CAN STOCK MARKET FORECASTERS FORECAST?

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INTRODUCTION

This paper presents results of analyses of the forecasting efforts of 45 professional agencies which have attempted, either to select specific common stocks which should prove superior in investment merit to the general run of equities, or to predict the future movements of the stock market itself. The paper falls into two main parts. The first deals with the attempts of two groups, 20 fire insurance companies and 16 financial services, to foretell which specific securities would prove most profitable. The second part deals with the efforts of 25 financial publications to foretell the future course of the stock market. Various statistical tests of these results are given.

These investigations were instituted five years ago as a means of testing the success of applied economics in the investment field. It seemed a plausible assumption that if we could demonstrate the existence in individuals or organizations of the ability to foretell the elusive fluctuations, either of particular stocks, or of stocks in general, this might lead to the identification of economic theories or statistical practices whose soundness had been established by successful prediction.

The forecasters include well-known organizations in the different fields represented, many of which are large and well financed, employing economists and statisticians of unquestioned ability. The names of these organizations are omitted, since their publication would be likely to invite wholesale controversy over the interpretation of their records. Some of the forecasters seem to have taken a page from the book of the Delphic Oracle, expressing their prophecies in terms susceptible of more than one construction. It would frequently be possible, therefore, for an editor, after the event, to present a plausible challenge of our interpretation. Most of the forecasts appear through the medium of weekly publications and each of these has been read and recorded on the day it became available to us, which in practically every case was before the event. In this way certain possible elements of bias have been eliminated. It was impossible that hindsight could influence our judgment, either in the selection of publications for analysis or in the interpretations placed on their forecasts. In the case of the fire insurance companies, however, the analyses were made annually, based on the transactions reported in *Kimber's Record of Insurance Company Security Purchases*. The companies were selected as fairly representa-

tive of their class. The analysis of the 26-year forecasting record of William Peter Hamilton, former editor of the *Wall Street Journal*, also falls in a different category, in that it was undertaken because of the reputation for successful forecasting which he had established over a long period of years.

FORECASTING THE COURSE OF INDIVIDUAL STOCK PRICES

We turn first to the records of two groups, the financial services and the fire insurance companies, which have attempted to select individual stocks that would prove more profitable for investment than the average issue. The first part of this section deals with the records, over the 4½ years ending July, 1932, of 16 leading financial services which have made a practice of regularly submitting to their subscribers selected lists of common stocks for investment. Our analysis includes about 7,500 separate recommendations, requiring approximately 75,000 entries. The first step was to record each week the name and price of each stock recommended for purchase or sale by each service. Next came the tabulation of the advice to sell or cover the commitment previously advised. Reiterated advice was not considered, action being assumed to have been taken as of the date when the recommendation was first published. The percentage gain or loss on each such transaction was recorded and, in a parallel column, the gain or loss of the stock market for the identical period. A balance was struck every six months which summarized the total results secured by each service as compared with the action of the stock market. Proper corrections were, of course, made to offset the effect of changes in capital structure resulting from the issue of rights, stock dividends, etc. Since a tendency existed among some services to emphasize their conspicuously successful stock recommendations and ignore more unfortunate commitments, we adopted a practice of automatically dropping a stock from the list six months after it had been last recommended, when specific advice to sell was not given.

A redistribution of funds in equal amounts among all stocks recommended has been assumed for each service at the beginning of every six months' period analyzed. It could be maintained, of course, that this equalizing process should take place as often as once a week, but this would increase the labor of computation to overwhelming proportions. Provisional experiments demonstrated that it would yield conclusions practically identical with those secured by the shorter method. Compounding the successive six months' records gives the percentage by which each service's recommendations have exceeded, or fallen behind, the stock market, as shown in Table I.

Only six of the 16 services achieved any success. To arrive at an

average performance, the record of each service was reduced to an effective annual rate which was then weighted in accordance with the length of the period represented. The average annual effective rate of all the services, thus arrived at, is −1.43 per cent.

TABLE I

RESULTS OF COMMITMENTS IN STOCKS RECOMMENDED BY 16 FINANCIAL SERVICES (RELATED TO MARKET AVERAGES)

Service	*Weeks*	*Per cent*
1.	234	+20.8
2.	234	+17.2
3.	234	+15.2
4.	234	+12.3
5.	234	+ 8.4
6.	26	+ 6.1
7.	52	0.
8.	104	− 0.5
9.	234	− 1.9
10.	52	− 2.2
11.	52	− 3.0
12.	52	− 8.3
13.	78	−16.1
14.	104	−28.2
15.	104	−31.2
16.	156	−33.0

PROBABILITY TESTS

In an attempt to determine whether the service having the best record achieved its result through skill or chance, we resorted to the theories of compound and inverse probability. Our conclusion is thus rendered consistent by obtaining approximately the same answer in two different ways.

With the aid of various checks, involving 1250 computations of the action of individual stocks selected at random, we derived a formula, A.D. $(t) = 5.42 + 1.5t$ (A.D. = average deviation, t, in units of 4 weeks, $\geqq 1$), representing the deviation, for all periods from one month up to one year, of the average individual stock from the average of all stocks.

Service Number 1, for the 9 six months' periods from January 1, 1928 to July 1, 1932, was successful 7 times and unsuccessful 2 times. With the aid of the table referred to, the averages of "chances in 1000 to do worse" for the 7 periods in which it was successful and the 2 periods in which it was unsuccessful were found to be 842 and 66 respectively. By the theory of direct probabilities, the probability of a single service being right at least 7 times in 9 is equal to the sum of the first 3 terms of the binomial $(\frac{1}{2}+\frac{1}{2})^9$.

$$p = 1/2^9 + 9/2^9 + 36/2^9 = 46/512 = .090$$

The probability that a single service could in 9 predictions be 7 times

on the positive side and in these 7 forecasts equal the achievement of Service Number 1 is,

$$P = .090 \times (1 - .842) = .014$$

However, the record of the best service is marred by its failure in the two negative cases. The average of the two chances to do worse in these cases is .066. We then have,

$$Q = (7/9) \times .842 + 2/9 \times .066 = .670$$

as the probability of a single random service having a record worse than that of Service Number 1. We therefore conclude that the probability that a random service can, first, be on the right side of the market 7 times out of 9, and second, equal in performance the record of Service Number 1, is

$$P = .090 \times (1 - .670) = .030.$$

This means that in 16 services we should expect to find $16 \times .030 = .48$ services which will equal the record of Service Number 1. That is to say, the chance is even that we should get at least one service as good as Number 1.

Because of the assumptions implied in this computation, we shall argue this another way. We shall assume that the probability that a service for its total forecast shall be on the positive side of the market is 1/2. Then the estimate of its success must be made by a different evaluation of Q. For this purpose we shall adopt a formula suggested by Bayes' rule in inverse probability in which the weights .910 and .090 instead of 7/9 and 2/9 are used. We get

$$Q = \frac{.910\ (.842)}{.910\ (.842) + (.090)\ (.934)} = .901$$

Hence, if a service was on the right side of the market, the probability of its achieving the success of Service Number 1 would be $1-Q$. Thus the compound probability would be

$$P = 1/2\ (1 - .901) = .050.$$

Among the 16 services the probability of the most successful one equalling the record of Service Number 1 would be $P = 16 \times .050 = .80$, that is to say, we should expect to get among 16 random services about one service which would equal Number 1. Since this answer is quite consistent with our previous answer, our analysis suggests the conclusion that the record of Service Number 1 could not be definitely attributed to skill.

TWENTY FIRE INSURANCE COMPANIES

The second analysis deals with the common stock investments, from 1928 to 1931 inclusive, of 20 of our leading fire insurance companies. Its significance lies in the fact that these companies are representative of a class of common stock investor which has had long years of experience and large amounts of capital at its disposal. Fire insurance dates from the Great London Fire of 1666, and active investment in stocks developed during the nineteenth century. The fire insurance companies are much older hands at the business of investment than either the financial services, which are a twentieth century product, or American investment trusts, which are largely a development of the last few years. The investment policies of these companies are based on the accumulated knowledge of successive boards of directors whose judgment might be presumed, over the years, to have been well above that of the average investor. The 20 companies which were selected for analysis hold assets totalling several hundred million dollars, and seem a fair sample of their kind.

Fire insurance companies carry between 20 and 30 per cent of their total investments in common stocks. Their average turnover amounts to only some 5 per cent a year. For this reason it was thought best to confine our analysis to the record of the actual purchases and sales made during the period under examination, rather than to compute the record of the entire common stock portfolio. To simplify the labor, all items of stock purchased were given equal weights, regardless of the amounts involved. While the conclusion does not exactly reflect the actual investment results secured by these companies, it should, however, provide a satisfactory test of the success of these organizations in selecting stocks which performed better than the average.

The method employed in the analysis is essentially the same as that used in the case of the investment services. A second purchase of an item was omitted from the record unless a sale of this item intervened. A record of the sale of an item, of course, determined the date as of which it was dropped from the list. Also, any item of which there had been no purchase recorded for 12 months was automatically considered sold.

The compounded records of the 20 companies for the 4-year period are shown in Table II.

Six of the companies show evidence of success, and the average of the 20 is −4.72 per cent. The average record of the companies in the stocks which they selected for investment fell below the average of the stock market at the effective annual rate of 1.20 per cent. A comparable result could have been achieved through a purely random selection of

stocks. The analysis of the fire insurance companies' records thus confirms the results secured in appraising the records of the financial services.

TABLE II

RESULTS OF COMMITMENTS IN STOCKS MADE BY TWENTY FIRE INSURANCE COMPANIES (RELATED TO STOCK MARKET AVERAGES)

All companies 1928–31, inc.

Company	*Per cent*
1.	+27.35
2.	+25.11
3.	+18.34
4.	+10.38
5.	+10.12
6.	+ 3.20
7.	− 2.06
8.	− 3.63
9.	− 5.06
10.	− 6.67
11.	−10.44
12.	−10.55
13.	−11.76
14.	−12.92
15.	−13.82
16.	−14.96
17.	−18.03
18.	−21.89
19.	−23.44
20.	−33.72

FORECASTING THE STOCK MARKET ACCORDING TO THE DOW THEORY

Having dealt with the efficiency of two great groups of professionals, fire insurance companies and financial services, in selecting common stocks for investment, we turn now to a consideration of skill in predicting the course of the stock market as a whole. This section also is in two principal sub-divisions. First we consider the record of William Peter Hamilton.

This analysis was undertaken because several decades of editorials in the country's leading financial newspaper have built up a great popular following for the Dow Theory, of which Hamilton was the principal sponsor. The Dow Theory was the creation of Charles H. Dow, founder of the Dow Jones financial news service, founder and editor of the *Wall Street Journal*. After Dow's death in 1902 Hamilton succeeded him as editor of the *Wall Street Journal*, continuing in this position until his death in December, 1929.

During 26 years of his incumbency Hamilton wrote 255 editorials which presented forecasts for the stock market based on the Dow Theory. These were sufficiently definite to permit scoring as bullish, bearish, or doubtful. This we did by a majority vote of five readers. When

doubtful we assumed that he abstained from trading. When bullish it was assumed that he bought equal dollar amounts of the stocks included in the Dow Jones railroad and industrial averages, and sold them only when he became bearish or doubtful. When bearish we assumed that he sold short equal dollar amounts of these stocks and covered only when he became doubtful or bullish. The percentage gain or loss on each such transaction has been calculated, and the results compounded through the 26 years. Since the Dow Jones averages have only recently been corrected to offset the effect of stock rights, stock dividends, and stock splits, such adjustments have been made for all the previous years on the basis of tables published by Dwight C. Rose in his book *Investment Management*. Corrections have also been made to allow for the effect of brokerage charges, cash dividends, and the interest presumably earned by Hamilton's funds when they were not in the stock market. The fully adjusted figures were then reduced to an effective annual rate of gain which is presented as a measure of the result accomplished.

From December 1903 to December 1929, Hamilton, through the application of his forecasts to the stocks composing the Dow Jones industrial averages, would have earned a return, including dividend and interest income, of 12 per cent per annum. In the same period the stocks composing the industrial averages showed a return of 15.5 per cent per annum. Hamilton therefore failed by an appreciable margin to gain as much through his forecasting as he would have made by a continuous outright investment in the stocks composing the industrial averages. He exceeded by a wide margin, however, a supposedly normal investment return of about 5 per cent. Applying his forecasts to the stocks composing the Dow Jones railroad averages, the result is an annual gain of 5.7 per cent while the railroad averages themselves show a return of 7.7 per cent.

Hamilton was long of stocks 55 per cent, short 16 per cent, and out of the market 29 per cent, of the 26 years under review. Counting only changes of position, he made bullish forecasts 29 times. Applying these to the industrial averages, 16 were profitable, 13 unprofitable. He announced bearish forecasts 23 times, 10 were profitable, 13 unprofitable. He advised 38 times that funds be withdrawn from the stock market, 19 of these withdrawals being profitable, 19 unprofitable. In all, 45 of his changes of position were unsuccessful, 45 successful. The application of the forecasts to the railroad averages confirms these conclusions except that in this case 41 changes of position were successful and 49 unsuccessful. For the period from 1909 to 1914 inclusive, when the industrial averages displayed what, in effect, was a horizontal trend, his hypothetical fund shrank 7.8 per cent per annum below what it would

have been if loaned at 5 per cent interest. The result of applying his forecasts to the railroad averages deserves attention in view of the fact that this group displayed an almost horizontal secular trend for the 26 years under consideration. His average annual gain of 5.7 per cent in this group would have been approximately equalled, in the case of a continuous outright investment, by the dividend income.

STOCK MARKET FORECASTS OF TWENTY-FOUR FINANCIAL PUBLICATIONS

For the analysis of other results secured in forecasting the course of the stock market, we selected during the period from January 1, 1928, to June 1, 1932, 24 publications (among which were 18 professional financial services, 4 financial weeklies, one bank letter, and one investment house letter). More than 3,300 forecasts were tabulated. The method used has been for each reader to ask himself the question, "In the light of what this particular bulletin says, would one be led to buy stocks with all the funds at his disposal, or place a portion only of his funds in stocks, or withdraw entirely from the market?" The reader graded the advice in each instance by means of one of nine possible entries, namely 100 per cent of funds in the market, 87½, 75, 62½, 50, 37½, 25, 12½, or 0 per cent. The great majority of forecasters confine themselves to general discussions of the investment situation, leaving to the reader the decision as to what proportion of his funds he shall place in the market. The tabulation, therefore, cannot be mathematically conclusive. Our method, in general, has been to have the vote of three readers of competent intelligence determine the interpretation of each forecast. Marginal commitments have not been incorporated in our tabulations because in no case have they been advised by any of the forecasters. Similarly, short commitments are not in general assumed because, of the entire 24 forecasters, only one recommended them. His record has been computed on a special basis.

The tabulated forecasts have been tested in the light of the actual fluctuations of the stock market as reflected by the Standard Statistics Company index of 90 representative stocks. If a forecast is 100 per cent bullish and the market rises 10 per cent in the subsequent week, the forecaster is scored as +10 per cent. If the forecaster, after weighing the favorable and unfavorable factors, leaves the decision hanging in the balance, the score is +5 per cent or one-half of the market advance. This is on the assumption that the investor, being in doubt as to the future course of the market and being, by definition, committed to common stocks as a possible investment medium, would be led to adopt a hedged position with half of his funds in stocks and half in reserve. If the forecast is 100 per cent bearish, the score is zero, regard-

less of the subsequent action of the market, on the assumption that, under such conditions, the investor would withdraw all of his funds from stocks. On the other hand, if the forecast is 100 per cent bullish and the market drops 10 per cent in the ensuing week, the score is −10 per cent. If the forecast is doubtful when the market drops 10 per cent, the score is −5 per cent. The compounding of all these weekly scores for the period covered gives a cumulative record for each forecaster. This permits comparisons which reveal relative success and average performance. While it may be thought that accurate week-to-week forecasting is a hopeless ideal, it should be emphasized that our analysis of weekly results also measures accurately the efficiency of long swing forecasts.

A figure representing the average of all possible forecasting results for the period was arrived at by compounding one-half of every weekly percentage change in the level of the stock market. The final scores given below for the 24 forecasters were computed by dividing the actual performance of each by the average of all possible results referred to above, and subtracting 100.

TABLE III
RESULTS OF STOCK MARKET FORECASTS

Forecaster	*Weeks*	*Per cent*
1.	105	+72.4
2.	230	+31.5
3.	230	+28.3
4.	21	+24.2
5.	157	+ 9.0
6.	53	+ 3.0
7.	126	+ 2.4
8.	53	+ 1.3
9.	105	− 1.7
10.	157	− 2.1
11.	230	− 3.6
12.	43	− 6.0
13.	53	− 6.7
14.	131	− 6.9
15.	230	−12.5
16.	230	−13.5
17.	53	−17.2
18.	230	−21.5
19.	69	−29.4
20.	230	−33.0
21.	230	−35.3
22.	230	−41.5
23.	157	−45.3
24.	230	−49.1

The records show that only one-third of the list met with any success. In order to derive a significant average of the performance of the

entire group the results listed above have been reduced to effective annual rates, and each has been given a weight to conform with the length of the record analysed. After these adjustments, we are enabled to conclude that the average forecasting agency fell approximately 4 per cent per annum below a record representing the average of all performances achievable by pure chance. This would seem to indicate that, in general, these stock market forecasters failed to accomplish their objective. The most that can be said in extenuation is that the long-continued decline in securities has been, naturally, a handicap to a group which, taking warning from the experience of Cassandra, usually seems constrained to look on the bright side. During the 4½ year period under analysis the number of weeks in which the stock market declined almost exactly equalled the number of weeks in which advances were recorded, and the total amount of the declines considerably exceeded the total amount of the advances. Yet we recorded during this period 2035 bullish, 804 bearish, and 479 doubtful forecasts. Further, we note that in 1928, the only year the market showed a net gain, the excess of bullish over bearish forecasts was smaller than in any succeeding year. Taking a glaring example, in the rising market of 1928 the ratio of bullish to bearish forecasts was only four to three. In 1931, when the market declined 54 per cent, there were sixteen bullish forecasts to every three bearish.

STATISTICAL INTERPRETATIONS OF RESULTS

In an attempt to illuminate the problem of whether the records of all these forecasters lay within the limits of pure chance, we compiled 24 records, identical with those of the 24 forecasters as to the total period covered, but having purely fortuitous advices applied to random intervals within these perids. For example, to compile a purely chance record to compare with the actual record of a forecaster whose operations covered 230 weeks from January 1, 1928, to June 1, 1932, we first determined the average number of changes of advice for such a period, which was 33. Cards numbered from 1 to 229 were shuffled, drawn, reshuffled, drawn, in all 33 times. Thus 33 random dates were selected as of which forecasts were to be changed. The investment policies which were to apply to the intervals between those dates were derived in similar fortuitous fashion, by drawing 33 times from nine cards on each of which a different one of the nine possible investment policies was noted.

It only remained to relate these random advices to a stock market index, cumulate the results, relate them, as we had done with the records of the actual forecasters, to the average of all chances for the period, and subtract 100. Thus we had a list of 24 purely chance fore-

casting records, shown in Table IV, to compare with the records of the actual prophets.

TABLE IV
RESULTS OF RANDOM FORECASTS

Forecaster	*Weeks*	*Per cent*
1.	230	+71.1
2.	230	+37.2
3.	230	+24.2
4.	157	+19.1
5.	230	+13.2
6.	105	+ 9.2
7.	230	+ 2.7
8.	53	+ 2.5
9.	131	+ 1.3
10.	230	+ 1.1
11.	53	− .1
12.	54	− .6
13.	157	− 2.5
14.	230	− 4.6
15.	43	− 5.4
16.	53	− 6.1
17.	230	−10.5
18.	21	−10.9
19.	157	−11.0
20.	105	−13.0
21.	230	−13.1
22.	230	−14.2
23.	69	−18.7
24.	126	−27.1

For easy comparison of the two groups we have prepared Figure 1 showing all the records, actual and hypothetical. The chart indicates that where forecasting agencies made gains, even the greatest of these lay within limits equalled by the best of our 24 imaginary records representing random action at random intervals. But the extremer losses of the forecasters tended to exceed the losses registered by the least successful of our 24 records of purely chance operations.

In any attempt at interpreting the significance of the performances of the various stock market forecasters we are embarrased by our inability to determine how often economic developments occur of sufficient importance to justify the revision of forecasts. This is tantamount to admitting that we do not know the true number of independent cases, or items, in the time series representing the various forecasting records. In these circumstances, probable errors for correlation coefficients, or for normal distributions, cannot constitute very exact measures of probability. We do know, however, since we are dealing with weekly publications, that the maximum possible number of forecasting opportunities is 52 a year. We also know that forecasts, on the average, undergo some degree of revision about 7 times a year. The correlation

coefficients and probable errors, which constitute one of our tests of probability, have been worked out on both of these bases.

The record of Forecaster Number 1 was available to us for a period of only two years, during which he did not once change his advice. We therefore omitted his record from consideration in our statistical interpretation on the ground that inferences based on it would be relatively inconclusive. For the correlation test therefore, Forecasters Number 2, 3, 22 and 24 were chosen as representing the best and the worst whose records covered the entire period under analysis. The weekly forecasts of each of these four were correlated with the first differences

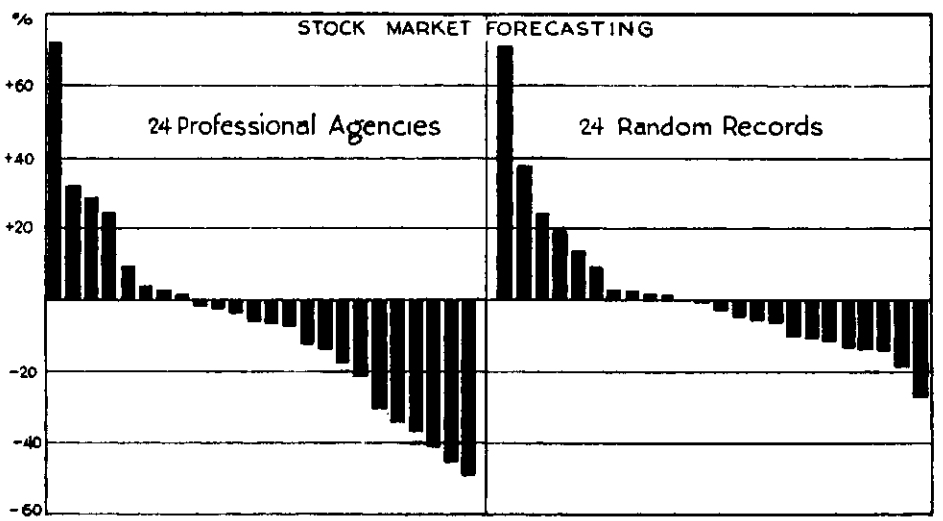

FIGURE 1

of the logarithms of the stock market averages over 4½ years. Forecaster Number 2 had a correlation coefficient of .151; Forecaster Number 3, of .197; and Forecasters Number 22 and 24, of −.124 and −.132 respectively. The probable error of the best correlation coefficient, with $n=230$, was .043. The difference in r between Forecasters Numbers 2 and 3 is about equal to this probable error, and $r=.197$ is greater than 4 times the probable error of .043. We have interpreted these data by the use of R. A. Fisher's technique, where $z=\tan h^{-1}r$. The best correlation $r=.197$, $n=230$, was first compared with a theoretical $r=.000$ $n=230$; and then compared with $r=-.132$, $n=230$, that is the lowest correlation coefficient.

	r	z	$n-3$	$1/n-3$
1st sample	.197	.200	227	.00441
2nd sample	.000	.000	227	.00441
	Difference	.200	Sum	.00882

$$2\sqrt{.00882}=.188$$

.188 is to be compared with .200. Since these figures are approximately equal, the presumption of skill is slight although the presumption does exist because of the fact that .188 is less than .200, the difference between the two values for z. Using R. A. Fisher's technique in the second case, that is, comparing the best correlation coefficient $r = .197$ with the lowest correlation coefficient $r = -.132$, seems to indicate that there is a real difference between the two samples. If another sample were taken from each of these two forecasters, we should expect to find a similar difference between them in favor of the first forecaster within the limits of the probable error.

We then computed correlation coefficients and probable errors for the data arrived at by taking as our items the periods during which each forecast was in force. We thus had 30 items for Forecaster Number 2, which equalled the number of changes he made in his forecasts, instead of the 230 items which represented the number of weeks for which his record was tabulated. On this basis Forecaster Number 2 had a correlation coefficient of .479; Forecaster Number 3 had a correlation coefficient of .245; and Forecasters Number 22 and 24 had correlation coefficients of $-.513$ and $-.206$ respectively. The probable error of the best correlation coefficient, with $n = 30$, was found to be .095. Thus $r = .479$ was about five times the probable error of .095. The best random forecast had $r = .356 \pm .102$, when his changes of position were taken as the items of the series. When the number of weeks (230), over which his random record extends, was used, and this record correlated with the first differences of the logarithms of the stock market averages, $r = .125 \pm .044$.

Deductions as to the significance of the relationships of the various correlation coefficients to the probable errors are rendered inconclusive, not only by our inability to identify the true number of independent cases in each series, but also by the fact that we have not computed a sufficient number of the correlation coefficients to enable us to determine the character of their distribution.

Having thus experimented with various correlation tests we then resorted to measuring the spread of the performances of the individual forecasters by means of frequency distributions of the percentage weekly gains and losses of each of six forecasters divided by the average result of all possible forecasts. The six chosen were two of the best actual records, two of the worst actual records, and the best and almost the worst random records. The series thus arrived at were each distributed into several classes ranging from 92.50 per cent to 108.50 per cent; these frequencies were plotted and appeared to be reasonably normal. (See Figure 2.) Averages of each of the percentage frequency distributions were computed and compared with a theoretical average

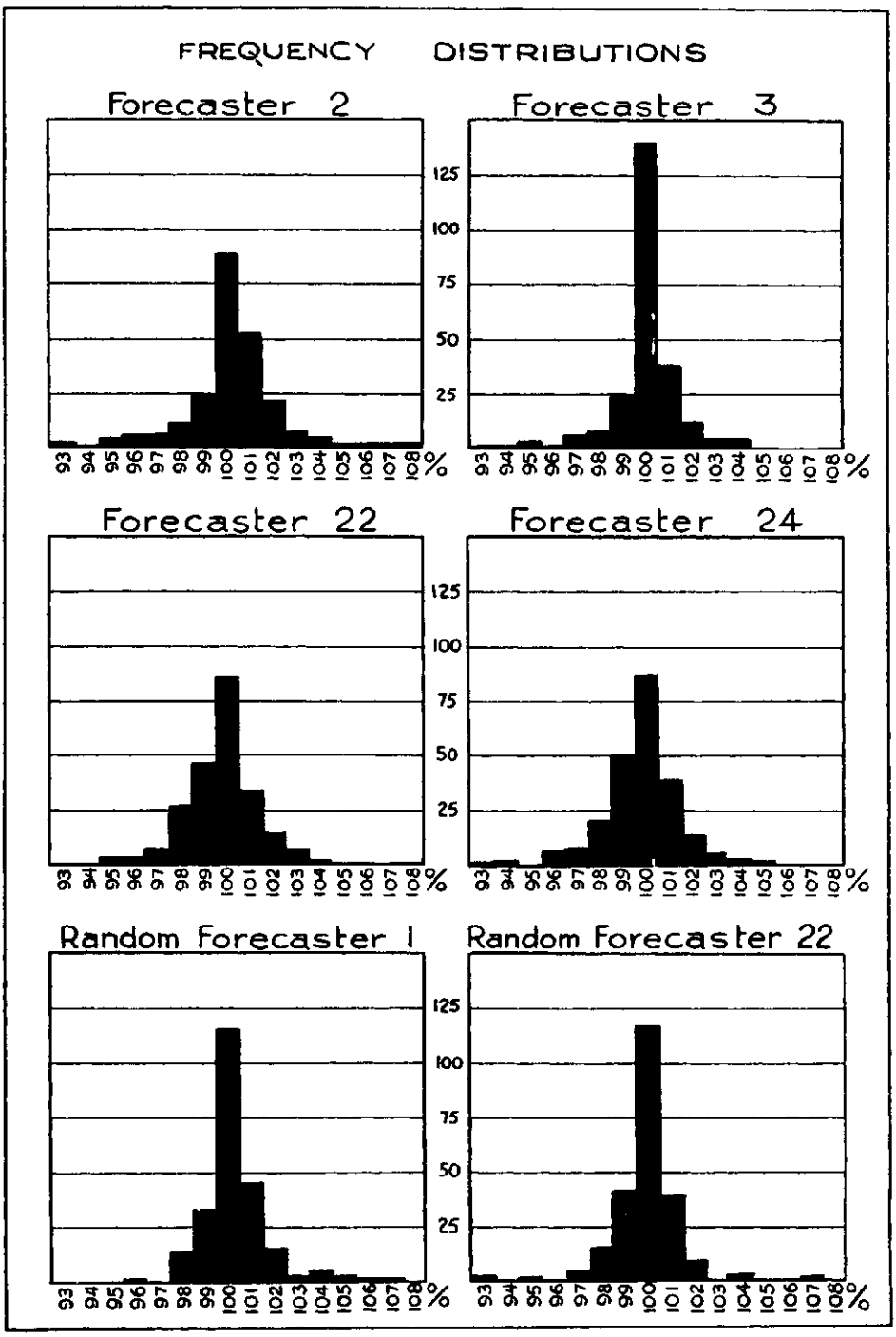
FREQUENCY DISTRIBUTIONS
Forecaster 2
Forecaster 3
Forecaster 22
Forecaster 24
Random Forecaster 1
Random Forecaster 22
125
100
75
50
25
93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 %

FIGURE 2

of 100, which represented the average of all random frequency distributions. The probable error of the latter was found to be .086. Forecasters Number 2 and 3 showed averages of 100.098 and 100.103 respectively; each deviating from the theoretical average by amounts which were slightly greater than the probable error .086, but considerably less than twice this probable error. Forecasters Number 22 and 24 had averages of 99.674 and 99.711 respectively; less than the theoretical average by .326 and .289. Each of these differences was more than three, and less than four, times greater than the probable error .086. When a similar frequency distribution is made for the best purely random forecaster, it is found that the average was equal to 100.213, which is greater than that of Forecasters 2 and 3. The deviation from the theoretical average lies within three times the probable error of this theoretical average.

SUMMARY

1. Sixteen financial services, in making some 7500 recommendations of individual common stocks for investment during the period from January 1, 1928, to July 1, 1932, compiled an average record that was worse than that of the average common stock by 1.43 per cent annually. Statistical tests of the best individual records failed to demonstrate that they exhibited skill, and indicated that they more probably were results of chance.

2. Twenty fire insurance companies in making a similar selection of securities during the years 1928 to 1931, inclusive, achieved an average record 1.20 per cent annually worse than that of the general run of stocks. The best of these records, since it is not very much more impressive than the record of the most successful of the sixteen financial services, fails to exhibit definitely the existence of any skill in investment.

3. William Peter Hamilton, editor of the *Wall Street Journal*, publishing forecasts of the stock market based on the Dow Theory over a period of 26 years, from 1904 to 1929, inclusive, achieved a result better than what would ordinarily be regarded as a normal investment return, but poorer than the result of a continuous outright investment in representative common stocks for this period. On 90 occasions he announced changes in the outlook for the market. Forty-five of these predictions were successful and 45 unsuccessful.

4. Twenty-four financial publications engaged in forecasting the stock market during the $4\frac{1}{2}$ years from January 1, 1928, to June 1, 1932, failed as a group by 4 per cent per annum to achieve a result as good as the average of all purely random performances. A review of the various statistical tests, applied to the records for this period, of these 24 fore-

casters, indicates that the most successful records are little, if any, better than what might be expected to result from pure chance. There is some evidence, on the other hand, to indicate that the least successful records are worse than what could reasonably be attributed to chance.

Cowles Commission for Research in Economics