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THE SHORT AND LONG RUN EFFECTS OF DEBT-EQUITY RATIOS AND DIVIDEND PAYOUT RATIOS ON CORPORATION STOCK PRICES

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INTRODUCTION

The paper reports the results of an investigation which sought to determine the effects of debt and dividend policies on corporate stock prices. More specifically, the research attempted to divide the total of the effects of debt and dividends into a part over which the managers of a firm can exercise direct control and those over which they have less control. That is, it was thought that stock price responses to debt and dividends were composed of two types of influences:

a. the influence of debt and dividend policies, which is said to be described by the average of the variables, and

b. the influence of short run variation in debt and dividends around these desired or policy levels.

It is hypothesized that in any specific year, the stock price of, say, Standard Oil of New Jersey differs from that of Texaco not only because Standard pursues different financial policies, but because, in that year, Standard and/or Texaco may have debt ratios or dividend payout ratios which differ from their target or average ratios due to the peculiarities of that year. Stated in even another way, variations in stock prices are thought to arise from variations in established financial policies between companies, and from within company year-to-year aberrations around these financial policies.

While there is an interest on the part of managers in knowing how short run fluctuations from established policies will affect their stock price, the more important managerial concern would seem to be that of determining the long run effects of specific policy choices. Thus, the real purpose of the research is to filter out the short run effects and focus on the long run effects of debt and dividend policies on stock prices.

The presumption that stock prices are generated by these two sets of forces requires that any statistical test for the effect of debt and dividend policies explicitly allow for both influences and attempt to separate them from each other. Otherwise, the manner in which a company's stock price responds to temporary aberrations from the company's normal financial policy, say dividend payout, may be confused with what would happen if the dividend policy itself were changed. As an example, there is no clear-cut *a priori* reason to believe that just because a company's stock price may rise as its dividend payout ratio temporarily rises, that a permanent upward change in the payout ratio would result in a permanent rise in price. The temporary rise in the payout ratio may convey information which implies that profit prospects are higher than was earlier anticipated. Thus the higher payout ratio might be associated with a higher stock price not because of the dividend itself but because of the information it conveyed about profit prospects. Alternately, if one assumes a dividend policy which attempts to dampen swings in dividend payments, a rise in the payout ratio may reflect a relatively constant dividend in the face of falling profits. In this case one might expect the temporary price response to be downward as the higher payout ratio accompanied poor current profits. Knowledge of the exact direction of the price response is not as important at the moment as awareness that this response to a temporary rise in the payout ratio need not be that which would accompany a change in policy which permanently raised the dividend payout ratio.

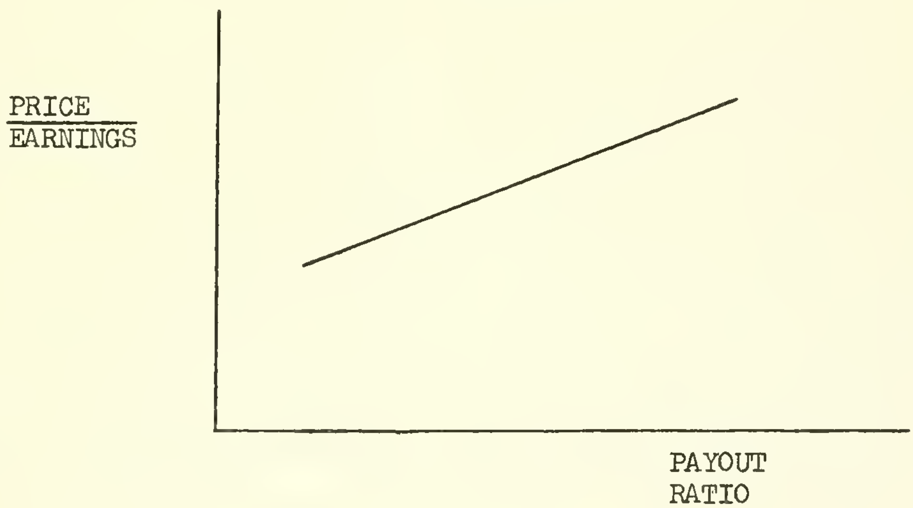
It is now our purpose to explain the elements of an existing statistical technique which allows a partitioning of variation into that which arises from these two sources. The formal name of the technique is the analysis of covariance.

THE ANALYSIS OF COVARIANCE

In the context of this problem, the analysis of covariance is a device to enable one to test the hypothesis that the regression relation that exists between two variables, say, the price-earnings ratio and the dividend-payout ratio is composed of two distinct parts. It gives one the capacity to test the hypothesis that the difference between the stock price of two companies is related to the differences between their financial policies, as well as the capacity to test to see if the year-to-year variations in the stock price of a specific company are related to the fluctuations of the company's financial variables around their average or policy levels.

These statements may become somewhat clearer with the following demonstration. Suppose one ran a regression using the data on price-earnings ratios and dividend-payout ratios for N companies in each of T years. Let the diagram in Figure 1 stand for the estimated regression relation between the price-earnings ratio and the dividend payout ratio.

FIGURE 1



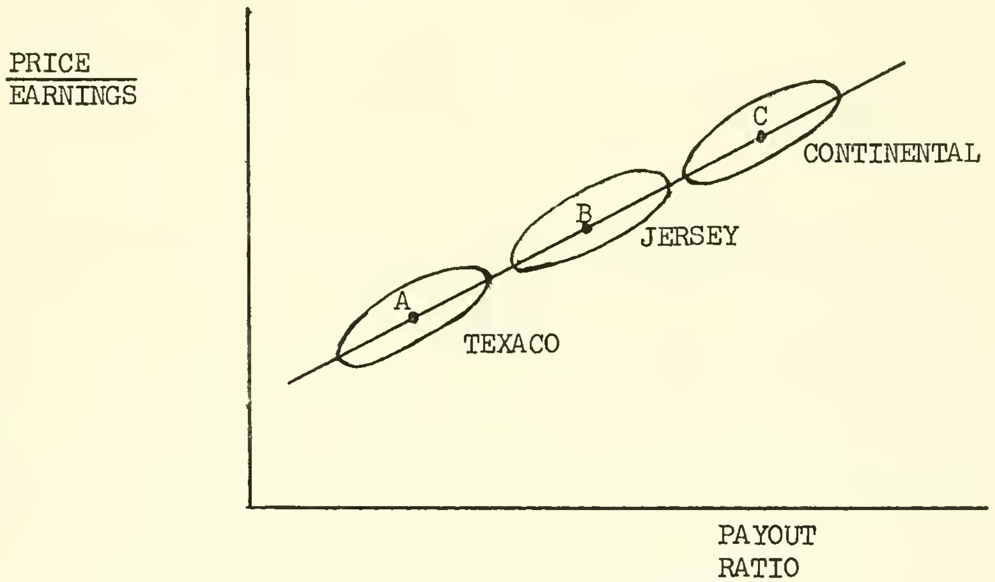
The relation in Figure 1 suggests that price-earnings ratios rise as payout ratios rise. Such a regression relation would lead some to say that people "like" dividends. In order for such a statement to be accurate, however, the following two statements must be true. First, it must be true that between companies, those companies with higher average payout ratios must have higher average price-earnings ratios and those with lower average payout ratios must have lower average price-earnings ratios. Second, it must be true that as the payout ratio of one firm temporarily moves above its average value, its price-earnings ratio must temporarily move above its average value and as its payout ratio temporarily falls below its average it must be true that its price-earnings ratio temporarily falls below its average.

Another way to say this is to think of three possible regressions which can be run through this data (these NT observations, T years for N companies). The first is a regression through all NT data points. This is the one shown in Figure 1. The second regression is a regression run through the average values of their payout ratio and price-earnings ratio for each of the companies (in this case through N points). The third set of regressions are those which are run through the individual data for each firm. In this example there are N such regressions, each containing data from T years. Thus, we have a total data regression, a between firm regression and N within firm regressions. In order for the statement that investors like dividends to make statistical and economic sense, all three types of regressions must give the same indication. That is, <u>between</u> firms, higher payouts must mean higher price-earnings ratios and <u>within</u> firms, higher than average payouts must mean higher than average price-earnings ratios.

We can see what this means graphically, if we let the ovals represent the area in which the data for a specific firm cluster -- say, one for all the data

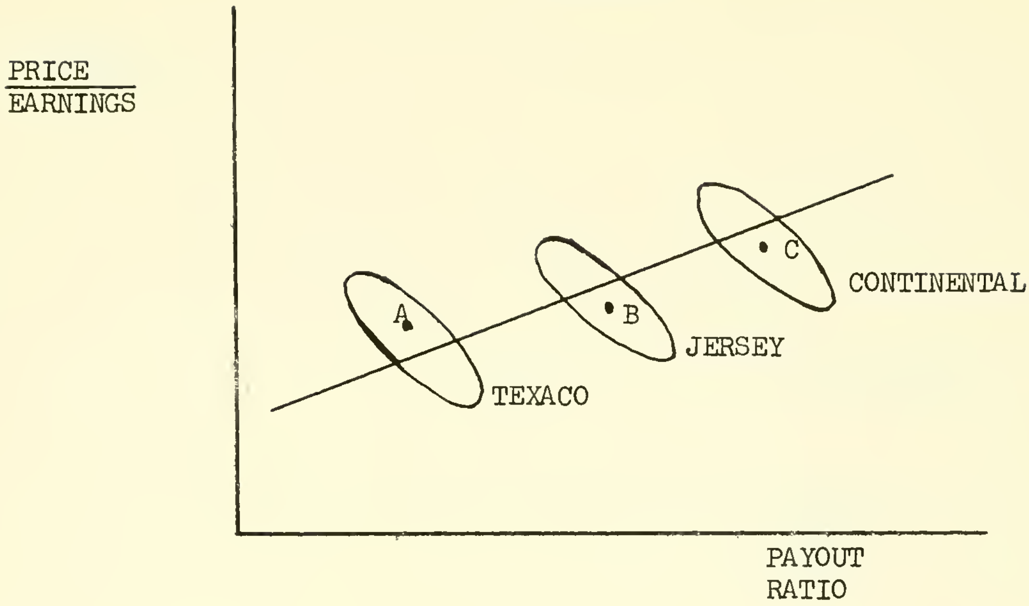
for the 12 years for Standard Oil of New Jersey, another for all the data for Texaco, a third for that of Continental and so on. For the statement that investors "like" dividends to be clearly true, the clusters of data should look something like those in Figure 2, where A is a point representing the average price-earnings ratio and the average payout ratio for Texaco, B that for Jersey, and C that for Continental.

FIGURE 2



In this case, whenever Standard raised its payout ratio, its price-earnings ratio rose and conversely, whenever it lowered its payout ratio, its price-earnings ratio fell. Moreover, the relations for Texaco and Continental were the same as that for Standard. In addition to these short run responses, a higher average dividend payout ratio implies a higher average price-earnings ratio. It is possible, however, that what gave rise to the upward sloping line through all the data was what is shown in Figure 3.

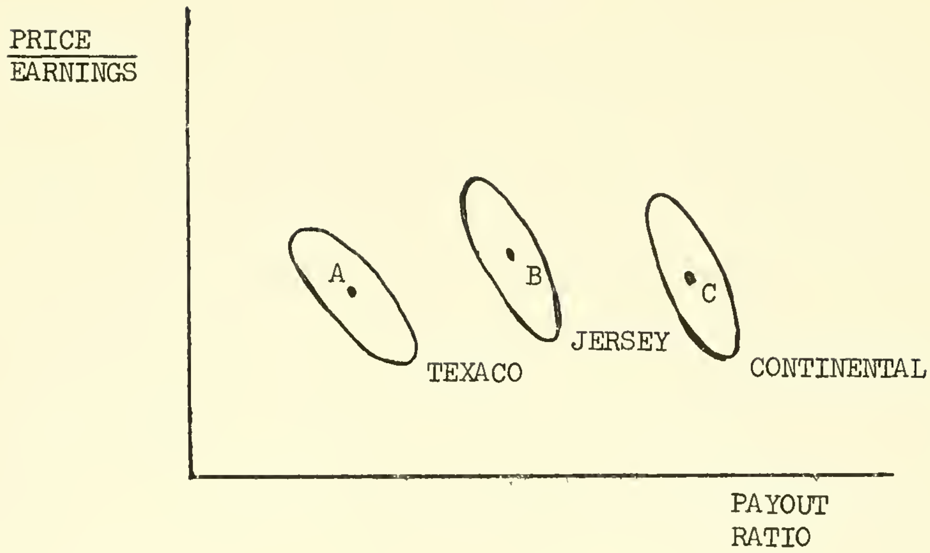
FIGURE 3



In this figure, as before, the ovals represent the cluster of data points for each firm. In this case, when Standard's payout ratio was above its average value (B), its price-earnings ratio was temporarily depressed. This might happen if the payout ratio rose because profits were temporarily lower, but the dividend was maintained at its old rate. The fall in the price-earnings ratio might then have been in response to the poor profits. Similarly, when the payout ratio was below average, it may have reflected higher than normal profits and resulted in temporarily higher price-earnings ratios. The important point to see is that in this picture the short run response to higher payout ratios was to cause price-earnings ratios to fall while there is other evidence which suggests that the long run response to a higher payout ratio policy or average would be to raise price-earnings ratios.

A third possibility which would generate the upward sloping regression line is shown in Figure 4.

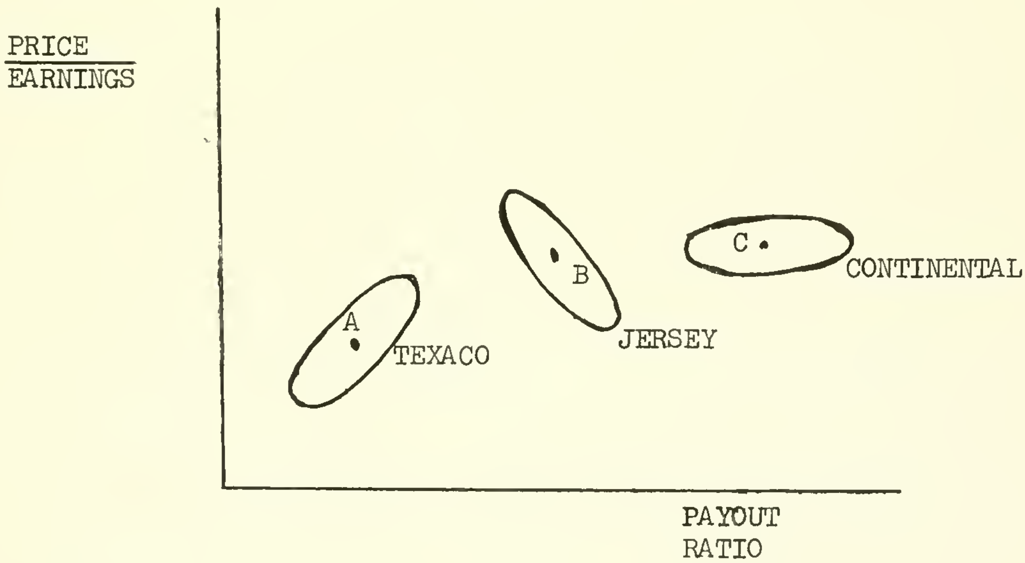
FIGURE 4



In this presentation, the short run response or within firm response of the price-earnings ratio of each of the companies is to fall as the payout ratio rises, but there is little evidence of a long run relation between their average price-earnings ratios and their average dividend payouts.

Figure 5 is meant to show the most perverse of the possible alternatives.

FIGURE 5



In Figure 5, the within company short-run relations are not the same and there is also little evidence of a relation between the average payout ratio of a company and the average value of its price-earnings ratio. Yet it is possible that a regression through all the data would yield evidence of an upward relation.

In the context of this problem, the analysis of covariance technique attempts to examine the regression relation through all the data to see if it can be decomposed into a relation <u>between</u> the companies and a relation <u>within</u> the companies. Having split the total relation into these two parts, it then permits the analyst to discover which of the Figures, 2 through 5, best portrays what is happening in the data. It should be clear that knowledge of which of the four possibilities is in fact the truth is required before sensible policy recommendations can be drawn from Figure 1.

Throughout this discussion of the statistical technique of the analysis of covariance and its applicability to the problem at hand, it has been assumed that there was only one variable which was related to the price-earnings ratio; namely, the dividend payout ratio. In fact, as the paper progresses, it will be suggested that more than one variable affects stock prices. We shall concentrate on two financial variables; payout ratios and debt ratios. Thus the statistical analysis which will be reported on later deals with a multiple regression and not a simple one as is shown in these pictures. However, the procedure is quite the same whether one uses a regression with two or more variables or whether one uses only a single variable.

Thus, after this lengthy introduction, the purpose of the title, "The Short- and Long-Run Effects of Debt and Dividends on Stock Prices," may be becoming clearer. The <u>between</u> company difference in stock price arising from differences in average financing behavior will be called the long-run effects of debt and dividend policies. The differences in stock prices which arise from fluctuations around the values set by company polcies shall be called the short-run effects of debt and dividend policies. The questions we shall ask are:

a. Is there any evidence that stock prices differ due to between company differences in debt and dividend policies?

b. Is there any evidence of short run variations in the stock price of a given company due to variations in its debt equity ratio and its dividend payout ratio?

c. Is there any evidence that these two responses are the same, and if not, what are their different implications?

THE RELEVANCE OF THE ANALYSIS OF COVARIANCE

Before going further, it may be useful to say why this procedure is thought to be more useful than simple regression analysis -- the more traditional test for the effect of debt and dividends on stock prices. The relevance of any statistical test cannot be measured in an absolute way. Its relevance can only be measured in terms of the hypotheses and models to be tested. If it is to be assumed and not to be tested that short run responses to fluctuations in financial variables around average policies affect stock prices in the same way as do permanent shifts in these policies, then the analysis of covariance is unnecessary in this context. One tests for the effects of financial policies on stock prices by the relatively simple procedure of running regressions on the data for a set of firms in a given year. If, however, the influence of short run fluctuations is thought to be different from that arising from permanent changes or differences, then these simple regressions using annual data confound the short-run and long-run effects. To test for long-run and short-run effects of financial policies on stock prices, one must combine the data on several firms in each of several years. After simultaneously estimating both short and long run effects, the equivalence of the two can be statistically tested instead of being arbitrarily assumed and not tested. To summarize, given the belief, that short run fluctuations generate a part of stock price movements and that differences in long run policies generate another part, and no strong

a priori reason to think these effects are similar, the analysis of covariance seems a much more appropriate statistical tool than simple regression analysis for determining the effects of financial variables on stock prices.

THE MODEL

Having postulated that any effect which the financial variables might exercise on stock prices is composed of a short run relation and a long run relation and having chosen a statistical technique which permits a test of the hypothesis that these two effects exist, the remaining problem is to develop a model which states which financial variables ought to affect stock prices and how they exert their influence. In order to clarify the issues and to construct a framework for evaluating the model which will be used, it is useful first to comment upon several other studies concerned with the general problem of valuation.

Much of the empirical research to date on the problem of the valuation of the firm has been primarily concerned with attempts to explain the price at which the equity of a firm is sold. This is usually done by arrying those variables which are thought to affect price on the right-hand side of a regression equation and proceeding with a least squares estimate of the slope coefficients. Examples of such procedures can be found in the work of Durand[1] and Gordon.[2]

Several attempts have been made along another tack. In these studies, earnings or dividends are explicitly capitalized to obtain price. Thus Durand[3] uses a

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[1] Durand, David, "Bank Stocks and the Analysis of Covariance," Econometrica, (January 1955). In another connection, however, this concern of Durand with covariance analysis is like that which is pursued at length in this paper.

[2] Gordon, Myron J., The Investment, Financing and Valuation of the Corporation, Homewood, Illinois: Irwin, 1962.

[3] Durand, David, "Cost of Debt and Equity Funds for Business: Trends and Problems of Measurement," Conference on Research in Business Finance, pp. 215-47, New York: National Bureau of Economic Research, 1952.

capitalization process and also discusses several problems associated with both the amount to be capitalized and the capitalization rate. Gordon and Shapiro[4] capitalize, at a rate k, a dividend stream growing at a rate g per year and comment that both the dividend rate and the debt-equity ratio may affect k. Modigliani and Miller[5] also use a capitalization procedure. Their model and conclusions are quite different from those of Durand and Gordon and Shapiro, however. In "The Cost of Capital, Corporation Finance and the Theory of Investment," they explore a model in which the value of a firm is independent of the debt-equity ratio and in "Dividend Policy, Growth, and the Valuation of Shares," they examine another model in which the value of the firm is independent of the dividend payout ratio and is a function only of the market discount for the risk associated with the streams of income arising from the physical assets the firm holds. Neither Durand nor Gordon and Shapiro present any tests of their proposition that the capitalization rate depends in part upon the financing decisions of the firm. Moreover, the Modigliani and Miller assumptions rule out any such effect. Although Gordon[2] is concerned with capitalizing streams, the model he develops is one explaining price and not the capitalization rate.

Several recent studies of the determinants of stock prices, however, have viewed the valuation procedure as one of capitalizing streams of income. A study by Benishay[6] discusses the determination of earnings-price ratios, and another by B Malkiel[7] deals directly with the model which will be advanced here.

[4]Gordon, Myron, and Eli Shapiro, "Capital Equipment Analysis: The Required Rate of Profit," Management Science, October (1956).

[5]Modigliani, Franco, and Merton Miller, "The Cost of Capital, Corporation Finance and the Theory of Investment," American Economic Review, June 1958; and "Dividend Policy, Growth, and the Valuation of Shares," Journal of Business, October 1961.

[6]Benishay, Haskel, "Variability in Earnings-Price Ratios," The American Economic Review, March 1961.

[7]Malkiel, B. G., "Equity Yields, Growth, and the Structure of Share Prices," The American Economic Review, December 1963.

In this paper, the market value of the equity of a firm will be derived as the capitalized value of the income stream to the stockholder. The anlysis differs from that presented in the previously cited works in that it concentrates attention on the capitalization rate itself rather than on the stock price. That is, in this study, the effects which financial variables have on stock price are thought to be indirect. They arise from the effects these variables have on the capitalization rate. Thus it is the capitalization rate which is the variable whose determinants are to be explored. To this end, a model of the manner in which real and financial variaoles are thought to affect the rate at which income streams are capitalized will be developed and statistical tests will be performed to determine if the hypothesized equation determining capitalization rates can be maintained in a statistical sense.

Capitalizing income streams in order to determine stock values is not a new procedure. It dates from the 1938 work of John Burr Williams[8] in which he proposed that a company's stock price should be equal to the discounted value of its future dividend payments. In 1956, Gordon and Shapiro[4] adopted this model to the case of steady growth and showed that, in this case, the stock price could be written as

$$\text{PRICE} = \frac{\text{DIVIDEND}}{k-g}$$

where DIVIDEND was the current dividend per share; g the growth rate in dividends per share or in stock price per share; and k was a discount factor -- a stockholder

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[8] **Williams**, John B., The Theory of Investment Value, Harvard University Press, Cambridge, Massachusetts, 1938.

or market determined discount rate. Since the Gordon and Shapiro article, this approach has come to be of more interest and is used in the work of Modigliani and Miller[5] and, in part at least, in some of that of Myron Gordon.[2]

An equivalent way of writing this model is to rearrange the terms to yield the following:

$$\frac{\text{DIVIDEND}}{\text{PRICE}} + g = k$$

That is, the stockholder's return, dividend yield plus capital gain, must be equal to a certain amount k, the stockholder's discount rate or the required rate of return. The model of behavior adopted in this paper states that, given the growth rate or potential capital gain and given the current dividend, the prospective stockholder chooses a stock price in order to obtain his desired or demanded return -- dividend yield plus capital gain, or k.

For example, given an expected capital gain of 5% and demanding a total return of 10%, would require the dividend yield to be 5%. If the dividend were $2 per share, this would imply a price of $40.

As stated earlier, the model of stock price determination adopted in this paper states that debt and dividends affect stock prices by affecting k, the discount rate. It differs from the models of some other researchers in that it does not assume that debt and dividends affect stock prices in a linear fashion causing stock prices to rise or fall in a direct relation to changes in financial policies. Rather, debt and dividend policies are thought to affect stock prices by affecting desired rates of return. These desired rates of return, given the potential capital gain and the level of dividends, determine stock prices.

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Suppose our illustrative company changes its payout ratio in such a way as to cause investors to be satisfied with a 9% return instead of the 10%. The stock price model suggests that this dividend policy change will raise the price to \$50. For, if the dividend yield plus capital gain must equal 9% and the capital gain is still expected to average 5% per year, the dividend yield need only be 4%. Thus the \$2.00 dividend will result in a price of \$50. If, on the other hand, they pursue some policy which raises the stockholder's required rate of return to 11% per year, the price will fall from \$40 to \$33. For then, the 5% prospective capital gain without a change in the dividend will mean the required dividend yield has to be 6%. With a \$2 dividend per share, a price of \$33 is that price which will give the necessary dividend yield.

The importance of this argument cannot be understated. In statistical analysis whether the stock price is hypothesized to be affected in a linear fashion by debt and dividend policy or in an indirect way, as stated here, it is of critical importance in the designing of the appropriate statistical tests and in judging the validity of any results.

To be specific as to the manner in which debt and dividends are thought to affect stockholders' required rates of return or discount rates, it is hypothesized that, within an industry grouping, higher ratios of debt to total capitalization mean riskier companies and lead to higher required rates of return on the part of investors. This is the result one would expect from either of the two schools of thought on the effect of debt-equity ratios on stock prices. The Modigliani-Miller view is that the yield on the equity of a company (which we have estimated as $\frac{DIV}{P} + g$) should rise linearly as the debt-equity ratio rises. Furthermore, those who feel that debt, even in the "allowable range," is not "riskless" also feel that higher debt-equity ratios imply higher required returns on equity.

had no preference for growth *per se*, a rapidly growing firm would have a dividend yield just enough lower to keep its total return in line with that necessary in view of its financial policies. In this case, the growth rate would offer no contribution as an explanatory variable. If, however, it was found that the coefficient of the growth rate as an explanatory variable was significant, it would signify that the growth rate itself had something to do with the desired return. Then, one could say either that investors paid for growth, which is the common belief, or that investors demanded higher returns from the high growth stocks. It was in order to test for this influence of growth that we included the growth rate in earnings per share as an explanatory variable. Thus the final specification of the model becomes

$$\left(\frac{DIV}{P} + g\right)_{ikt} = \overline{\left(\frac{DIV}{P} + g\right)_{kt}} + \alpha_o + \beta_1\left(\frac{D}{D+E}\right)_{ikt} + \beta_2\left(\frac{DIV}{PRO}\right)_{ikt}$$

$$+ \beta_3 g_{ikt} + \epsilon_{ikt}$$

where

$\left(\frac{DIV}{P} + g\right)_{ikt}$	is the dividend yield plus growth rate -- the total rate of return for the ith firm in the kth industry in year t.
$\overline{\left(\frac{DIV}{P} + g\right)_{kt}}$	is the average rate of return for all firms in the kth industry in year t. It is a "market" rate of return for that year.
$\left(\frac{D}{D+E}\right)_{ikt}$	is the ratio of the book value of debt to the book value of total capitalization or of debt to debt plus equity of the ith firm in the kth industry in year t.
$\left(\frac{DIV}{PRO}\right)_{ikt}$	is the ratio of dividends to profits for the ith firm in the kth industry in year t.
g	is the rate at which the stock price is expected to grow for the ith firm in the kth industry in year t.

That is, the required return for the ith firm in the kth industry in year t depends first on the state of the stock market in year t as measured by the average required return for all stocks included in that industry. In addition to these effects of the year and industry, however, there are three effects which are peculiar to each company -- that arising from its debt policy, that arising from its dividend policy, and that due to its growth rate.

To allow the pooling of the annual cross sections, a procedure necessary to implement the analysis of covariance, the model will be written for testing purposes as

$$\left(\frac{DIV}{P} + g\right)_{ikt} - \overline{\left(\frac{DIV}{P} + g\right)_{kt}} = \alpha_o + \beta_1\left(\frac{D}{D+E}\right)_{ikt} + \beta_2\left(\frac{DIV}{PRO}\right)_{ikt}$$

$$+ \beta_3 g_{ikt} + \epsilon_{ikt}$$

That is, the deviation of the $(\frac{DIV}{P} + g)$ for each firm from the average value of $(\frac{DIV}{P} + g)$ for all the firms in that industry in that year -- in the language of this paper, the deviation of the required return or capitalization rate of each firm from the capitalization rate for the industry -- is said to be linearly related to that firm's debt-equity ratio, its dividend payout ratio and its growth rate.

THE DEFINITIONS OF THE VARIABLES

Thus far we have a test procedure and a stock price model. What is left to explain is a definition of the variables and a selection of companies to be studied. The variable definition must relate to the character of the model. That is, it is hypothesized that stock prices were determined by the process of capitalizing a dividend growing at a specific rate of growth. The dividend being capitalized in

year, say, 1956, was said to be the average of the dividend per share paid in 1955, 1956, and 1957. It is clear that in determining stock value, the investor has no choice but to forecast somewhat and what is assumed here is that although the investor might not forecast perfectly, he at least forecasts the correct amount "on the average."

The estimation of the growth rate which the investor has in mind when he is willing to pay a specific price for a current dividend presents a most difficult problem. It was felt that the primary source of price was earnings per share and thus it was thought that the rate of growth of earnings per share would provide the best estimate of the rate of growth which investors anticipated. Using the year 1956 as an example, the growth rate investors are thought to have in mind when they set the stock price is measured as that exponential growth rate which best fit the earnings per share data for 1954, 1955, 1956, 1957, and 1958. It is a centered five-year growth rate.

The definition of the dividend payout ratio and the debt to total capitalization ratio was similar to that of the dividend being capitalized. Again using 1956, the numerators are the average of debt and of dividends in the years 1955, 1956, and 1957. The denominators are the averages of total capitalization and of net earnings in those three years. The stock price thought to be determined by all these variables was the average of the high and low stock price for the year -- in this case the year 1956.* The years included in the study are 1948 through 1959.

*All these data were taken from the Compustat data tape supplied to M.I.T. by the Standard Statistics Corporation. The existence of this large file of accurate and machine readable information was an invaluable aid to this research.

It is clear that "risk" plays an important role in determining stock values. In order to standardize for the risks associated with the income streams generated by the assets, firms were categorized into industries, and five such industries were examined. Within these industries, the model advanced in this paper suggests that company risks differ mainly due to financial risks -- those risks arising from the amounts of debt financing relative to equity financing. The industries chosen for study are the Chemical, Food, Machinery, Oil, and Retail industries. The specific firms are listed in the appendix. It was within each of these five industries that we conducted all our tests.

Before presenting the results, the questions are:

Are there long run effects of debt and dividend policies on stock prices?

Are there any short run effects?

Are these two effects similar, and, if not, what are their different implications?

THE RESULTS

Regressions run through all the data for all the firms in each industry over the twelve years which do not attempt to separate short and long run effects suggest that there may be a relationship between dividend payout ratios and required rates of return. Table 1 shows the results of these regressions.

In the Food and Retail industries, there is some evidence that discount rates are lower -- stock prices are higher -- as payout ratios are higher, while in the Machinery and Oil industries, there is some evidence that higher payout ratios mean higher discount rates and lower prices. There is little evidence of the expected effect of debt-equity ratios on required rates of return. Four of

TABLE 1

Results of Regressions Run Using $(\frac{DIV}{P} + g)$ as the Dependent Variable for Each of the Five Industries Which does not Attempt to Split the Total Effect into its Short- and Long-Run Components

Industry	Slope Coefficients and "t" Ratios				R^2
	Constant	$\frac{D}{D+E}$	$\frac{DIV}{PRO}$	g	
Chemical	-.0192 (1.2136)	-.0345 (1.6800)	-.0031 (.0521)	.6387 (18.4872)	.6138
Food	-.0104 (.6912)	.0284 (1.2138)	-.0414 (1.7192)	.6228 (18.9711)	.6344
Machinery	-.0896 (5.5271)	.0329 (1.0358)	.0929 (3.3384)	.7340 (21.8582)	.7279
Retail	-.0107 (1.0068)	.0307 (1.8348)	-.0250 (1.4616)	.4717 (13.6613)	.5003
Oil	-.0557 (5.9857)	.0018 (.0736)	.0658 (4.0128)	.6768 (16.4521)	.6553

the five industry groups show debt ratios increasing required rates of return, but only one of these, Retail, could be called statistically significant.

However, when we specifically test to see if this total effect is composed of a short and long run effect that are similar in their implications, quite different things are learned. There is little evidence of any significant between company effects which involve debt and dividend policies. That is, there is little evidence of a long run effect of debt and dividend policies on stock prices. Said in even another way, there is little evidence that between company differences in required returns are related to between company differences in debt and dividend policies. What relationship there is suggests that dividend price ratios or dividend yields are almost constant between firms and do not vary with debt policies, dividend policies, or growth rates as measured here. Furthermore, there seems to be no single short run response of a company's stock price to fluctuations in dividends and debt around their average value. As the payout ratios of some companies rise above their average values, their stock prices rise, and as the payout ratios for these same companies fall below their average, the stock prices fall. On the other hand, for some other companies, the reverse is true. A temporary rise in the payout ratios of these companies results in lower prices, and a temporary fall in their payout ratios results in higher prices.

Some further tests I have conducted suggest that the firms within any specific industry with higher variability in earnings are the firms whose price falls as their payout ratio rises. This suggest that for these firms, a temporary rise in their payout ratio is most likely to be caused by a decline in earnings, and it is this earnings decline which causes the fall in price. Those firms within the industry with lower variability of earnings generally had a rise in price accompanying a rise in the payout ratio. This may well be due to the fact

that for them the rise in the payout ratio was taken as evidence of a belief on the part of investors that the earnings prospects of the company were improving. In summary, debt-ratios seem not to affect investor required rates of return, and any effect dividends have seems to be transitory, in terms of the information these dividends yield about the relation of present profits to past profits and future profits.

THE EVIDENCE

The evidence for these conclusions is as follows. The analysis of covariance procedure takes four steps. First, one computes the mean deviation from the yearly industry average $\frac{DIV}{P} + g$ for each firm, along with that firm's mean debt-equity ratio, dividend payout ratio and growth rate. A regression is then run on this data using all the firms in the industry. This is a long run relation or a between firm regression. One then computes a regression for each firm using the T data points for that firm. There are N of these regressions. These are the short-run regressions which allow each firm its own intercept and its own slope coefficients. Finally, a regression is computed using the T data points for each of the N firms which allows each firm to have its own intercept, but which forces all the firms to have the same slope coefficients. This is what is usually called a regression employing dummy variables as intercepts.

The N regressions through the T data points for each firm generate an estimate of the mean squared residual error. This mean squared residual error is compared with the mean squared error from the regression computed using the mean value data -- the long run regression -- in order to test the hypothesis that the long run regression "fits" as well as the short run regressions. If it does not, it is said that there is no evidence of a long run regression and vice versa. The mean squared error from the dummy variable regression (which forced the slope co-

efficients to be the same for each firm and only allowed the intercepts to differ) is then compared with this mean squared error from the N regressions which allowed the slope coefficients and intercepts to be different for each firm to test the hypothesis that allowing different slopes does not result in a significantly smaller mean squared error. If the many sets of slope coefficients, one set of each firm, show a significant reduction in mean squared error, it is said that the short run relations are not homogeneous. On the other hand, if the evidence is such that the long-run relation can be said to exist and that the short-run relations are homogeneous, it is then possible to test the hypothesis that these two relations have identical slope coefficients. Table 2 shows the elements necessary for the first two of these computations.

TABLE 2

Elements of the Analysis of Covariance Procedure

Source	Sum of Squared Residuals	Degrees of Freedom	Mean Squared Error
Due to cell mean	T*SSR(M)	N-n	MS(1)
Due to Dummy Variable Regression minus that due to the N individual regressions.	SSR(D) - SSR(I)	(N-1)(n-1)	MS(2)
Due to the N Regressions computed from the T data points for each firm. (This is an estimate of the residual mean squared error.)	SSR(I)	N(T-n)	MS(3)

where SSR(M) is the sum of squared residuals from the regression through the means,

SSR(D) is the sum of squared residuals from the dummy variable regression,

SSR(I) is the sum of squared residuals from the N individual firm regressions,

N is the number of firms,

T is the number of years over which each firm is studied, and

n is the number of independent variables in the regression equation, constant included.

The existence of a long run relation is tested by comparing MS(1) with MS(3). The existence of a homogeneous short run relation is tested by comparing MS(2) with MS(3).*

Table 3 presents a sample of the results obtained for each of the five industries. Since all the industries yield quite similar results, only one is presented.**

The first conclusion one can draw from this table is that there is evidence of a relation through the means -- a long run relation. This is true because the residual error sum of squares does not differ significantly from the mean squared error of the regression through the cell means, i.e., 1.68 is less than 1.70. For each of the five industries, this F ratio is quite close to the critical F ratio at a 5% level of significance. However, if we examine the cell mean or long run relation in each of the industries, it can be seen that while the analysis of co-variance procedure says a cell mean regression does exist, it is also clear that

*A more thorough explanation of this statistical procedure can be found in Mood, A. M., Introduction to the Theory of Statistics, New York, McGraw-Hill, 1950, pp. 350-356.

**For those interested, copies of all five tables can be obtained from the author.

TABLE 3

Results of the Analysis of Covariance Procedure for the Twenty Firms in the Retail Industry over the Twelve-Year Period 1948 - 1959

Source	Sum of Squared Residuals	Degrees of Freedom	Mean Squared Error	F	$F_{.05}$
Due to cell mean.	12 x .0016919 or .0203028	20-4 = 16	.00127	1.68	1.70
Due to the dummy variable regressions minus that due to individual firm regressions.	.3485797 minus .1211384 or .2274413	(20-1)(4-1) = 57	.00399	5.27	1.40
Due to individual	.1211384	20(12-4) = 160	.00076		

debt ratios and dividend payout policies do not explain much of the between firm differences in $\frac{DIV}{P} + g$. Table 4 shows these results. Most of the explanation of the dividend yield plus the growth in earnings is "explained" by the growth in earnings itself -- never do debt ratios and only once does the dividend payout ratio have a significant effect.

The second important fact that Table 3 reveals is that within the Retail Industry, the short run relations of debt and dividends to $(\frac{DIV}{P} + g)$ are not homogeneous firm to firm, i.e., 5.27 is larger than 1.40. Similar evidence of a heterogeneous short run response is found in all five industries studies. In an attempt to determine the cause of this heterogeneity, within each industry, the size of the slope coefficient of the dividend payout ratio for each firm was regressed against the variability of the ratio of its earnings (before taxes and

TABLE 4

Results of the Long Run Regressions

Industry	Slope Coefficients and "t" Ratios				R^2
	Constant	$\frac{D}{D+E}$	$\frac{DIV}{PRO}$	g	
Chemical	-.0354 (1.9394)	-.0071 (.3295)	-.0092 (.3463)	.9690 (9.2663)	.8568
Food	-.0472 (3.1830)	.0232 (1.3629)	.0022 (.1083)	.9456 (7.0455)	.7696
Machinery	-.0684 (4.2491)	-.0126 (.4783)	.0310 (1.0792)	1.0109 (11.2485)	.9191
Oil	-.0777 (7.0937)	.0218 (.7103)	.0715 (4.2149)	1.0779 (9.4975)	.9370
Retail	-.0097 (.4066)	.0222 (1.3724)	-.0353 (1.0095)	.6554 (3.3014)	.7159

interest) to the book value of its assets, a size variable (total assets) and the number of stockholders. The results indicate that in the Oil and Retail industries the more variable the earnings, the more likely it is that the slope coefficient of the dividend payout term is positive. This positive slope coefficient signifies that an upward fluctuation in the dividend payout will cause a rise in the discount rate or required rate of return and a lower stock price, other things equal. Whether a company is large or whether it has relatively more or less stockholders seems to have little effect in this regard for any of the industries studied.

What these results suggest is that the evidence offered by the regressions run through all the data using standard regression procedures is misleading. Contrary to its indications, the further tests gave very little evidence of any long

run relation between financial policies and stock prices for any of the industries and also no evidence of a consistent short run relation for any of the five industries. What appears to be happening is that certain of the firms have such pronounced short run responses to temporary fluctuations in their financial variables that these short run responses cause the regression through all the data to give an indication of a relation between debt and dividends and stock prices. A more careful analysis has shown this aggregative or total relation does not contain information about the source of differences in stock prices between companies or the source of fluctuations in the stock price within any one of the individual companies.

In a vain attempt to lay the blame at the foot of one poorly defined variable, new definitions of the growth rate in earnings were employed. One device was to have the growth rate be that for a seven rather than a five year centered period. Another took the growth rate as that rate which existed over the whole twelve year period. However, none of these experiments lead to any different conclusions.

AN EARNINGS-PRICE MODEL

Having found that regressions which do not attempt to separate short run responses from long run relations had led to misleading conclusions when using the model that stock prices were equal to discounted dividends, it was decided to see if there was any evidence that this phenomenon existed when other stock price models were used. Therefore, a more familiar, although from the author's view a less appropriate, stock price model was accepted. In this model, stock prices are determined by ascertaining appropriate earnings price ratios in terms of debt and dividends. In this case regressions are run using the earnings-price

ratio as the variable to be explained rather than the dividend yield plus growth rate in earnings per share.

To be explicit, the model which was used was

$$\left(\frac{E}{P}\right)_{ikt} - \left(\frac{\bar{E}}{P}\right)_{kt} = \alpha + \beta_1\left(\frac{D}{D+E}\right)_{ikt} + \beta_2\left(\frac{DIV}{PRO}\right)_{ikt} + \beta_3 g_{ikt} + e_{ikt}$$

where

$\left(\frac{E}{P}\right)_{ikt}$ is the ratio of earnings per share after tax and interest to stock price for the ith firm in the kth industry in year t.

$\left(\frac{\bar{E}}{P}\right)_{kt}$ is the average earnings-price ratio for all the firms in the kth industry in year t.

This model is more like that used by others, and the results are more startling than with the first model. First, as Table 5 shows, a regression through all the data yielded considerable evidence of a significant relation between earnings-price ratios and dividend payout ratios. This regression offers strong evidence that prices rise as payout ratios rise. However, when an attempt to see if this relation through all the data reflected a relation between the companies and another relation within the companies that were the same, it was found that neither of these fundamental relations could be found in the data. An application of the analysis of covariance procedure showed there was no evidence of a long run or between firm relation between debt, dividends, growth and earnings-price ratios. Moreover, the short run responses were not homogeneous -- some firms experienced temporary rises in their earnings-price ratio as their payout ratios temporarily rose and others experienced temporary falls. The strength of some of the short run relations had caused the implications of a regression run through all the data to be that a consistent and meaningful relation existed between earnings-price ratios and financial policies when in fact no such relation existed.

TABLE 5

Results of Regressions Run Using Earnings-Price Ratios as the Dependent Variable through all the data for each of the Five Industries which does not Attempt to Split the Total Effect into its Short- and Long-Run Components

Industry	Slope Coefficients and "t" Ratios				R^2*
	Constant	$\frac{D}{D+E}$	$\frac{DIV}{PRO}$	g	
Chemical	.0566 (5.8050)	0.0013 (.1133)	-.1002 (6.6285)	.0356 (1.2904)	.2123
Food	.0834 (10.0670)	.0286 (1.9695)	-.1574 (12.5121)	-.0699 (2.6585)	.4768
Machinery	.0604 (5.2125)	.0088 (.3392)	-.1182 (6.0283)	-.1230 (3.1713)	.2331
Retail	.0407 (5.2381)	.0361 (2.7667)	-.0883 (7.2409)	-.0757 (2.1111)	.2414
Oil	-.0140 (3.3328)	.0008 (1.4105)	.0306 (3.0676)	.1299 (3.1739)	.1451

*The reason they are low with respect to the correlation coefficients obtained in other studies using E/P ratios may well be that these are regressions explaining the deviation from industry average E/P for that year rather than the E/P ratios themselves. These are all significantly different from zero at the 5% level.

CONCLUSIONS

The conclusion to which one is lead by this analysis is that considerable care must be exercised in the interpretation of the results from cross-section regressions relating stock prices to financial variables. We have hypothesized that financial variables affect stock prices in two ways. First, it is thought that the differing financial policies of different companies generate differences in stock prices between companies. Second, it is thought that the year-to-year fluctuations around its established policies by a specific company generate fluctuations in its own stock price. With the stock price data being generated by such a compound process, estimates using only one year's data may confuse the effects of within firm or short run variations with those of between firm or long run variations. In fact, in the two models of stock prices discussed in this paper, and more especially in the earnings-price ratio model, it was shown that when these two kinds of effects were not isolated, one was led to think there was evidence that a permanent rise in dividend payout ratios would result in a permanent rise in price. When the hypothesis that these results truly measured the long run response to differences in debt and dividend policies was explicitly tested, quite different results were found. It was found that there existed no evidence of a long run effect of debt and dividends on stock prices. What relation there was, was of a short run variety causing prices to fluctuate as the financial variables fluctuated around their average values. Moreover, this short run response of prices to fluctuations in financial variables differed from company to company.

The implications of these results seem to be five. First, the statistical tests presented here suggest that stock price movements are in response to two sorts of forces -- short run and long run -- and that those studies which do not attempt to separate these forces are apt to be misleading. Furthermore, the

technique of the analysis of covariance seems a most appropriate and useful statistical tool in this connection.

Second, for some time there have been suggested many models of stock prices which claim to be able to explain with reasonable accuracy the between company difference in stock prices. They do this in terms of a few, relatively easy to compute, financial variables like debt-equity ratios, dividend payout ratios and the like. The evidence presented here suggests that these models may be misleading, and that if we wish to explain inter-company differences in stock prices, we will have to look for variables in addition to these. While large bodies of financial data are easily accessible and modern computing techniques make regression analysis relatively easy, we may have to force ourselves to look more carefully at what are usually called intangibles if we are to adequately "explain" the movements in stock prices.

Third, the evidence this paper presents suggests that stock prices are set much more in terms of dividends than in terms of the growth in earnings. That is, for the companies studied, the dividend yields for those companies which exhibit rapid growth in earnings per share are not that different from the dividend yields of those companies which exhibit slower growth in earnings per share. One could almost say that dividend yields were constant across firms, or at least that they did not vary much as firms had faster or slower rates of growth in earnings per share, or paid out more or less of their profits as dividends, or raised more or less of their long-term capital in the form of debt.

Fourth, throughout this study there was no evidence that the value of a company's stock was affected by the debt-equity ratio of that company. This finding is in conflict with that to be expected within the framework of the writings of Modigliani and Miller or within the view expressed by other, not-so-analytical, financial theorists. Before reading too much into these results, it must be

remembered that the effect of debt upon stock prices is thought to arise from an increase in risk with an increase in debt. If, in fact, categorizing firms into the industry groups used in this paper does not exactly standardize for the differential business or asset risk (as, in fact, the next paragraph will suggest), then it is quite possible that we do not find an influence of debt on stock prices not because one does not exist, but because we have not effectively standardized for differences in business risk. Until we find some way to assure ourselves that we have standardized for unequal business risk, it will be hard to evaluate the effects of different financial risks, different debt-equity ratios, on stock prices.

Finally, the evidence presented here suggests that within what was called an industry, the short run responses of stock prices to short run variations in financial variables differ from firm to firm. This suggests that within industries there are substantial differences among the companies. For example, in the Oil industry, the stock price of Standard Oil of New Jersey seems to go up as its payout ratio temporarily rises, that of Texaco falls as its payout ratio temporarily rises, and that of Continental shows no consistent response. With such varying responses within the industry, a natural question seems to be: what do you mean by industry, or in what sense are the stocks of the firms in a given industry homogeneous?

If the answer is that the stocks are not very homogeneous, then the common practice of analyzing the stock price movements of the firms in a given industry as if the industry classification held constant something that was meaningful, must be questioned. To restate this: until we know enough about stock prices to explain why the short run responses of the stock prices of the firms in something called the Oil industry to variations in their financial variables are so different, we will remain uncertain about what the concept of an industry means in the analysis of stock prices.

APPENDIX

Listing of Companies

Chemicals Industry

Air Reduction Company
Allied Chemical Corporation
American Cyanamid Company
American Potash and Chemical Corporation
Atlas Chemical Industries, Incorporated
Diamond Alkali Company
Dow Chemical
Dupont, (E.I.) De Nemours and Company
Eastman Kodak Company
FMC Corporation
Hercules Powder Company
Hooker Chemical Company
Interchemical
International Salt Company
Monsanto Company
National Lead Company
Pennsalt Chemicals Corporation
Pittsburgh Plate Glass Company
Union Carbide and Carbon Corporation

Food Industry

Beech-Nut Life Savers, Incorporated
Consolidated Foods Corporation
Kellogg Company
Quaker Oats Company
Standard Brands, Incorporated
Beatrice Foods Company
Borden Company
Fairmont Foods Company
Foremost Dairies, Incorporated
National Dairy Corporation
California Packing Corporation
Ralston Purina Company
Penick and Ford, Ltd., Inc.
National Biscuit Company
American Sugar Company
Sucrest Corporation
Amalgamated Sugar Company
Great Western Sugar Company
Holly Sugar Corporation
Hershey Chocolate Corporation

Machinery Industry

General Cable Corporation
Babcock and Wilcox Company
Caterpillar Tractor Company
Clark Equipment Company
Halliburton Company
Warner and Swasey
Black/Decker Manufacturing Company
Briggs/Stratton
Ex-Cell-O Corporation
Otis Elevator Company
Blaw-Knox Company
Chicago Pneumatic Tool Company
Cooper-Bessemer Corporation
Gardner-Denver Company
Ingersoll-Rand Company
Waukesha Motor Company

Oil Industry

Continental Oil Company
Phillips Petroleum Company
Richfield Oil Corporation
Shell Oil Company
Standard Oil Company (Ohio)
Sun Oil Company
Tidewater Oil Company
Union Oil Company of California
Gulf Oil Corporation
Socony Mobil Oil Company, Inc.
Standard Oil Company of California
Standard Oil Company of New Jersey
Texaco, Incorporated

Retail Industry

Associated Dry Goods Corporation
Federalted Dept Store, Incorporated
Gimbel Brothers, Incorporated
Interstate Department Stores
Macy (R.H.) and Company, Inc.
Marshall Field and Company
May Department Store Company
Mercantile Stores Company, Inc.
Penney (J.C.) Company, Incorporated
Aldens, Incorporated
Sears, Roebuck and Company
Walgreen Company
Acme Markets, Incorporated
First National Store, Incorporated
Grand Union Company
Great Atlantic and Pacific Tea Co., Inc.
Jewel Tea Company, Incorporated
Kroger Company
National Tea Company
Lane Bryant, Incorporated