THE INCORPORATION OF CYCLICAL SALES PATTERNS
INTO STOCK MARKET RETURNS

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Introduction

Theorists and practitioners who are concerned with financial markets are
interested in how investors evaluate the economic activity of firms over time.
The purpose of this study is to examine the effects of timing differences in
the cyclical sales patterns of individual firms on the timing and riskiness
of the respective stock returns. Specifically, the problem is to determine if
stock market returns reflect the informational value of regular leads and lags
in corporate sales, either in terms of differences in cyclical patterns of returns
or in terms of the riskiness of those returns.

Studies show that while most economic processes – including stock returns –
are cyclical, they are not necessarily coincidental. Rather, economic series
regularly follow one another sequentially over time. Indeed, the stock market
is viewed as a important bellwether of future economic conditions. The
leads and lags in economic processes arise from the inability of real markets
to adjust instantaneously, which in turn is due to imperfect knowledge and the
costs associated with abrupt adjustments. This process of adjustment is
observed in the level of business activity of the individual firms whose out-
puts constitute the various processes and sectors of the aggregate economy.
Assuming that the relative timing of firms' sales activity is known with
certainty, the rational investor will incorporate this information into the
price of the various stocks.

The paper is divided into three sections. Section I contains the theo-
retical development, Section II describes the methodology and results, and
Section III contains the conclusions.

I Theoretical Considerations

The adjustments that are made in financial markets in reaction to changes in the underlying economic processes are studied at both the micro and the macro levels. On the aggregate level, the relationship between overall stock market activity and the aggregate business cycle is well known. Statistically, the Standard and Poor's 500 Index consistently leads real GNP by about six months. Although the market sometimes gives false signals, it is considered to be the most reliable leading indicator in business cycle analysis [8]. On the micro level, considerable empirical evidence has been collected that supports the efficient market hypothesis, which argues that stock returns reflect all publicly available information [3]. The semistrong form test of the hypothesis is concerned with measuring the timing and degree of effect on returns of individual stocks as investors adjust stock prices in response to specific events such as earning announcements or stock splits [1, 2]. Empirical results show that stock prices often do adjust prior to the precipitating event, indicating that investors anticipate future economic effects on the micro level just as they do on the macro level. Since stock market indexes are an aggregate of individual stocks and individual and market cyclical patterns, there must exist some dynamic link.

Since the past financial data of cyclical firms are available to investors, the relative timing and degree to which sales vary with the aggregate level of business activity may be considered public information. The time interval over which the information is incorporated into stock prices is of specific concern here. Consider the case of two firms which are dependent to the same degree upon the aggregate level of economic activity over the business cycle

(i.e., aggregate income elasticities of sales are the same). One firm's sales and profits tend to lead the economy by one or more periods, and the other's sales and profits lag. The question is: Do investors observing the earlier sales pattern adjust their evaluation of the stock of the leading firm before they observe signals from lagging firms and adjust the price of the lagging firm's stock? If so, one would expect stock returns of some firms to lead or lag the market. On the other hand, if the sales of the leading firms serve as a fore-casting signal for the whole market, investors will adjust all stock prices at the same time, and no leads or lags in individual stock prices or returns will be observed.

The observance of leads or lags in the adjustment of some stock returns would indicate that biases exist in beta, the commonly employed estimate of systematic risk. The capital asset pricing model of Sharpe [10], Lintner [6], and Mossin [9] predicts that in a well-diversified portfolio of common stocks, the systematic or market-related risk associated with a security is estimated by the regression equation:

$$R_{jt} = \alpha + \beta R_{Mt} + e_{jt},$$

where

R_{jt} = monthly return of security j,

R_{Mt} = index of monthly return of market,

α = estimated parameter,

e_{jt} = stochastic error term,

$E[e_{jt}] = 0$,

$$\text{Cov } (e_{jt}, R_{Mt}) = 0,$$

$$\text{Cov } (e_{it}, e_{jt}) = 0 \quad i \neq j,$$

$$\text{Cov } (e_{jt}, e_{js}) = 0 \quad t \neq s; \text{ and}$$

$$\beta = \frac{\text{Cov } (R_{jt}, R_{Mt})}{\sigma_M^2} = \frac{\rho (R_{jt}, R_{Mt}) \sigma_j}{\sigma_M},$$

where

ρ = correlation coefficient, and

σ = standard deviation of respective returns.

A finding that $|\rho(R_{j,t-s}, R_{Mt})| > |\rho(R_{jt}, R_{Mt})|$, where $t = 1$ to 240 and $s \neq 0$, defines a lead or lag between the returns of the individual stock and the market would carry important implications. If such instances occur, the conventional beta computation would underestimate the actual amount of systematic risk and would require considerable adjustment in the use of beta for portfolio and security analysis.

If the returns of cyclical leading or lagging firms do not lead or lag the aggregate index of market returns, the question remains of the informational value of the timing differences for investors. We do know that investors consider a variable cash flow to be more risky than a steady one. Ceteris paribus, two firms whose cash flows vary to the same degree are said to exhibit the same degree of cyclical risk. Given the unpredictability of the business cycle, however, if the cash flows of the one firm are antici-pated with more certainty, the risk of investing in the security which exhibits the more certain flow ought to be lower. This factor of timing may be a determinant of systematic risk, a topic which has been the subject of considerable theoretical and empirical work over the past decade. Among the many factors that influence systematic riskiness, the degree of sales variability has been shown to be

correlated with estimates of systematic risk [5, 11]. The relative timing of that variation as a determinant, however, has not previously been considered.

II Methodology and Results

To test for the effects of cyclical economic activity on stock returns a test group of cyclical firms was selected in the following manner. The data base consisted of 202 manufacturing firms for which complete data existed on both the Compustat Annual Industrial Tapes and the CRSP (Center for Research on Security Prices, University of Chicago) tapes for the years 1956-1975 and whose fiscal year coincided with the calendar year of the macroeconomic data. Only manufacturing firms (SIC 2000-3900) were used so as to eliminate highly regulated industries and to concentrate on those firms whose products were most likely to demonstrate aggregate income elasticity of demand. The test period was selected to encompass four complete, designated business cycles.

Cyclical firms were selected by examining the timing relationships of firm sales with real GNP. In order to remove autocorrelative tendencies, corporate data and GNP were adjusted for growth trends by calculating the residuals of the following equations:

$$GNP_t = a + b_t + e_t$$

$$S_{jt} = c + dt + f_{jt} ,$$

where

GNP = annual rate of GNP in 1972 dollars,

S_j = annual sales of firm j,

a, b, c, d = regression coefficients,

t = 1-20 time periods, and

e, f = respective residuals from trend.

Coefficients of correlation between the residuals e_t and f_{jt-s} were then calculated for timing differences of up to three years $(-3 \leq s \leq 3)$.[1] Those firms which exhibited statistically significant correlations (significance at the 0.01 level) at a noncoincidental $(s \neq 0)$ timing interval formed the test group. Since annual data were examined, there existed seven potential test groups (three leading, three lagging, and one coincidental). Two groups emerged from this exercise—a group of eighteen firms whose sales led GNP by one year and a larger group of firms whose sales varied coincidentally with GNP. No firms were found whose sales led by two or three years, nor were any found to lag GNP.

A group of eighteen firms was randomly selected from the cyclical, coincidental group to match the one-year lead group in size. The first test was an examination of the returns of the individual firms in each group to see if there were any timing differences in cycle timing relative to an index of market returns. The series of returns for each firm were correlated with the market return index series, using monthly returns for the twenty year period, at timing differences up to a one year lead. Group summaries of the individual correlation coefficients for the various timing intervals (t-12 to t-0) are shown in Table 1. The only statistically significant relationship between any individual return and the market index of returns occurred when the returns were coincidental (t-0). These results are consistent with the efficient market hypothesis, the interpretation of which is that, although the underlying economic events (here sales) occur at different times, investors' adjustments of prices and, thus, of returns occur at one point in time.

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[1] The median duration of the U.S. business cycle is about four years. Since a lead or lag of more than three years could shift the relationship between series by one whole cycle, the relationships were examined for differences of no more than three years.

Table 1

CORRELATION COEFFICIENTS BETWEEN LEADING

STOCK RETURNS AND THE MARKET RETURN*

(Monthly, 1956-75)

Lead in Months	Mean Correlation Coefficients	
	Leading Group	Coincidental Group
12	-.0014	-.0106
11	.0116	-.0408
10	-.0346	-.1047
9	.0338	.0102
8	-.0812	-.0391
7	.0572	-.0855
6	-.0248	-.0536
5	-.0012	-.0068
4	.0132	.0679
3	.0406	.0778
2	-.0213	-.0442
1	.0581	.0031
0	.5239	.5733

*A coefficient greater than 0.15 is considered significantly different from 0 at the 0.01 level.

On the basis of these results, one can discard the concern that common estimates of beta may be inaccurately measured because of differences in timing of returns. Even though individual stock returns vary cyclically, they do so coincidentally with each other and, thus, in the aggregate. This concerted activity in the financial market differs from the pattern in real markets, where cyclical leads and lags in individual economic processes do exist.

A further piece of information helps explain the link between the individual firm's economic behavior and investors' reactions to changes in it. When the market return index was compared with the trend-adjusted real GNP on a quarterly basis for the 1956-1975 period, a market lead of four and five quarters was found.[2] This lead of stock market returns over GNP is greater than the one- or two-quarter lead usually observed for the S & P 500 Index relative to real GNP. The difference may be attributed to differences in the structure of the two indices. The S & P index is a weighted average of stock prices while the CRSP index is a weighted average of stock returns; thus, the CRSP reflects the change in stock prices (and dividend yields), whereas the S & P index records stock prices. The significance for this study is that the market index varies coincidentally with the earliest sales of the firms which lead by the perfect margin. Thus it appears that dividends and stock prices adjust considerably in advance of the majority of economic events, but coincidentally with changes in sales of some firms.

With the awareness that the stock market moves in concert across securities and a year or more ahead of aggregate economic activity, the question remains; of what value, if any, are the leading sales patterns to investors?

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[2] The correlation coefficients were 0.246 and 0.249 for four- and five-quarter leads, respectively. Both coefficients were statistically significant at the 0.01 level.

From the point of view of the firm, earlier revenues are preferred to later flows. Over the business cycle, however, the benefits and costs of high and low revenues cancel out, so that the leading sales revenues are not of continuous value to the firm. From an investor's viewpoint, however, the earlier cyclical path of sales for some firms may provide information that can reduce the uncertainty associated with evaluating stock prices. If so, the stock returns of cyclical leading firms will be less risky than other stock returns.

An empirical test of whether the risk of leading cyclical stocks is ceteris paribus less than that of coincidental cyclical stocks requires a comparison of systematic risks. Beta coefficients were estimated for each firm and for each of the two groups (considering each group as a portfolio). Monthly returns were regressed against the market index for the period 1969–1975.[3] The coefficient estimates are shown in Table 2.

Table 2

BETA ESTIMATES FOR

LEADING AND COINCIDENTAL FIRMS

(Monthly returns 1969–1975)

	Portfolio Beta	Group Mean Beta
Leading Firms	1.0027 (.056)	1.172 (.056)
Coincidental Firms	1.0948 (.102)	1.127 (.062)

Standard errors are in parentheses.

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[3]Gonades [4] has shown that beta coefficients which are computed from approximately eighty-five observations provide relatively good estimates of the "true" beta.

Contrary to expectations, the estimates of systematic risk do not differ between the two groups in statistically significant ways.

III Conclusions

The relative timing of real and financial market adjustments has been investigated. In spite of the fact that some firms' sales lead the aggregate cycle by one year, the returns of the respective stocks vary coincidentally with the aggregate market. An index of market returns was found to lead GNP by four or five quarters, which was close to the time lead of the cyclical sales. From this we can suggest that the cyclical sales may serve as important leading indicators of future aggregate economic activity, and that the stock market reacts to these leading sales patterns. The absence of differential riskiness between leading and coincidental cyclical firms suggests that this information is not applied to individual firms. Instead, the signals from the leading sales may be part of the information set to which investors react. Alternatively, this may be the result of more basic economic economic changes to which investors are also reacting. On the basis of results, one can question the plethora of advice to investors to buy or sell a particular stock at a particular time because of its position in the business cycle. The returns of all stocks vary together over the cycle, although, of course, the degree of variation differs.

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APPENDIX

Firms in Leading and Coincidental Groups

Leading	Coincidental
Adams Millis Corp.	Alcan Aluminum Ltd.
Bell and Howell Co.	Allied Chemical Corp.
Copper Range Co.	American Brands, Inc.
Dan River, Inc.	American Home Products Corp.
Exxon Corp.	Ametek, Inc.
Inspiration Cons. Copper Co.	Armco Steel Corp.
Kennecott Copper Co.	Armstrong Cork
Kroehler Mfg.	Diamond International Corp.
Lehigh Portland Cement Co.	Fruehauf Corp.
M. Lowenstein & Sons, Inc.	Hammermill Paper Co.
Mead Corp.	Hercules, Inc.
Munsingwear, Inc.	Kraftco Corp.
National Gypsum	Lukens Steel Corp.
Penn-Dixie Inds., Inc.	McGraw Edison Co.
Phelps-Dodge Corp.	Monsanto Co.
Revere Copper & Brass, Inc.	Phillips Petroleum Co.
Scovill Mfg. Co.	Sterling Drug Inc.
Victor Comptometer Corp.	Texas Instruments, Inc.