

AN ANALYSIS OF THE ADVANCE-DECLINE LINE
AS A STOCK MARKET INDICATOR

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Introduction

Perhaps one of the most time-honored of technical market indicators is the Advance-Decline Line. Its predictive powers as a leading indicator of the general market have been written about, and historical data on this index are published in *Barron's*. However, the validity of this series as a leading indicator has not been subjected to rigorous statistical analysis.

This article subjects the Advance-Decline Line to such analysis and finds it wanting. In fact, it is our conclusion that the Advance-Decline Line is virtually worthless as a leading indicator of the stock market, at least during the time period studied. The point of this research is not necessarily to validate or debunk conventional stock-market "lore"; rather it is to point up the kind of analysis that could, and should, be done in investigating so-called "technical" indicators. This kind of validation depends on a very careful definition of how the leading indicator works, and a processing of past information relating movements of the indicator to that of the stock market. It is to be hoped that the definitional techniques used in this research will lead to future studies of other technical indicators--for example, the various stock-price charting techniques. These, as the Advance-Decline Line, have a prominent position in the arsenals of institutional, as well as individual, investors. Their validity remains to be demonstrated in a rigorous way.

In this study, Advance-Decline Lines covering two different time periods and the corresponding market averages were subjected to correlation analysis. The two time periods involved include daily data tabulated from September 6, 1966 to October 29, 1967 and weekly data from April 11, 1963 to October 26, 1967. A method of defining peaks and troughs of the Advance-Decline Line which can be practically utilized is described.

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Concepts of the Advance-Decline Line

One of the more important problems faced by investors in the stock market is the determination of the future behavior of the stock market as represented by any of the commonly accepted market averages. Of interest to most investors is not only the immediate future behavior of the market, but the long term behavior of the market as well. Countless numbers of "technical" methods and indicators have been developed over a period of time with the intent of predicting the future movement of the market; these procedures have met with varying degrees of success. According to George K. Freeman, one of the most respected of the technical indicators is the Advance-Decline Line.¹ As with most other technical indicators, logical arguments for the use of the Advance-Decline Line can be made and the evidence presented by Freeman tends to support the claims for success which have been made about this particular indicator.

There are many variations in the construction of the Advance-Decline Line. In its simplest form, the indicator is simply the cumulative net difference between the number of common stocks which have experienced a price rise and the number of stocks which have experienced a price decline in a given time interval.

Thus, if in a given time period 970 stocks rise in price while 350 stocks decline, the Advance-Decline entry for that time period would be 620. If, in the subsequent time period, 220 stocks advance while 980 stocks decline in price, the value of the Advance-Decline Line would be -140, which is the previous value (620) plus the number of advances (220) minus the number of declines (980). A plot of the cumulative net difference versus time forms the Advance-Decline Line and may be continued indefinitely. The time periods involved may be of any constant duration; a common interval is either one day or one week.

The shape of the Advance-Decline Line is not dissimilar in shape to the market average, i.e. it includes not only long term peaks and valleys but also short term disturbances. Obviously, the absolute values of the

¹"Advance-Decline Line: A Clue to the Underlying Strength or Weakness of the Market," George K. Freeman, *Barron's National Business and Financial Weekly*, January 21, 1963.

Advance-Decline Line bear no relationship to the absolute values of any stock market average such as the Dow-Jones Industrial Average, for each is measured on a completely different scale. However, the claim has been made that the peaks of the Advance-Decline Line occur in time substantially ahead of the peaks of the DJIA and that every significant peak of the market average is preceded by a peak in the Advance-Decline Line. The Line can therefore be used as a predicting indication of the weakening of a bull market. Freeman's article includes a graph of the Advance-Decline Line and DJIA covering the years 1950 to 1962; the graph appears visually to substantiate the hypothesis. Freeman asserts, "In early 1951, early 1955, early 1959, and in mid-1961, the Advance-Decline Line revealed a weakening of the market coincidentally with or slightly ahead of, minor or intermediate tops, but substantially ahead of far more important peaks in the Average. Indeed, though complete studies are not available, it seems certain that practically every salient market top would have showed up early in this index." It is further asserted that the lows or valleys of the Advance-Decline Line are coincident in time with the lows of the market average; thus only the peaks of the Line can be used as a predictive indicator.

The Advance-Decline Line is said to be valid in predicting not only the major peaks of the market average but also the day to day variations. "The Advance-Decline Line is not only a useful key to the market's long-term position, but also a fine-focusser on lesser turning points. In fact, no other technical indicator is quite so consistent in picking market tops, whatever their eventual dimension." Joseph Granville² also uses the Advance-Decline Line to describe the day to day behavior of the market. Much of the literature on the subject of the Advance-Decline Line describes specific instances in which the Line is said to predict day to day behavior of the market as well as the major variations of the average.

The Analysis

In view of the claims which have been made for the predictive ability of the Advance-Decline Line, it seems desirable to subject the technique to

² Joseph Granville, *Strategy of Daily Stock Market Timing* (Englewood Cliffs, N. J.: Prentice-Hall, 1961).

objective statistical analysis. Two sets of data were employed throughout this analysis. One set consisted of the daily number of advances and declines of stocks listed on the New York Stock Exchange and of the daily closing average of Standard & Poor's composite index of 425 stocks. These data were obtained for the period from September 6, 1966 through October 29, 1967. The second set of data included the weekly totals of advances and declines and the weekly closing value of Standard & Poor's index. These data were obtained for the period April 11, 1963 through October 26, 1967.

The cumulative Advance-Decline Line was plotted over the entire time period. Values of the Advance-Decline Line were plotted against the corresponding values of the Standard & Poor's index. A simple regression line was fitted through these points with the value of the Advance-Decline Line being used as the independent variable. To determine a measure of relationship between the Advance-Decline Line and the index, the coefficient of correlation was computed. The coefficient of determination--a measure of the percentage of variation of the market index which is associated with the variation of the Advance-Decline Line--was also computed. The procedure was repeated with the Advance-Decline Line being shifted in time relative to the Standard & Poor's index, the amount of shift was varied in unit time periods (days or weeks, depending upon the set of data) from +15 to -15.³ In other words, the Advance-Decline was allowed to "lead" the market average for up to 15 time periods and was similarly allowed to "lag" the average for up to 15 time periods. The amount of shift which resulted in the largest coefficient of correlation was concluded to be the amount of time by which the Advance-Decline Line leads (lags) the market average in a predictive sense.

³The 15-period time duration is sufficiently long to indicate the lack of predictive power on the part of the Advance-Decline Line. Subsequent exhibits suggest that a 15-period sample includes most of the variance around what is essentially a coincident indicator. The actual time periods used (4 years from April 11, 1963 to October 26, 1967, and 1 year from September 6, 1966 to October 29, 1967) were chosen on the basis of recency. The four-year period was used for weekly data, and the one-year period for daily data. It was felt that the time periods included enough data points to be of meaning to the investor, and that longer periods would add very little. On this basis, while the periods were arbitrarily drawn, the method of selection should introduce no bias to the study.

Emphasis should not necessarily be placed upon the computed values of the coefficients of correlation and determination. If, for example, the relative strength of the peaks of the Advance-Decline Line to its valleys is considerably different from the relative strength of the peaks to valleys of the Standard & Poor's average, the coefficient of correlation would not be large. No claims are made that the value of the Advance-Decline Line can be used to predict the value of the market average. What is important, however, are the relative values of the coefficient of correlation for the varying degrees of time shift between the Line and the average, for this is an indication of how significant a predictive capability exists to forecast the weakening of bull markets and the strengthening of bear markets.

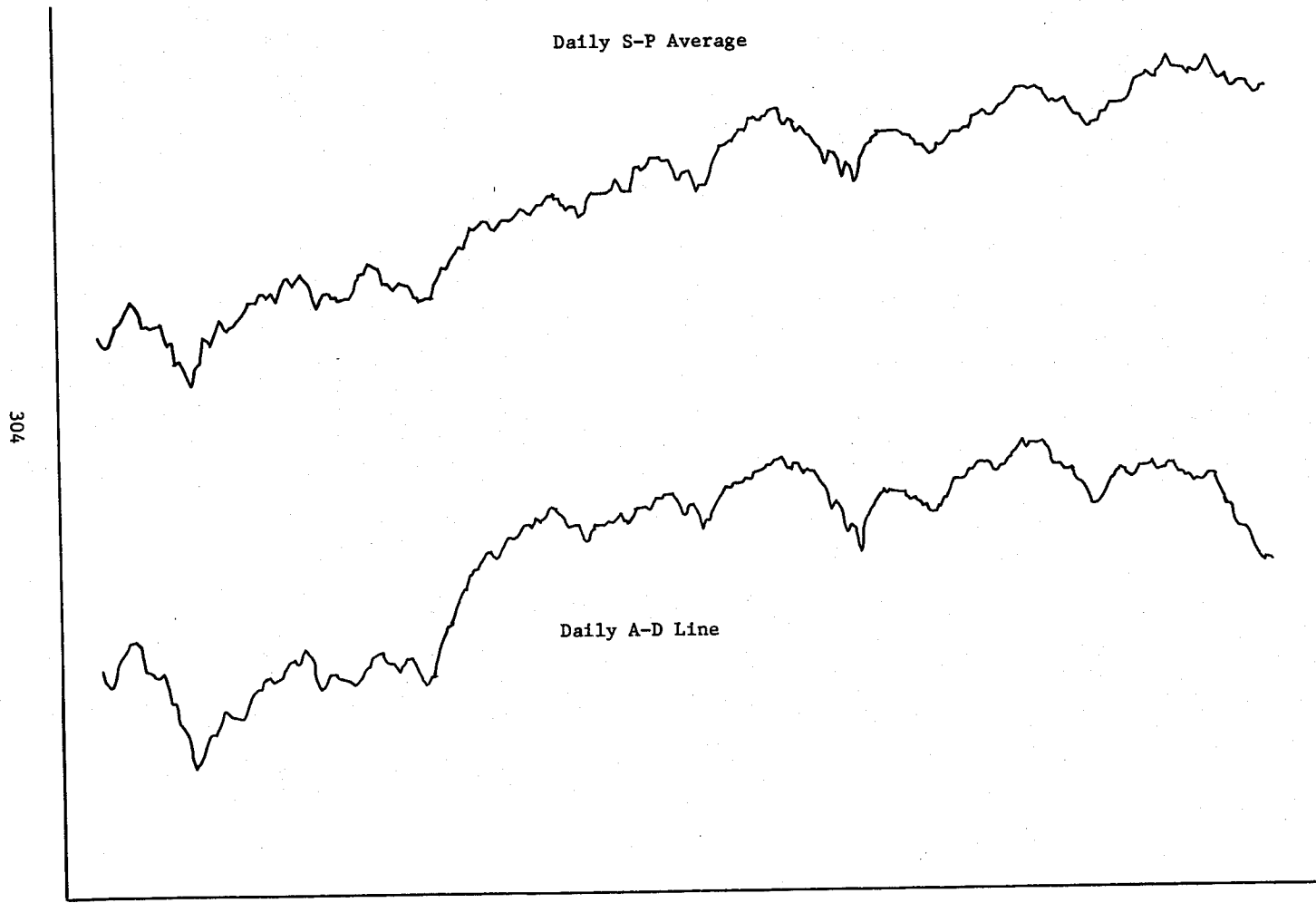
The Advance-Decline Line and the Standard & Poor's composite average for the daily and the weekly sets of data are shown in Figures I and II, respectively. The values of the daily Line ranged from a minimum of -4715 to a maximum of 2926 while the Standard & Poor's average varied from 77.89 to 106.15. The weekly Advance-Decline Line varied from 4933 to 6831 while the limits of the market average were 71.64 and 105.80. It should be noted that in addition to minor variations, the weekly data includes at least one major shift of the market; it is hoped that both sets of data are in fact typical of general market behavior.

The Correlation: Cumulative Advance-Decline Line

Table 1 contains the important results of the simple correlation analysis. The first column of the table represents the number of time periods by which the Advance-Decline leads the Standard & Poor's composite average; a negative entry in this column indicates that the Line actually lags the average. For each amount of lead, the coefficient of correlation is tabulated for both the daily and weekly sets of data. The coefficient of determination is not shown in the table because of its lack of importance in drawing the type of conclusion we are interested in; its value may be computed easily, however, for it is simply the square of the value of the coefficient of correlation.

The most important conclusion to be drawn from the data of Table 1 is that because the highest value of the coefficient of correlation occurs when the Advance-Decline Line leads the market average by zero time periods, the Advance-Decline Line is not a good predictive indicator of the market

Figure I

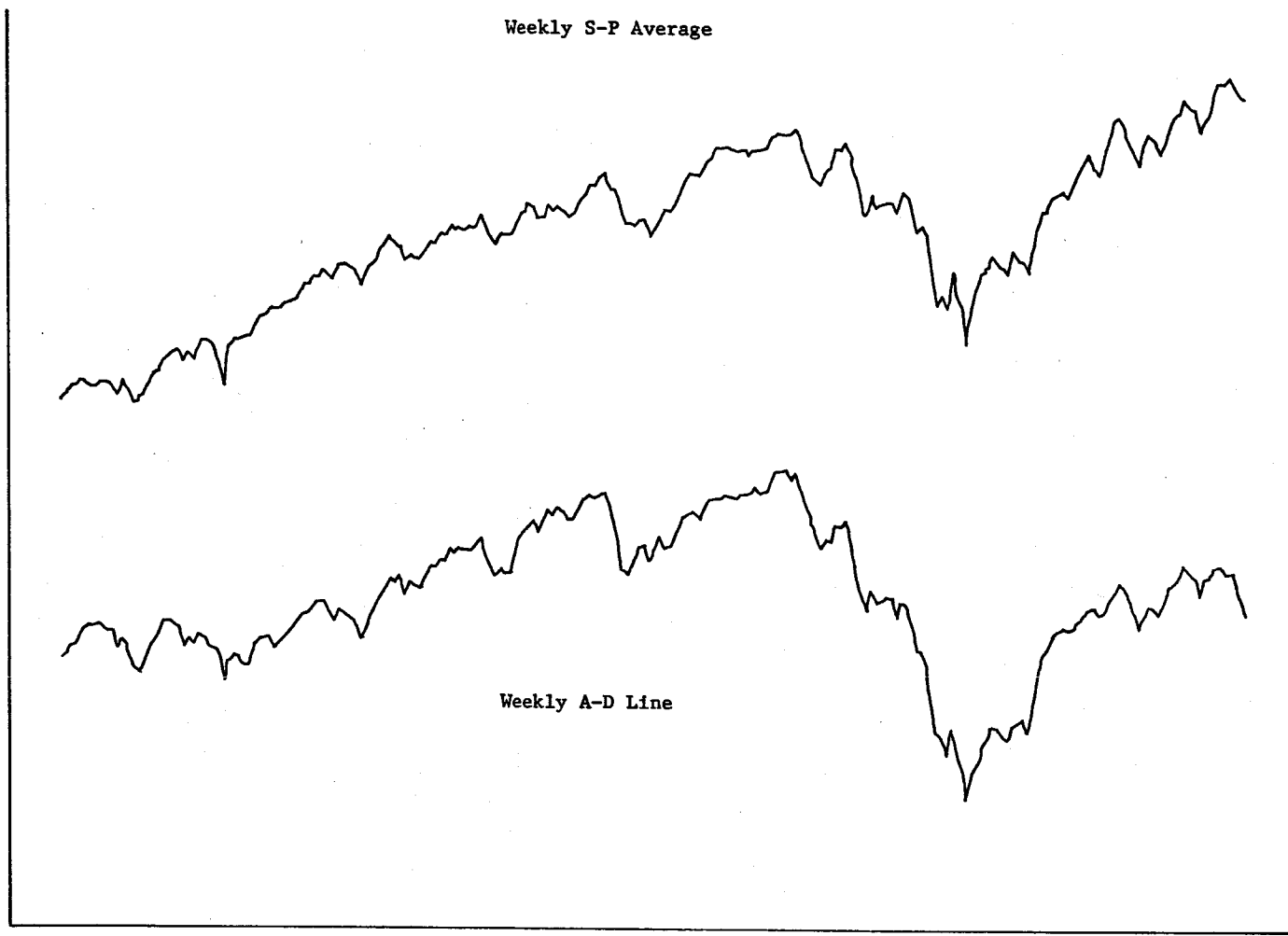


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Figure II

Weekly S-P Average

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Weekly A-D Line

Table 1

RESULTS OF CUMULATIVE ADVANCE-DECLINE LINE

Number of Time Periods by which Advance-Dcline Leads Standard & Poor's Average	Coefficient of Correlation	
	<i>Weekly</i>	<i>Daily</i>
15	0.369	0.896
14	0.290	0.897
13	0.409	0.900
12	0.430	0.904
11	0.451	0.909
10	0.474	0.914
9	0.494	0.920
8	0.515	0.926
7	0.532	0.932
6	0.549	0.938
5	0.565	0.942
4	0.582	0.947
3	0.595	0.952
2	0.611	0.956
1	0.626	0.959
0	0.637	0.962
-1	0.621	0.959
-2	0.599	0.953
-3	0.577	0.947
-4	0.560	0.940
-5	0.540	0.931
-6	0.522	0.922
-7	0.506	0.921
-8	0.491	0.903
-9	0.475	0.894
-10	0.456	0.885
-11	0.437	0.874
-12	0.415	0.861
-13	0.390	0.849
-14	0.362	0.838
-15	0.328	0.827

average: this conclusion is the same for both the daily and the weekly data. It is not clear what, if any, importance should be attached to this result but it would seem to indicate that the shorter the time interval which a point of data represents, the more closely the shape of the Advance-Decline Line resembles that of the market average. Carried to the extreme, this finding is not surprising; if only one stock is traded during an interval, then the average will be affected upward or downward by the transfer of this single stock and the relative motion of the Line and the average would be in perfect agreement.

When the daily Advance-Decline Line is coincident with the average in time--when there is no leading or lagging involved--the coefficient of determination was found to be 0.925 on a daily basis. This can be interpreted as indicating that 92.5 percent of the variation exhibited by the Standard & Poor's composite average is associated with the variation in the Advance-Decline Line; there is substantial association between the Line and the average. If Y represents the value of the market average and if X represents the value of the Advance-Decline Line, the simple regression equation for this case may be expressed as $Y = 86.3 + 0.0018 X$. For weekly data with no leading or lagging, the coefficient of determination is 0.405 and the regression equation is $Y = 85.4 + 0.0017 X$. The association between the weekly Line and market average is less than half of that for the weekly data. Unfortunately, because the maximum correlation occurs when no leading or lagging is involved, the regression equations are of little practical value to the investor as a tool for estimating the future value of the market average.

Changes in the Advance-Decline Line and Market Changes

Table 1 clearly shows that taken as an entity, the Advance-Decline Line does not act as a leading indicator of the market movement, at least for the time periods for which data was collected. The question was previously raised as to why an Advance-Decline Line should be cumulative; that is, why should the long age history of the trading activity be employed in attempting to predict the future of the market average. It would intuitively seem that a better indicator of market behavior might be the change in the Advance-Decline data, rather than a cumulative sum. To see if this is in fact the case, the changes on a period by period basis of the weekly and daily

Advance-Decline data were correlated with the market average as previously described. In both the daily and the weekly data sets, the coefficient of correlation bounces around in an apparently random manner as the amount by which the Line leads the market average is varied. This phenomenon, coupled with the low coefficients of correlation as compared with those previously obtained, indicates that changes in the Advance-Decline Line not only are worthless as a leading indicator but furthermore bear little resemblance to the market average. The obvious conclusion to be drawn from the results shown in Table 2 is that changes in the Advance-Decline Line are not a valid leading indicator of the market average.

A further variation on the same theme would be to attempt to associate changes in the Advance-Decline Line with changes in the market average. This was in fact performed and the results were not unexpected. Except for the situation in which there was no lead or lag permitted, the coefficient of correlation appeared to be essentially a random variable with values typically less than 0.100. For both the daily and the weekly set of data, the coefficient of correlation at coincidence was considerably larger, on the order of 0.77 or more. While the results are not tabulated, the conclusion is clearly that changes in the Advance-Decline Line cannot be used as a leading indicator for either changes in value of the market average or in the average itself.

The results which have so far been presented should not necessarily be construed as negating the claims which have been made in favor of the Advance-Decline Line. To the authors' knowledge, it has not been stated that the entire Advance-Decline Line should be used as a leading indicator; it was only claimed that the peaks of the Advance-Decline Line could be used as a predictive indicator of the peaks of the market average. The analysis which has so far been described has treated both the peaks and the troughs of the Line and of the average in the same breath.

Peaks and Turning Points

To investigate the validity of the claims as made, it is necessary first to determine some manner by which peaks may be defined; various methods can be suggested with equal justification. For the purpose of this study, a peak is taken to be a relative concept, and the peak of the index (Line or market average) is defined in terms of the immediate history of the

Table 2

RESULTS OF CHANGES IN ADVANCE-DECLINE LINE

Number of Time Periods by which Advance-Divide Leads Standard & Poor's Average	Coefficient of Correlation	
	<i>Weekly</i>	<i>Daily</i>
15	0.136	0.010
14	0.134	0.018
13	0.110	0.011
12	0.127	0.023
11	0.127	0.036
10	0.143	0.059
9	0.125	0.070
8	0.128	0.066
7	0.107	0.071
6	0.105	0.066
5	0.097	0.061
4	0.105	0.046
3	0.071	0.026
2	0.097	0.020
1	0.088	0.014
0	0.054	0.003
-1	-0.106	-0.066
-2	-0.144	-0.110
-3	-0.137	-0.136
-4	-0.110	-0.156
-5	-0.121	-0.190
-6	-0.107	-0.210
-7	-0.099	-0.220
-8	-0.093	-0.243
-9	-0.102	-0.257
-10	-0.115	-0.256
-11	-0.121	-0.260
-12	-0.133	-0.255
-13	-0.152	-0.248
-14	-0.173	-0.234
-15	-0.203	-0.223

index. To determine the existence of a peak, the local minimum of the index is determined. As time progresses, the index is monitored as it begins to rise. When the index begins to decrease in value, the local maximum is recorded. This local maximum is the highest value of the index since the previously recorded local minimum. A peak is said to have occurred when the amount of the decrease exceeds a pre-specified fraction of the previous rise as measured from the local minimum to the local maximum. When a peak is determined to have occurred, a trough is known to have begun. The beginning of the trough is taken to be the point at which the existence of the peak becomes determined; but the downward excursion of the trough is measured from the recorded local maximum. A trough is terminated by the same method described above, with the obvious change or reverse of directions. Under this form of definition, only peaks and troughs can exist; if an index is not experiencing a peak, it must be in the midst of a trough. There are two advantages in this method of defining local peaks; the definition is not a function of the value of the index and can therefore be used on current data. No hindsight is needed except for the recording of the preceding local maximum or minimum value. The importance of this definition is that it can be used in practice and need not be confined to historical analysis. Of course, to be useful as a predicting device, a peak in the Advance-Decline Line must be known to occur before the corresponding peak has occurred in the market average. This is a difficulty not of the definition but rather one of how much the peaks of the Line do in fact lead the peaks of the market average.

The method of defining peaks described above utilizes a pre-specified fraction. Because no guidelines were available as to what this fraction should be, a number of different values were used, ranging from 0.1 to 1.2.

Having determined what periods of time constituted peaks of the Advance-Decline Line, the analysis continued as previously described. The peaks and troughs of the Line were allowed to lead and lag the market average by varying amounts as before. The correlation analysis was performed for all the values of the specified fraction to determine how in practice to define a change which would yield optimum results. The results of this analysis must be interpreted with care. If the change in the Advance-Decline Line is not recognized to have occurred until long after the corresponding market change occurs, the predictive ability of the Line is of no practical value.

The results of the independent analysis of the peaks and troughs of the Advance-Decline are summarized in Table 3. In this table, the entries in the first column are the values of the pre-specified fraction; this fraction, it is remembered, represents the amount of the immediately previous rise of the Advance-Decline Line by which the Line must fall in order to define the existence of a peak. It should further be remembered that those intervals of time which do not constitute a peak are by definition periods which form the troughs. For each value of the pre-specified fraction, the correlation analysis was performed with time shifts of up to ± 15 periods between the Advance-Decline Line and the Standard & Poor's composite average. Only the amount of shift which resulted in the largest coefficient of correlation for each definition of the peak is shown in Table 3.

The results summarized in Table 3 deserve some comment. Generally speaking, for both the daily and the weekly sets of data the amounts of shift which are required to maximize the coefficient of correlation for the peaks and the troughs are different; this result is in keeping with the Advance-Decline Line theory. The magnitude of the coefficient of correlation as well as the amount of shift which maximized this coefficient is a function of how the peaks are defined. Furthermore, the corresponding definitions of peaks do not yield consistent results for the daily and the weekly data. For example, in the daily data, peaks which are defined by a fraction of 1.00 result in the lowest coefficient of correlation, while peaks of the weekly data which are defined the same way result in almost the highest coefficient of correlation. These results indicate that in practice an investor would have difficulty in describing satisfactorily the existence of a peak which would be useful in both long and short term forecasting.

The most interesting and important result which is shown in the entries of Table 3 pertains to the amount of shift required to maximize the coefficient of correlation. Without exception in the daily data and with only two major exceptions in the weekly data, the coefficients of correlation for both the peaks and the troughs are maximized when the peaks and troughs of the Advance-Decline Line either are coincident in time with the market average or actually lag the market average. In all but two instances, the Advance-Decline Line is a very poor leading indicator of the market behavior as expressed by Standard & Poor's composite index. This result is undoubtedly the most important of the entire study.

Table 3

RESULTS OF INDEPENDENT ANALYSIS OF PEAKS AND TROUGHS

<u>Fraction</u>	<u>P E A K S</u>			<u>T R O U G H S</u>	
	<u>Maximum Coefficient of Correlation</u>	<u>Time Periods by which Advance-Decline Line Leads Standard & Poor's Average</u>	<u>Maximum Coefficient of Correlation</u>	<u>Time Periods by which Advance-Decline Line Leads Standard & Poor's Average</u>	
		<i>Weekly</i>			
0.10	0.602	-1	0.696	0	
0.25	0.574	0	0.685	-1	
0.50	0.641 (0.591)	15 (0)	-0.535 (0.286)	15 (0)	
0.800	0.860	0	0.587	0	
1.00	0.839	9	0.544	0	
1.20	0.807	1	0.394	0	
		<i>Daily</i>			
0.10	0.955	-2	0.975	-1	
0.25	0.958	-3	0.989	-1	
0.50	0.946	0	0.846	-1	
1.00	0.904	0	0.955	0	

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Focusing upon the two instances of the weekly data which suggest the existence of a leading indicator, consider first the peaks defined by the fraction 0.50. In all cases, the coefficient of correlation was found to be a smooth function as the amount of shift between the Line and the average was varied; that is, as the amount of shift varied from -15 to +15 time periods, the coefficient gradually approached its maximum value and then declined. In this particular instance, however, two relative maxima of the coefficient of correlation were found; one occurring at a relative shift of +15 and the other occurring at a shift of zero. At a relative shift of +15, the coefficient of correlation between the troughs of the Line and the average was also a maximum and it was negative. This indicates that a relative peak of the average was associated with the troughs of the Line, a finding which one would hope not to find in a satisfactory indicator. Thus, the findings of this particular instance must be discounted.

The case where weekly peaks are defined by the fraction 1.00 appears to offer the most support for proponents of the Advance-Decline Line theory. In this instance, the coefficient of correlation was well behaved, obtaining a smooth maximum value when the peaks of the Line led the market average by nine weeks. True to the claims, the troughs of this instance and the average were maximally correlated when the two indices were coincident in time. The question now arises as to whether or not this finding is of any practical utility in attempting to predict the behavior of the market. The question to be asked is whether or not more than nine weeks are required to determine the existence of peaks as defined for this case. If for example, it requires 30 weeks to determine the existence of peak, but the peak provides only nine weeks of advance warning, then clearly such a result is of limited use to an investor.

Using a fraction of 1.00, the weekly data was found to contain three peaks of the Advance-Decline Line. The first peak lasted 15 weeks, the second lasted 11 weeks, and the third lasted 126 weeks. It can be argued that the first two peaks are of sufficiently short duration that they could satisfactorily be used as predictive indicators; however, they also comprise such a short period over which the correlation was performed that their contribution to the value of the coefficient of correlation is questionable. In the case of the third peak, by the time the peak of the Line is finally

recognized to have occurred, the market average has been falling for more than twenty-one weeks. One must strongly question the value of such a so-called leading indicator.

One might be tempted to assert that he would not have to wait out the full downward trend of the Line until he was convinced that a peak had occurred. This may in fact be true but if it is, how does one define the existence of a peak such that the definition is applicable in all periods of time? Once the definition is made, the investor would be wise to stick to it if consistent success is to be obtained. The feeling of the authors is that no definition which can be practically applied would substantially alter the results which have been presented; further investigation which could negate this opinion is to be encouraged.

Summary and Conclusions

There is a significant relationship between the Advance-Decline Line and the Standard & Poor's composite average of 425 stocks. Because this relationship is strongest when the Line and the average are coincident in time, the Line does not constitute a good leading indicator of the market average. Period to period changes in the Advance-Decline Line are also poor indicators of future behavior of the market average. For the time periods covered by this study, the troughs of the Advance-Decline Line were always maximally correlated with the market average when there was no leading or lagging time period involved. Generally speaking, the same result was found for the peaks of the Line. In the one instance in which a leading indication was found, the time required to recognize the signal given by the Line was so great that the market average had changed before the signal was recognized.

The preponderance of evidence resulting from this study indicates that the peaks of the Advance-Decline Line are at best a very poor leading indicator of the market average as represented by Standard & Poor's composite average. In general, it was found that both the peaks and the troughs of the Line are maximally correlated with the average when the Line and the average are essentially coincident in time. These findings are valid for both daily and weekly tabulations of Advance-Decline and market average data. Finally, it should be stressed that the findings are known to be correct only for the time periods which were analyzed in this study; analysis of longer and different time periods should be conducted before inviolate conclusions can be made.