

## Forecasting Security Prices



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It is this extension or modification of the Pearsonian method which Mr. Peabody used in fitting both the Gompertz and the Makeham curves.

The discovery that the use of an extra moment will eliminate the transcendental term is the outcome of a search on the part of Mr. Sasuly for a method of fitting the exponential  $y = be^{-mx}$  without having to reduce it to its logarithmic form and without having to solve a transcendental equation in  $m$ . When the present writer called his attention to the fact that the negative exponential is one of the "uncommon types" of Pearson's system of frequency curves and that in fitting this curve by the method of moments Pearson has recourse neither to logarithmic transformation nor to the solution of a transcendental equation,<sup>1</sup> Mr. Sasuly, after an examination of Pearson's method, came to the conclusion that *any* transcendental term may be eliminated through the use of an extra moment. At the time that Mr. Peabody's article was being prepared, the scope and validity of this extension of the method of moments were only partially investigated which is one of the reasons why the publication of this method was deferred.

Mr. Peabody finds that the less involved summation method gives more satisfactory results than this (modified) method of moments. This is due either to the use of raw moments or to the comparatively large probable error of the (extra) fourth moment. Should this finding be confirmed by a wider experience with the two methods, we will, of course, have to conclude that the advantage of using an extra moment is of more theoretical than practical importance. For the time being it is best to suspend judgment.

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Washington, D. C.

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### FORECASTING SECURITY PRICES

On April 17, 1925, a dinner meeting of the American Statistical Association was held at the Aldine Club in New York City. About 420 people were in attendance. The topic under discussion was Forecasting Security Prices.

The first four speakers represented commercial agencies active in the forecasting field. Mr. Paul Clay of Moody's Investors' Service ascribed the success of that institution to its creed. He affirmed a belief in economists and statisticians because "they are far ahead of the average business man in realizing the practical value of economic study, and they have done wonders in learning to understand the ways of trade and in reducing its hazards." He continued:

The free play of economic forces was never better safeguarded. This country was never more free from actual monopolies. The stock market was never more unspotted by manipulation, and bulls and bears never before had so little to do with your own investment success as they have now.

We have never seen the infallibility of judgment which is supposed to belong to the mythical insiders. To our mind, the belief in inside interests is as fabulous and antiquated as that in the oracle of Delphi.

<sup>1</sup> The exponential may be written  $y = \frac{N}{\sigma} e^{-x/\sigma}$  where  $N$  is the total frequency and  $\sigma$  is the standard deviation. See Elderton, W. P.: *Frequency Curves and Correlation*, Addendum, 1917, p. 8, and *Phil. Trans., A*, vol. ccxvi, pp. 429-457.

We believe in the rule of economic forces, and this is why we reject the Delphic oracles and inside interests. There is nothing mysterious about the stock market except those phases of it which research and data have not yet covered. It is merely the great American capital market, into which flows the surplus capital of every industry, and out of which flow streams of capital to supply the expansion needs of every industry. Typical men, whatever their business and wherever they live, buy stocks and bonds when they have surplus funds, and not at other times. They dump securities on the markets when they are in financial distress, and they never do so when they are not in distress. Therefore, the financial situation of the typical business man dominates the course of the market.

So it is that the stock market is a creature of every day economic forces. Complete data would probably show that during bull movements the rise is roughly proportionate to the inflow of capital saved out of the earnings of industries. It would probably show that during bear movements the decline is proportionate to the urgent liquidation on the part of business men who are short of necessary capital. Presumably, if we had an accurate measure of the surplus earnings of industries in prosperous times and of the capital shortages of industries in depression times, we should know exactly what the stock market is going to do.

Our researches have disclosed many evidences of the rule of economic forces. Perhaps the most striking is the parallelism of our trade barometer with the main swings of the stock market. This barometer is a monthly weighted average of selected barometrical trade returns; and we have compiled it in either finished or in crude form back to 1863. Throughout the entire course it runs generally parallel to the main swings of the stock market.

Close study reveals the fact that the stock market is a creature of trade, and a trailer after it, and not a leader or a maker of trade conditions. The popular belief that the stock market discounts or anticipates has no basis in fact. The belief itself doubtless arises from the fact that trade conditions are so complex that very few people realize changes therein until months after these changes have occurred.

The high peaks of the stock market are the result of an unbroken chain of economic forces. First, the money value of our commercial turnover dominates the trend of interest rates; second, commercial paper discounts move with interest rates, and bond yields follow commercial paper. The high peak in the stock market is that point at which prices have risen so far that stock yields are slightly below bond yields. This has been consistently true of the major peaks in the stock market throughout the history of the New York Stock Exchange.

Seasonal variations of trade and stock prices are practically alike except in that portion of the year during which the money market exercises more influence upon securities than the trade situation does. From the middle of September to the middle of January, the stock market responds to the money market curve, whereas during the entire balance of the year it responds to the growth of trade conditions. Furthermore, the money market curve itself is the creature of the trade curve.

Now, if the stock market is a creature of economic forces, it follows that the right method of forecasting is to study these forces. By way of defining the right method, let me first speak of some of the methods which we have rejected. First, there is the single index method. Many years ago it was believed that pig iron was a good forecaster for the stock market, and now many persons think that one can forecast successfully just through observation of blast furnace capacity, and nothing else. There is no question that these indices are worth studying, but we do not believe in any single index, for the course of the stock and bond markets is a reflection of the change in the financial condition of the entire American people. If the resultant of forces can be calculated from a single factor in finance, why not in physics, as well?

Another forecasting instrument which we have rejected is the automatic barometer. There are those that, by combining certain barometrical returns, obtain a barometer or index number which is supposed to move ahead of the stock market and indicate its course. This surely is better than the single index, but here again there is the serious objection that the forecaster is compelled to reject all economic forces not contained in that barometer.

Doubtless, however, the most popular method of forecasting is chart reading, and this, too, we have rejected. The chart is a post-mortem and not a diagnosis, it is a result, rather than a cause, and its occurrence is afterward rather than beforehand. Prices, according to John Stuart Mill, are founded upon supply and demand, and not upon double tops and double bottoms. Adam Smith believed that the causes of value

were utility and labor, and not bull and bear chart curves. We have chosen to cast our lot and our fortunes with these sober students of economic forces.

Now, since the course of the stock market is the resultant of economic forces, let me tell you what some of these measures are and how we use them. First, there is our trade barometer, which is a weighted average of barometrical trade returns. Trade conditions are bullish or bearish in accordance with the movement of this trade barometer, except that an excessive rise far above normal is bearish, while an excessive decline far below normal is bullish.

Another measure of economic forces which we highly value is our employment index. Its value lies in the fact that it is a crude measure of the purchasing power of the American people. When labor is well employed, plant capacity and capital is also well employed, and employers as well as their men are making money.

A third important measure of economic forces employed by us is the ratio of bank loans to deposits. A sharp rise in these ratios invariably means that capital supplies are running short, and vice versa. Any doubt as to interpretation can readily be eliminated by use of our monthly averages of interest rates.

Another of our measures of economic forces is our inflation index, which is an abstract index number so constructed that it will rise sharply whenever credit, inventories or operating costs are inflated. By inflation we mean not mere expansion, however great, but any condition of unsoundness or overexpansion which is bound to result in forced liquidation on the part of business men.

Of our other measures of economic forces, I will mention only one. This is an index number of the latent earning power of industries. By latent earning power, I mean the earnings which might theoretically be made if materials, labor, capital, etc., could be bought at current prices, instantly converted into finished goods, and the goods instantly sold. In our woolen index, for example, we figure just as a woolen mill manager might. We compute the cost of production, and compare with the market value of the finished goods.

A few applications of these measures of economic forces will serve to illustrate our methods of forecasting. At the present time, for example, we are not taking a bearish position. On the 5th and 12th of March we advised profit taking, merely because stocks had risen too fast as compared with trade improvement, and the market was in an overbought condition. However, these measures of forces have not turned bearish, and we have regarded the decline which occurred since the middle of March as nothing worse than a fair opportunity to repurchase stocks at substantial concessions.

Mr. Clay further pointed out that in 1920 forecasts of his service were based primarily on the overexpansion of credit. In the summer of 1921, they were dominated by the latent earning power of industries. In October, 1922, the employment index was the governing factor, while in December, 1924, reliance was placed mainly upon the employment index supplemented by the ratio of loans to deposits.

Mr. Clay concluded his remarks with a plea for more extensive research in this field.

The next speaker of the evening was Mr. William Peter Hamilton, editor of the *Wall Street Journal*. He set forth the theory of the stock market, original with the late Charles H. Dow, former editor of the *Wall Street Journal*. He said:

The major swing of the stock market is the most important of the three tendencies into which Dow's theory divides the price movement. Over a period of twenty-one years, starting from June, 1900, and ending with June, 1921, there were twelve major movements of the stock market—six up and six down. What is interesting to note is that the upward movement, or bull swing, averaged twenty-five months in length, while the downward, or bear market, averaged seventeen months.

It is to be noted that these bull and bear markets are never uninterrupted. Here comes in what may be called the secondary movement of the Dow theory. A bull market is interrupted by sharp reactions, as, for instance, that which set in on the 7th of last March, reaching its low point on March 30, while a bear market is checked in its progress by sharp recoveries, if only for the technical reason that such a market is apt to become oversold.

That is the Dow theory of the price movement. It does not claim to be anything more than an hypothesis, and practically every scientific discovery the world ever saw developed from a workable hypothesis.

The speaker expressed the view that the present reaction of the stock market was merely a minor phase of a general upward movement which was not yet over. Mr. Hamilton pointed out that he had published a book in 1922, called *The Stock Market Barometer*, showing the application of the principles of the Dow theory. He stated that if the Harvard University Committee on Economic Research were to omit bank debits from its line of speculation, that this line would correspond to the Dow-Jones averages used by the *Wall Street Journal*. He stated that the line of speculation always precedes by some months a corresponding fluctuation in the line of business. Mr. Hamilton emphasized the fact that manipulation of the market had little significance. He stated, "It is not difficult to see how, in a narrow market with a small volume of trading, the daily fluctuation could be manipulated. It would be much more difficult to manipulate the secondary reaction or rally, because it would be necessary to take in hand at least a majority of forty active stocks. You may take it from me that there is no financial interest, or combination of financial interests, in Wall Street or in the whole country, which is big enough to do anything of the kind or foolish enough to try."

Mr. Hamilton cited as an example of the surprising way in which the stock market forecasted business that in December, 1917, eleven months before the armistice, the market predicted the final and complete defeat of Germany. Mr. Hamilton vigorously condemned "stock tipping agencies."

His remarks were followed by those of Roger W. Babson, of Babson's Statistical Organization, who illustrated his remarks by the aid of a chart, showing the equality of action and reaction in business for a long period of years. He held that while it was folly to attempt to forecast the short swings in the stock market, practically all the economic services have a clean record on the long-swing movements. He said that we know what period we are in and what the next period will be; the only uncertain factor being the duration of the respective periods. As the Department of Commerce and other organizations are continually collecting and compiling more and more statistics, all the services are constantly improving their ability to determine the duration of the periods. He pointed out that the science of forecasting was rapidly developing into a very sound and useful industry, and that every additional person who becomes interested in this study makes the next boom less reckless and the next panic less severe. Mr. Babson predicted that the forecasting service of years hence would combine the good features of the leading agencies that now exist. He also expressed the view that we are still in the upward movement of the stock market.

The fourth speaker was Mr. Ray Vance, President of the Brookmire Economic Service. He began by defining the term, "forecasting" as being "such a measure of business happenings and such a survey of the results which have followed these happenings in the past, as will permit the anticipation of security price movements with a worth-while approximation to accuracy." He emphasized the fact that by security price changes he did not mean the changes which occurred from hour

to hour, or even from month to month, but those major movements which ordinarily occur not oftener than once a year. He also stressed the point that the Brookmire method cannot be regarded as in its final form. Changes of major importance may be made at any time. He stated that the factors used and the reasons for using them are:

1. The height of stock prices themselves and the activity on the exchange. The higher stocks are, the more likely (other things being equal) they are to decline, and incidentally, the greater the activity, the more likely is a decline.
2. The greater the volume of basic raw material production going on within this country, the greater is the chance that production is running ahead of consumption. Therefore, high physical volume of production is used as a bearish factor, and low physical volume as a bullish one.
3. The importation of goods is, as an economic fact, an equivalent to an increase in production and vice versa. Therefore, the ratio between imports and exports is used as a third factor. When this ratio is high, it indicates trouble, and when it is low, it shows a fundamentally strong position.
4. The turnover of bank deposits is measured by the ratio of bank clearings to bank deposits. A high rate of turnover is unfavorable and a low rate favorable.
5. The supply of purchasing power in the form of bank deposits is a flexible thing until the banking strength of the country is exhausted, or until a governing body, such as our Federal Reserve Board, artificially tightens credit. As an index of whether this point has been reached or not, we use the commercial paper rate in the United States.
6. Because the supply of loanable bank funds is really an international affair, we used as a sixth factor the open market money rate in London.

Mr. Vance pointed out that while this method has fallen considerably short of 100 per cent accuracy, that it has been very successful during the past two years. Recent changes in the method are expected to make it even better than it has been. He submitted a chart on which were marked the points at which clients of the service had been advised to buy and sell stocks, and he emphasized the fact that all predictions made by the Brookmire Service were specific. He stated that in February advice was given to sell stocks, and that there was no reason to believe that this advice was not sound. He concluded his remarks by saying, "We consider the service, in spite of its lack of present perfection, has accomplished far in excess of what is accomplished by the average buyer of securities, and hence its use is justified."

The program was closed by Mr. Frederick R. Macaulay of the National Bureau of Economic Research, who gave a critical review of the remarks of the preceding speakers. He began by pointing out that the Dow theory of forecasting endorsed by Mr. Hamilton stood in contrast to the other three theories in that it was based upon the movements of the stock market itself. He observed that there was a striking similarity between the fluctuations of the stock market and those of a chance curve which may be obtained by throwing dice. Everyone will admit that the course of such a purely chance curve cannot be predicted. If the stock market can be forecast from a graph of its movements, it must be because of its difference from the chance curve. There undoubtedly are such differences, said Mr. Macaulay. Because of the earning power of the companies themselves, for example, it is certain that the curve will never reach the zero line and will never rise indefinitely. There is no limit to the distance which a chance curve may rise or fall. Mr. Macaulay expressed the view, however, that Mr. Hamilton's method of prediction was much less dependable than those used by the

other three speakers, inasmuch as the essence of the Dow method was to buy as long as the market continued to rise and sell as long as it continued to fall, which was just the reverse of taking advantage of the fact that the market has a definite bottom and that there is a limit to the distance to which it can rise. Mr. Macaulay also suggested that it might be unwise, in attempting to forecast from a record of the market itself, to exclude the volume of trading from consideration. He called attention to the fact that "double tops" and "double bottoms" seem to be just as characteristic of a chance curve as of the stock market record, and hence that it is doubtful whether they have any particular signification as predicting factors.

He next turned his attention to the methods used by the other three agencies; namely, that of utilizing recorded movements of economic forces outside the markets to show what is going to happen to stock prices. He raised the question, in regard to Mr. Babson's chart, as to whether it was not just as difficult to predict the areas above and below the trend, as to forecast the course of the stock market directly. Mr. Macaulay showed that the chief way in which the method used by Mr. Clay differed from that used by Mr. Vance was that Mr. Vance attempts to construct a mathematical formula for weights, while Mr. Clay uses a mental rather than any mathematical weighting. Mr. Clay, moreover, takes into consideration any event or force which he deems important, while Mr. Vance tends to restrict himself to the six factors in his barometer. The apparent advantage of utilizing all types of forces is perhaps more than offset by the danger that the forecaster will be unduly influenced by events of the moment, and may therefore use weights that are not logical.

The meeting was ably presided over by Mr. Walter S. Case, President of Case, Pomeroy & Co., who stated that the experience of his firm had favored the use of outside economic factors in foretelling the general course of the market. As to the present outlook for the prices of railway stocks, he was inclined to agree with the first three speakers, who believed that the rising market would continue, even though he had great respect for the method used by Mr. Vance which gave contrary indications.

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#### THE COST OF LIVING INDICES OF THE N. I. C. B. AND OF THE B. OF L. S.

In her extended article in the December number of the JOURNAL, Miss Elma Carr of the Bureau of Labor Statistics begins her valuable description of the differences between the cost of living indices of the Bureau and the Board with a reference to their extensive use in wage adjustments and ends with the conclusion that the methods of the Bureau are "far superior" and that its index should therefore be considered "much more reliable." If the JOURNAL'S space permitted, and if the subject were important enough not to have been forgotten since Miss Carr's article appeared, a great deal could be said about it. It is possible, however, to venture only a few general comments.