The Predictive Significance of Five-Point Chart Patterns

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THE PREDICTIVE SIGNIFICANCE OF FIVE-POINT CHART PATTERNS*

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INTRODUCTION

One of the stock market technician's most prized tools is the chart of individual security price movements. The technician contends that certain price patterns (head and shoulders, triangles, channels, flags, pennants, double bottoms, and the like) recur frequently and that price direction subsequent to the formation of these patterns is predictable.

Unfortunately, very little rigorous research has been addressed to the significance of the various chart patterns. This lack of research may be attributable to one or more of the following factors: (1) the scarcity of adequate computer-readable data bases; (2) the difficulty in designing the experiment; (3) the inability of standard statistical techniques to satisfactorily reflect the complicated nonlinearity of most price formations; (4) the unwillingness of many technicians to define their methods in precise, unambiguous terms; or (5) the fear of exposing the extraordinary success or the extraordinary failure of a rather mysterious art.

The purpose of this article is to overcome some of these obstacles; to study selected chart patterns in a systematic and scientific manner; and to measure empirically the results of chart following so that these results may receive the praise, or scorn, or further study which they deserve.

Figure 1 illustrates the thirty-two possible forms of a five-point chart pattern (i.e., a pattern with two highs and three lows, or two lows and three highs). In the right-hand corner of each box, the patterns are numbered from 01 through 32. In the left-hand corner, the patterns are assigned five-digit identifiers where the digits, from left to right, represent the rank (in descending sequence) of the respective reversal points. The charts are arranged in order of these five-digit identifiers.

The avid chartist will recognize, among the thirty-two patterns, several variations of channels, wedges, diamonds, symmetrical triangles, head and shoulders, reverse head and shoulders, triple tops, and triple bottoms. Each of these formations allegedly reflects underlying supply/demand and support/resistance conditions which have implications as to future price behavior. A common belief among chartists is that the appearance of certain patterns followed by a "breakout" gives a profitable buy or sell signal. Our task is to test the predictive significance of these thirty-two patterns.

DATA

Our data file consists of daily closing prices (fully adjusted for splits, cash dividends, rights, and other distributions) for 548 New York Stock Exchange (NYSE) securities. The time period covered was July 3, 1964 through July 4, 1969—a span of five years. However, the

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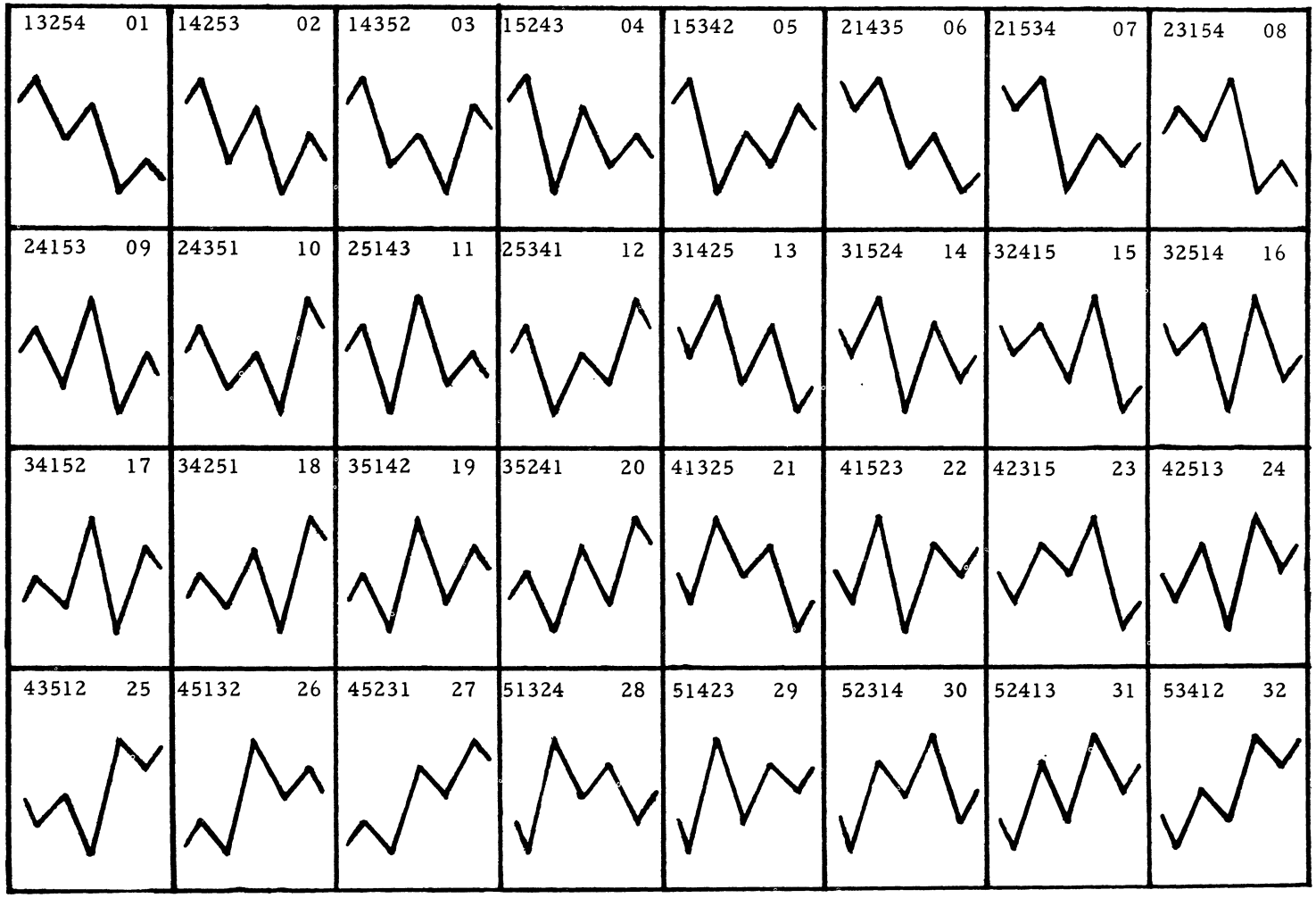

FIG. 1.—Possible forms of a five-point chart pattern

first pattern was not formed until September 15, 1964; and the search for patterns was terminated on January 3, 1969 in order that sufficient subsequent prices would be available for the measurement of investment results.

The five-year period includes one major bear market (1966); part of another (1969); an oscillating market of the type astute traders prefer (1968); and two and a half years of strongly advancing prices (1964, 1965, and 1967). This variety of environments is, we believe, helpful in appraising the applicability of our results to diverse market conditions. Of course, the principal reason for the selection of the test period chosen was that it was the most recent interval for which data were available in our files for a broad list of securities.

Selection of the 548 stocks was made on an even more pragmatic basis. Our computer-readable price and volume tapes cover approximately 2,350 common stocks on both major exchanges. However, complete five-year histories are recorded for only 548 of these issues. The selected companies are all traded on the NYSE and in general they tend to be the more actively traded and widely held listings. We are confident that an adequate cross section of the economy is represented. (A list of all 548 stocks is available from the author.)

SUMMARY OF FINDINGS

A total of 19,077 patterns were detected. Of these, 9,383 patterns, with an average formative length of 149.6 weekdays, were followed by a breakout and were further processed. Investment results, ignoring commissions, were measured week by week for one through twenty-six weeks subsequent to the breakout. For each of the thirty-two patterns, these results were expressed in the following terms: (1) the absolute rate of return; (2) the rate of return relative to the market (for this purpose the "market" was gauged by the daily geometric average of the adjusted prices of the 548 stocks in the research file); and (3) the standard deviation of the relative-to-market returns.

When investment results are summed by type of pattern, some patterns were found to precede performance that was better than average or better than the market, while others performed worse. This is hardly surprising: Different investment rules, even if nonsensical, will produce different investment results. But neither the best nor the worst of these thirty-two rules performed very differently from the market. As a result, *after taking trading costs into account, none of the thirty-two patterns showed any evidence of profitable forecasting ability in either (bullish or bearish) direction.* Not one of the patterns for any holding period, from one through twenty-six weeks, produced an indication of significantly better-than-average purchase or short-sale opportunities, except with respect to those persons or firms who are able to buy and sell free of commissions. Moreover, the most bullish results tended to be generated by those patterns which are classified as bearish in the standard textbooks on charting, and vice versa.

Of course, the omission of daily trading volume may be a deficiency. Some technicians (i.e., principally those that use bar charts rather than point and figure charts) rely heavily on volume patterns to confirm the price formations which we have studied. Certainly, worthwhile additional research could be performed which include this potentially important consideration. Nevertheless, it is reasonably clear from these studies that five-point patterns based upon price

alone are not likely to be of major assistance to portfolio managers. The burden of proof respecting volume now rests heavily upon the shoulders of those technician-chartists who would have us believe that they are offering something more than ex post reinterpretations of statistical artifacts.

RESEARCH METHOD

The first problem in pattern specification and recognition—at least with respect to the patterns analyzed herein—is the definition of a "reversal point." For this study, we have defined a "reversal point" as the highest (lowest) price preceding a cumulative price decline (advance) of a given percentage increment. And the "increment" has been defined as the quantity $a + bV$; where a and b are constants, and V is the volatility of the individual stock as measured by the arithmetic average of the day-to-day percentage price changes over the most recent 131-day period.

By using a V factor, we can adjust for the changing volatility of a stock over time and the differing volatilities between stocks at any one point in time. Without an adjustment of this nature, the study would be dominated by the more volatile companies. For example, if the percentage increment were set to a constant, say 7 percent, there would clearly be a greater number of five-point patterns produced by Admiral than by Consolidated Edison. Of course, if domination by volatile issues is desired, the filter could be canceled by setting b to 0, whereupon the percentage increment would be governed solely by the constant a. In any event, the size of the increment is a direct determinant of the formative length of the average pattern and an inverse determinant of the total number of patterns detected.

The a and b constants have been set to 0 and 6, respectively, for the studies reported below. As previously mentioned, this has resulted in the recognition of 9,383 buy or sell signals with an average formative length of 149.6 weekdays. These seem to be reasonable parameters, although in future research we may also investigate patterns of longer or shorter duration.

The adjusted daily prices and daily V factors were examined stock by stock for each of the 548 securities. A percentage increment equal to $0 + 6V$ was computed daily, and, based on this increment, all reversal points were identified for the entire test period. Then, the computer program proceeded as follows: (1) every series of five consecutive reversal points was separately inspected; (2) the prices at the five points were ranked in descending sequence; (3) the ranks (R1 through R5) were converted into a pattern identification number by the formula $(R1 \times 10{,}000) + (R2 \times 1{,}000) + R3 \times 100) + (R4 \times 10) + R5$; and (4) the pattern was classified by matching the resultant identification number against the five-digit numbers appearing in figure 1. Then, each pattern was further processed *only if* a "chart breakout" occurred prior to the next reversal point (i.e., before the time at which a new pattern would be recognized). The "chart breakout" was defined as a price movement which penetrated the fourth reversal point of the pattern—on the upside if the fourth point was a high, and on the downside if the fourth point was a low. This penetration is the event which most technicians require before they will take a long or short position in an issue.

For the 9,383 patterns which then gave buy or sell signals, performance was measured weekly from the occurrence of the pattern breakout through twenty-

six weeks into the future. To determine the length of pattern formation, we compared the date of the penetration with the date on which the sixth preceding reversal point was established. Also tabulated was a frequency distribution, by date, of the number of patterns processed.

RESULTS

Table 1 shows the one-, four-, thirteen-, and twenty-six-week results before trading costs for each of the thirty-two patterns. (The results for the interim weeks were no more revealing and so are not reproduced here.) On a relative-to-market basis, the best and worst performers for the four holding periods were as shown in table 2.

The *t*-test for the significance of the difference between the best and worst relative-to-market performances produces values as follows: one-week, 4.67; four-week, 6.75; thirteen-week,

TABLE 1

RESULTS FOR EACH PATTERN BEFORE TRADING COSTS

Identification	No. of Patterns	Percentage Rate of Return without Trading Costs											
		1 Week			4 Weeks			13 Weeks			26 Weeks		
		Absolute	Relative*	S.D.†	Absolute	Relative*	S.D.†	Absolute	Relative*	S.D.†	Absolute	Relative*	S.D.†
1 13254	351	−0.1	0.2	4.2	0.8	0.4	6.8	4.6	0.8	12.8	15.8	2.7	21.1
2 14253	615	0.0	0.3	4.0	0.5	0.0	6.3	3.1	0.2	11.8	8.2	−0.5	17.8
3 14352	149	0.0	0.3	3.1	1.1	0.9	6.8	4.2	0.4	11.0	7.8	−0.3	16.3
4 15243	237	−0.7	−0.1	3.4	0.0	0.0	6.6	3.6	0.7	12.4	6.4	−0.2	17.3
5 15342	171	0.3	0.5	3.4	0.2	−0.1	6.1	3.9	−0.3	11.7	5.7	−1.7	16.8
6 21435	249	−0.4	−1.0	4.1	1.5	−0.9	7.0	7.5	−0.6	13.2	16.0	0.3	19.7
7 21534	193	0.9	−0.1	4.1	3.6	0.1	7.2	10.0	0.1	15.4	18.1	1.2	19.9
8 23154	149	0.8	0.9	3.6	2.2	1.4	6.2	7.1	2.5	10.9	15.8	1.7	14.2
9 24153	322	−0.1	−0.1	3.3	−0.8	−0.4	6.0	2.1	0.0	11.4	7.5	0.4	15.4
10 24351	90	1.2	0.8	3.6	1.8	1.0	5.7	5.2	1.9	11.9	7.9	2.1	16.6
11 25143	145	0.6	0.3	3.5	1.5	0.9	7.0	4.6	2.2	11.6	8.0	1.6	18.8
12 25341	120	0.8	0.5	3.1	0.8	0.5	5.5	5.8	0.8	10.2	8.2	1.1	13.5
13 31425	404	0.5	−0.3	3.6	0.7	−1.4	6.5	4.0	−2.1	12.0	10.1	−1.5	18.0
14 31524	419	0.9	0.2	4.6	2.1	−0.3	7.8	4.0	−1.2	11.7	8.7	−1.6	16.8
15 32415	74	1.1	0.4	3.8	1.8	−0.2	7.4	5.8	1.0	13.8	7.7	−0.4	15.2
16 32514	90	1.4	0.4	4.2	2.6	0.1	11.2	6.3	0.6	12.2	12.2	1.8	17.5
17 34152	78	0.1	0.3	3.4	1.0	0.7	7.3	3.5	0.3	10.0	4.7	0.7	14.0
18 34251	58	0.3	0.6	3.2	−0.1	0.2	5.0	1.9	0.2	7.5	4.2	0.7	14.7
19 35142	449	0.3	0.3	3.5	0.9	0.7	6.6	3.9	1.0	11.9	6.9	1.9	17.2
20 35241	363	0.7	0.7	3.4	1.5	0.6	6.1	4.9	0.9	10.7	8.6	1.4	18.7
21 41325	166	0.2	−0.4	3.5	1.7	0.1	6.2	5.0	0.9	12.6	8.1	0.6	18.8
22 41523	154	0.9	0.4	3.5	2.2	0.4	7.0	5.0	1.0	11.6	9.2	0.6	18.0
23 42315	86	0.0	−0.5	4.2	1.0	−0.9	7.6	4.0	−0.8	13.3	10.3	−0.2	25.0
24 42513	377	0.7	0.1	4.5	1.2	−0.3	6.7	2.8	−0.7	12.1	7.4	0.2	18.1
25 43512	411	0.7	0.1	4.3	1.2	−0.1	8.0	3.7	0.6	14.1	4.3	0.3	19.6
26 45132	363	0.1	0.3	3.6	1.7	1.2	6.7	5.2	2.0	13.2	5.8	2.5	19.4
27 45231	371	0.9	0.8	4.0	2.8	1.9	7.1	6.1	2.8	13.1	7.4	2.3	19.2
28 51324	418	0.6	0.0	4.0	2.0	0.5	7.1	3.8	0.4	13.5	6.5	1.2	19.8
29 51423	328	0.9	0.3	4.5	2.1	0.8	7.7	4.3	1.5	14.6	7.2	2.3	19.2
30 52314	238	1.1	0.4	4.6	2.0	0.6	8.4	3.6	0.7	14.4	7.3	2.7	21.2
31 52413	910	0.7	0.2	4.1	1.4	0.2	7.7	2.4	−0.2	11.6	5.3	1.5	17.9
32 53412	835	1.0	0.6	4.2	1.3	0.3	7.5	2.7	0.6	13.0	4.9	1.9	17.7

* Relative to the geometric average of the adjusted daily prices of the 548 stocks in the research file.

† Standard deviation of the relative percentage returns.

TABLE 2

PERFORMANCES ON RELATIVE-TO-MARKET BASIS

	Best Performing Pattern				Worst Performing Pattern			
	1 Week	4 Weeks	13 Weeks	26 Weeks	1 Week	4 Weeks	13 Weeks	26 Weeks
Pattern identification	23154	45231	45231	13254	21435	31425	31425	15342
No. of patterns	149	371	371	351	249	404	404	171
Absolute return (%)*	0.8	2.8	6.1	15.8	−0.4	0.7	4.0	5.7
Relative return (%)*	0.9	1.9	2.8	2.7	−1.0	−1.4	− 2.1	− 1.7
S.D. relative return	3.6	7.1	13.1	21.1	4.1	6.5	12.0	16.8

* Before trading costs.

5.43; twenty-six week, 2.38. In each case, the differences are statistically significant. It could of course be argued that this application of the *t*-test is of questionable validity since it was not hypothesized a priori that the particular patterns involved would indeed be the best and worst. However, once trading costs are introduced, the appropriateness of the best/worst comparison becomes a moot issue; the differences in relative-to-market performance are no longer significant, as shown below.

If we assume that the chartist would have been buying those stocks which formed the best pattern, and shorting those which formed the worst pattern, the incurrence of 2.0 percent round-trip trading cost would have resulted in the following adjusted relative-to-market returns: best performing pattern—one week −1.1; four weeks, −0.1; thirteen weeks, 0.9; twenty-six weeks, 0.9: worst performing pattern—one week, 1.0; four weeks, 0.6; thirteen weeks, −0.2; twenty-six weeks, 0.2. Notably, for one-week and four-week holding periods, there are now losses on both the long and the short positions. For the remaining holding periods, the recomputed *t*-values reveal no significant difference between best and worst performing patterns: thirteen weeks, 1.22; twenty-six weeks, 0.38. Moreover, the chartist who chose to be either long or short but not both, would find no meaningful distinction between his results after trading costs and a relative-to-market performance of 0.0 percent. This is confirmed by the following *t*-values relating the actual relative performance to a hypothetical value of zero: buy best performing pattern—thirteen weeks, 1.32, twenty-six weeks, 0.80; short worst performing pattern—thirteen weeks, 0.33, twenty-six weeks, loss position.

As mentioned above, we have used geometric averaging in computing "market" performance. The resultant returns would have been somewhat higher if an arithmetic mean of price ratios had been substituted for the geometric mean. Consequently, relative-to-market performance of individual stocks would have been worse for long positions and better for short positions. Both the arithmetic and geometric average return of the 548 stocks in the test file over all conceivable four-, thirteen-, and twenty-six-week holding periods are reflected, respectively, as follows: four weeks—1.3 and 1.0 percent; thirteen weeks—4.3 and

3.3 percent; twenty-six weeks—8.4 and 6.3 percent. On balance, it would appear that our conclusions would have been further strengthened by the employment of an arithmetically averaged market measure.

Even more important, an evaluation of the six distinct best and worst patterns for the four holding periods uncovers an extraordinary contradiction between the lessons of the chartist's textbook and the empirical evidence generated by these tests. For example, the *best* performing patterns would probably be characterized as bearish by most technicians, and conversely, the *worst* performing patterns would, in two of the three cases, be characterized as bullish, as seen in table 3. In only one of six cases does the chartist's anticipated price movement actually develop—and even then, the development is statistically insignificant when trading costs are taken into account.

As a final matter, we have tabulated by date the frequency of pattern breakouts (for all patterns combined). This tabulation is presented in table 4, compressed into calendar quarters. The Standard & Poor 500-Stock Index is also listed for reference purposes.

Aside from the abbreviated last period and the two beginning periods when the first patterns were being formed, there were more than 400 breakouts in each of the quarters. Interestingly, there seems to be an expansion in the number of breakouts as the market declines and a contraction in the number as the market advances. We cannot conclude, however, based on the sketchy evidence above, that there is any predictive value in the various expansions and contractions which occur.

CONCLUDING REMARKS

This article is certainly not intended as irrefutable proof that charting is a useless preoccupation. While the preliminary evidence is indeed discouraging to chart advocates, nevertheless we would be the first to admit that our studies may be deficient in several respects—some of which may be important. One deficiency is probably the failure to consider trading volume. Other potential problem areas could be: (1) the use of daily close rather than high-low range; (2) the specification of our a and b constants in the formula which determines the percentage incremental price move required to establish a reversal point; (3) the measurement of volatility as it applies in this same formula; (4) the definition of a breakout as penetration of the fourth

TABLE 3

EVALUATION OF PATTERN BEHAVIOR

Pattern Identification	Pattern Designation	Direction of of Breakout	Implications of Breakout
Best performing:			
13254.....	Descending channel	Down	Neutral-to-bearish
23154.....	Sloping head and shoulders	Down	Bearish
45231.....	Ascending channel	Down	Bearish
Worst performing:			
15342.....	Inverted flag	Down	Bearish
21435.....	Falling wedge	Up	Bullish
31425.....	Descending channel	Up	Bullish

TABLE 4

FREQUENCY OF PATTERN BREAKOUTS

PERIOD DURING WHICH BREAKOUT OCCURRED	NO. OF BREAKOUTS	S & P 500	
		Beginning of Period Value	% Change for Period
9/15/64- 9/30/64	8	83.22	1.2
10/ 1/64-12/31/64	185	84.18	0.7
1/ 1/65- 3/31/65	420	84.75	1.7
4/ 1/65- 6/30/65	679	86.16	— 2.4
7/ 1/65- 9/30/65	561	84.12	6.9
10/ 1/65-12/31/65	474	89.96	2.7
1/ 1/66- 3/31/66	637	92.43	— 3.5
4/ 1/66- 6/30/66	670	89.23	— 5.0
7/ 1/66- 9/30/66	676	84.74	— 9.7
10/ 1/66-12/31/66	643	76.56	4.9
1/ 1/67- 3/31/67	445	80.33	12.3
4/ 1/67- 6/30/67	532	90.20	0.5
7/ 1/67- 9/30/67	524	90.64	6.7
10/ 1/67-12/31/67	634	96.71	— 0.2
1/ 1/68- 3/31/68	631	96.47	— 6.5
4/ 1/68- 6/30/68	575	90.20	10.4
7/ 1/68- 9/30/68	528	99.58	3.1
10/ 1/68-12/31/68	541	102.67	1.2
1/ 1/69- 1/ 3/69	20	103.86	0.1
Total	9,383	.....	.....

reversal point (alternative definitions might be penetration of the highest or lowest reversal points, or penetration of the trendline drawn through the highs or lows); and (5) the failure to require a specified minimum percentage breakout prior to taking a long or short position in an issue.

Notwithstanding these possible shortcomings, we believe that our results are both interesting and challenging. Furthermore, we believe that we have illustrated a method of research for studying complicated price patterns, and that this method can be extended, by us and by others, toward resolving potential trouble spots and toward a more thorough analysis of the charts studied herein as well as other types of time series and point-and-figure graphics.