjustment	Net Monetary Assets Adj.	Long-term Debt Adj.
Chemicals	$	$						
Dow Chemical	271.1	276.4	1.02	-.210	-.125	+.063	-.013	+.304
Drugs								
Eli Lilly	155.5	141.5	.91	-.050	-.015	+.033	-.063	+.004
Merck	178.3	166.3	.93	-.060	-.015	+.035	-.038	+.010
Food								
General Foods	119.5	8.9	.07	-.150	-.970	+.020	+.029	+.145
Iron and Steel								
Armco	99.3	72.3	.73	-.316	-.360	+.059	-.047	+.392
Bethlehem	206.6	128.3	.62	-.390	-.230	+.079	-.052	+.215
Republic	87.7	55.9	.64	-.372	-.324	+.082	-.009	+.276
U.S.	325.8	220.1	.68	-.524	-.246	+.096	+.030	+.319
Machinery								
Heavy Equip. Internat. Harvester	106.9	93.9	.88	-.241	-.433	+.009	+.224	+.320
Construction & Materials Handling								
Rexnord	13.0	8.8	.68	-.223	-.338	-.015	-.069	+.323
Paper								
Scott Paper	56.4	41.8	.74	-.298	-.287	+.064	+.035	+.227
Petroleum								
Exxon	2,443.3	1,838.5	.75	-.160	-.183	+.046	-.028	+.077
Gulf	800.0	522.5	.65	-.264	-.233	+.065	-.072	+.157
Mobil	849.3	379.2	.45	-.200	-.526	+.055	+.026	+.091
Royal Dutch	1,070.9	513.5	.48	-.184	-.566	+.049	-.024	+.204
Standard (Calif.)	843.6	556.2	.66	-.167	-.271	+.048	-.038	+.088
Standard (Ind.)	511.2	284.5	.56	-.263	-.377	+.072	-.036	+.160
Texaco	1,292.4	953.3	.74	-.124	-.250	+.039	-.014	+.087
Tire and Rubber								
Firestone	164.9	134.9	.82	-.205	-.181	+.053	-.070	+.221
Goodyear	59.5	43.9	.74	-.387	-.292	+.057	-.076	+.435
Medians			.71	-.217	-.279	+.054	-.032	+.210

figures and makes the inventory holding period appear deceptively short. Accelerated depreciation may also come back in style with parallel consequences.

VI. Conclusions

Numerous issues remain to be resolved. At the level of the basic model, the possibility that corporate behavior patterns will respond (or adjust) to inflation is largely by passed. So also is the matter of the appropriate discount factor. In both instances, the presumption is that rates of price change can simply be superimposed upon the underlying patterns and discount rate. The basic model also supposes that debt is the residual or equating factor.

The fact is that management does react to its environment. The question is how and how quickly. As yet, the experience with rapid inflation is so limited that conditioned reflexes have yet to be developed.

Recent stock market behavior supports the thesis that market risk premiums and company beta values are conditioned by either inflation itself, the uncertainties associated therewith, or questions relative to public policy.

At the level of reported earnings, deficiencies have been noted. The propriety of the adjustments made, however, is not entirely clear. Nor is the investor response to such deficiencies self-evident. Further study is clearly warranted. In particular, attention needs to be directed to variations among industries and firms in (1) value added and (2) the ratio of labor and related costs to value added. The smaller the value added component is, the greater becomes the vulnerability to exogenous price changes.

Appendix A-1

Selected Regression Equations for Seven Companies, Based upon Time Series Data, 1954-72

Company	Regression Constant	Regression Coefficients X_1	X_2	R^2	D.W.
	Operating Expense (before depreciation) Regressed on Sales (X_1) and Gross Plant and Equipment (X_2)				
Burroughs	-.376 (-.267)	1.008 (13.936)	-.261 (-5.886)	.986 (.824)	.556
Dow Chemical	-.418 (-2.284)	.772 (9.681)	.005 (.080)	.998 (.236)	.917
Eastman Kodak	.393 (6.510)	.530 (16.074)	.137 (3.781)	.999 (.112)	1.980
Goodrich	2.917 (1.476)	.796 (15.685)	.069 (1.903)	.996 (.949)	.980
Republic Steel	-.651 (-.239)	.754 (15.868)	.099 (5.623)	.982 (1.619)	1.196
Scott Paper	-.065 (-.051)	.565 (1.848)	.218 (1.075)	.988 (.461)	.450
Standard Oil(Ind.)	1.616 (4.834)	.935 (19.604)	-.105 (-4.055)	.998 (.437)	1.053
	Depreciation Regressed on Capital Expenditures (X_1) and Past Depreciation (X_2)				
Burroughs	-.017 (-.249)	.025 (1.485)	1.126 (23.819)	.991 (.178)	3.010
Dow Chemical	-.043 (-.774)	.081 (3.032)	.964 (14.049)	.984 (.074)	2.259
Eastman Kodak	-.007 (-.519)	.102 (4.065)	.920 (15.219)	.991 (.030)	2.331
Goodrich	.017 (.138)	.017 (.518)	1.035 (14.018)	.969 (.177)	2.124
Republic Steel	.516 (1.079)	-.041 (-1.140)	.956 (6.819)	.758 (.466)	2.023
Scott Paper	.023 (.619)	.026 (1.159)	.985 (23.028)	.978 (.050)	1.943
Standard Oil(Ind.)	.083 (.429)	.050 (.947)	.973 (10.263)	.970 (.263)	1.961

Company	Regression Constant	Regression Coefficients X_1	X_2	R^2	D.W.
Capital Expenditures Regressed on Sales (X_1) and Past Sales (X_2)					
Burroughs	-5.826 (-2.848)	.437 (1.992)	-.130 (-.535)	.680 (2.490)	.925
Dow Chemical	-.371 (-.930)	.041 (.173)	.165 (.617)	.782 (.609)	1.400
Eastman Kodak	-.172 (-1.856)	.075 (1.551)	.036 (.666)	.922 (.188)	.891
Goodrich	-4.110 (-2.636)	-.012 (-.226)	.145 (2.237)	.678 (1.216)	1.223
Republic Steel	-5.296 (-.926)	.024 (.270)	.128 (1.434)	.235 (3.010)	.910
Scott Paper	.587 (1.113)	.274 (1.267)	-.229 (-1.000)	.233 (.561)	1.404
Standard Oil(Ind.)	-.137 (-.126)	.402 (1.932)	-.255 (-1.047)	.878 (.893)	1.610
Taxes Regressed on Earnings before Taxes (X_1)					
Burroughs	.030 (.564)	.464 (34.986)		.986 (.137)	.885
Dow Chemical	.146 (4.543)	.338 (20.695)		.962 (.047)	2.017
Eastman Kodak	.048 (1.751)	.483 (57.968)		.995 (.062)	.901
Goodrich	-.193 (-1.346)	.506 (17.926)		.950 (.158)	.805
Republic Steel	-1.101 (-3.722)	.571 (14.313)		.923 (.541)	.547
Scott Paper	.019 (.145)	.428 (7.241)		.755 (.122)	.302
Standard Oil(Ind.)	-.500 (-5.884)	.323 (15.890)		.937 (.151)	.952

Company	Regression Constant	Regression Coefficients X_1	X_2	R^2	D.W.
	Working Capital Regressed on Sales (X_1)				
Burroughs	-.698 (-.648)	.351 (10.949)		.876 (1.473)	1.346
Dow Chemical	1.053 (3.225)	.087 (3.810)		.461 (.574)	1.323
Eastman Kodak	.158 (.934)	.330 (22.091)		.966 (.363)	.466
Goodrich	12.473 (4.678)	.110 (2.831)		.321 (2.491)	1.405
Republic Steel	16.856 (4.697)	-.012 (-.252)		.004 (2.283)	1.254
Scott Paper	1.879 (3.576)	.025 (.767)		.034 (.604)	1.977
Standard Oil(Ind.)	5.697 (7.433)	.061 (3.106)		.362 (1.013)	1.787
	Dividends Regressed on Available for Common (X_1) and Past Dividends (X_2)				
Burroughs	.338 (4.236)	.024 (4.349)	.281 (1.658)	.839 (.020)	1.776
Dow Chemical	.026 (1.426)	.036 (.924)	.942 (10.950)	.986 (.025)	1.609
Eastman Kodak	.061 (2.025)	.108 (1.460)	.777 (4.521)	.981 (.059)	1.683
Goodrich	-.061 (-.130)	.093 (1.458)	.872 (3.578)	.473 (.145)	1.498
Republic Steel	-.877 (-2.449)	.176 (5.015)	1.042 (8.585)	.852 (.215)	2.338
Scott Paper	.091 (.801)	.236 (2.472)	.526 (2.975)	.739 (.089)	1.531
Standard Oil(Ind.)	-.107 (-.835)	.181 (1.462)	.710 (3.192)	.977 (.111)	1.137

Selected Regression Equations for Seven Companies, Based upon Time Series Data, 1952-70

Company	Regression Constant	Regression Coefficients X_1	X_2	R^2	D.W.
		Cost of Sales Regressed on Sales (X_1)			
Burroughs	3.718 (2.62)	.426 (8.81)		.820 (1.832)	.419
Dow Chemical	-.731 (-4.00)	.656 (86.20)		.998 (.306)	1.275
Eastman Kodak	.571 (11.88)	.466 (92.40)		.998 (.104)	1.500
Goodrich	.799 (1.11)	.705 (62.58)		.996 (.567)	1.359
Republic Steel	-1.722 (-.48)	.838 (18.30)		.952 (2.185)	.863
Scott Paper	1.471	.503			
Standard Oil(Ind.)	4.867 (1.67)	.486 (5.71)		.657 (3.108)	.608
		Selling and Administrative Expense Regressed on Sales (X_1)			
Burroughs	1.214 (1.94)	.239 (11.18)		.880 (.810)	1.082
Dow Chemical	-.415 (-3.22)	.138 (25.85)		.975 (.215)	1.348
Eastman Kodak	-.204 (-4.19)	.177 (34.60)		.986 (.105)	.804
Goodrich	-3.804 (-4.39)	.224 (16.47)		.941 (.684)	1.079
Republic Steel	1.560 (3.08)	.024 (3.61)		.434 (.311)	.302
Scott Paper	-1.807	.313			
Standard Oil(Ind.)	-1.813 (-.63)	.221 (2.62)		.287 (3.084)	.615

Company	Regression Constant	Regression Coefficients X_1	X_2	R^2	D.W.
Dividends Regressed on Earnings (X_1) and Past Dividends (X_2)					
Burroughs	.182 (1.99)	.021 (2.49)	.591 (3.03)	.668 (.028)	1.773
Dow Chemical	.017 (.54)	.066 (1.81)	.922 (11.56)	.988 (.044)	2.184
Eastman Kodak	.030 (1.34)	.141 (2.02)	.759 (4.73)	.985 (.047)	2.672
Goodrich	-.019 (-.15)	.084 (3.87)	.884 (14.25)	.934 (.052)	1.852
Republic Steel	-.017 (-.03)	.081 (1.48)	.878 (5.74)	.700 (.217)	1.555
Scott Paper	.091	.119	.732		
Standard Oil (Ind.)	-.269 (-2.16)	.288 (2.41)	.591 (2.86)	.979 (.096)	1.644
Capital Expenditures Regressed on Sales (X_1) and Past Sales (X_2)					
Burroughs	-8.689 (-4.57)	.508 (4.44)	-.093 (-.66)	.812 (1.890)	.726
Dow Chemical	-.496 (-.56)	.504 (2.48)	-.376 (-1.45)	.783 (1.120)	1.665
Eastman Kodak	-.291 (-7.69)	.137 (12.09)	-.016 (-1.14)	.988 (.072)	1.358
Goodrich	-5.748 (-3.75)	.175 (3.29)	-.020 (-.32)	.811 (.980)	1.993
Republic Steel	-8.011 (-1.70)	.237 (4.60)	-.047 (-.91)	.603 (2.165)	1.432
Scott Paper	.522	.384	-.355		
Standard Oil (Ind.)	-.618 (-.25)	.306 (1.84)	-.141 (-.55)	.863 (.810)	1.864

Company	Regression Constant	Regression Coefficients X_1	X_2	R^2	D.W.
	Depreciation Regressed on Capital Expenditures (X_1) and Past Depreciation (X_2)				
Burroughs	.024 (.35)	.047 (1.84)	1.023 (9.74)	.986 (.150)	2.904
Dow Chemical	-.154 (-.87)	.055 (1.67)	1.057 (9.24)	.962 (.166)	1.443
Eastman Kodak	.030 (3.96)	.171 (10.96)	.650 (13.35)	.997 (.013)	2.386
Goodrich	.093 (.74)	.031 (.78)	.970 (8.71)	.958 (.176)	1.918
Republic Steel	.948 (1.68)	-.012 (-.24)	.759 (3.59)	.548 (.547)	1.784
Scott Paper	.027	.025	.991		
Standard Oil(Ind.)	.206 (1.17)	.014 (.27)	.985 (12.17)	.967 (.249)	2.490
	Taxes Regressed on Earnings before Taxes (X_1)				
Burroughs	-.035 (-1.43)	.505 (64.68)		.996 (.062)	1.555
Dow Chemical	.335 (4.21)	.325 (14.13)		.922 (.112)	2.172
Eastman Kodak	.041 (1.92)	.494 (63.60)		.996 (.051)	1.204
Goodrich	-.634 (-2.38)	.612 (12.21)		.898 (.311)	.812
Republic Steel	-1.887 (-4.33)	.686 (12.80)		.906 (.636)	.590
Scott Paper	.410	.267			
Standard Oil(Ind.)	-.438 (-3.44)	.321 (9.25)		.834 (.208)	.551

Company	Regression Constant	Regression Coefficients X_1	X_2	R^2	D.W.
	Net Working Capital Regressed on Sales (X_1)				
Burroughs	2.391 (3.31)	.240 (9.73)		.848 (.933)	2.323
Dow Chemical	2.595 (4.24)	.067 (2.62)		.287 (1.025)	1.100
Eastman Kodak	.323 (3.01)	.300 (26.69)		.977 (.231)	.344
Goodrich	15.739 (6.69)	.052 (1.40)		.103 (1.858)	.980
Republic Steel	17.388 (4.80)	-.020 (-.42)		.011 (2.228)	1.181
Scott Paper	1.928	.021			
Standard Oil(Ind.)	5.973 (6.32)	.050 (1.80)		.160 (1.007)	1.315

Footnotes

*Professor of Finance, University of Pennsylvania, Wharton School. Financial support from the Rodney L. White Center for Financial Research is gratefully acknowledged.

[1]Lambda (λ) simply allows for the possibility that equipment and plant construction costs may be changing at a different rate than product prices. For simulation purposes, the productivity factor is presumed to be buried in the derived regression parameters and is ignored as a special factor.

[2]Fama and Babiak [1] conclude that deleting the constant term and adding E_{t-1} improves slightly the predictive power of the model.

[3]Real growth is presumed to include a normal price-change component of two to three percent.

[4]No specific indices were available for three companies.

[5]The median decline in earnings occasioned by switching to Lifo in 1974 was .175 for 39 companies. Cf. A. Merjos, "Fifo to Lifo," Barron's, October 21, 1974, p. 5.

References

1. E. F. Fama and H. Babiak. "Dividend Policy: An Empirical Analysis," Americal Statistical Association Journal, December, 1968, pp. 1132-61.

2. R. S. Cutler and C. A. Westwick. "The Impact of Inflation Accounting on the Stock Market," Accountancy, March 1973, pp. 15-24.