General Approach to

Explicit Forecasting for Business Firms

by

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I. INTRODUCTION

Dr. Cardner Ackley, Chief Archtect for President Johnson's economic policy, recently said something to the effect that with their unremitting pulse-taking and fever-charting, Americans are becoming a nation of economic hypochondriacs. Business, government, universities and private research organizations all maintain stables of Delphic oracles whose main duties are to analyze and interpret every zig, zag, and zug in dozens of economic time series.

The stress on economic projections is not surprising in any sense. Most governments today assume active responsibility for full employment, acceptable growth rates, reasonable price changes and other important economic policy decisions. Their economic policy has to be extensively based on forecasting potential economic conditions. No national economic policy is formulated without some assumptions about the future[1]. However, the need for making assumptions in the future is not just a governmental one, it must be the concern of every businessman. Thus forecasting must be received as an unavoidable necessity for realistic decision making.

Good forecasting is vital to modern business; it is a primary key to successful and intelligent planning. A firm's ability to forecast the internal and external trends in business makes it possible to more intelligently determine the appropriate levels of production, inventory, procurement, capital expenditures and sales. It must be rememberd that in these times of shrinking profit margins the managers who are able to comprehend and apply the more sophisticated tools of forecasting are the managers who will produce the greatest profit for their firm.

The method of forecasting used may range from a pure guessing game approach to a common sense approach, or from simple attempts at keeping well

informed to complex systems of analysis which may include highly complicated econometric models. Forecasts, whatever their nature, are based on fact, intuition and even inaction, but when combined, will imply some picture of the future. The purpose of all modern-day forecasting techniques is designed to either limit the necessary area of judgment or to improve the quality of judgment by broadening its intellectual base and reinforcing it with factual information.[2]

The purpose of this article is to explore the general approach to explicit forecasting in the business world, a world that must deal with certain underlying assumptions and logic. It might be called the "philosophy" of forecasting. This article does not inculde an extensive analysis or evaluation of the methodology and techniques of forecasting since numerous writings in the area have been carried in many professional journals. However, in view of increasing business activities in Korea and her advancement into the international market, I do hope that this genral approach may ease the life people who are trying to find their way in the world of business forecasting by providing them a clue to how the problem of forecasting should be approached.

II. GENERAL APPROACH TO FORECASTING

We have said that forecasting should be treated as an essential part of future business planning because it will improve the quality of decisions. Now the question is not whether to forecast, but how to forecast most accurately and economically within the framework of the firm. Unfortunately in this world there is no way to foresee clearly and with certainty what may lie ahead. The best that can be managed is the use of an indirect approach to attempt to understand the casuses of impending events and to anticipate their coming. Another indirect approach would be the analysis of past experience and behavior in order that it could be safely projected to some period beyond the present.

The first of these approaches requires the understanding of various economic principles and relationships which affect business behavior. Also required is an understanding of the direct measurement of the factors and forces that determine business activity, such as the size of customer demand and the availability of funds to make that demand effective. This approach is completely scientific and rational in that it depends on the development and understanding of general principles and on the measurement of necessary data. However, this approach fails to be a complete solution for two reasons, first because we are dealing with a considerable measure of human behavior which may not be rational and second because we cannot determine or measure all the necessary factors.[3]

The second of these approaches supplements the first and attempts to bridge its deficiencies. This method of organizing past experience and projecting it into the future assumes that all other conditions of the past remain the same in the future. This general approach includes the determination to extend trend lines of growth, to chart seasonal fluctuations and to estimate cyclical movements in the business activities. This method of analyzing past behavior and relationships, assuming that this past experience can be usefully projected into the future, is frequently frowned upon. Nevertheless, it is quite generally used. For most industries, however, the study and projection of trends and cycles are useful only in long-rang forecasting. The results of such approaches are far from the acceptable degree of accuracy needed for planning the month-to-month operation of a business firm.

The possible improvement of forecasting methods and the increase in accuracy and dependability of forecasts, lies a great extent, in two directions: in the discovery and scientific use of general principles and factual measurements, and in the systematic analysis, organization, and projection of past experience.

However, it is true and should be recognized that forecasting organized as a separate management function is not equally necessary in all industries or in all firms. The difficulties in achieving good forecasts and the benefits to be derived from them vary widely with different businesses. Each firm may have a unique problem which only the management of that firm can solve satisfactorily. There is no universal plan. There are, for example, many small business enterprises that may not need organized forecasting. A concern small enough, or with operations simple enough, will usually depend on its chief executive's foresight and ability for its success. Forecasting in such a concern is likely to be of the intuitive or subconscious kind. But as a business grows in size and complexity beyond the physical and mental powers of one man, forecasting should become a separately organized function of management. Organized forecasting thus, becomes more necessary and pays larger dividends as a firm increases in size, in variety of products, in number of markets, and in its extent of decentralization.[4]

In case where the firm is facing an elusive market environment and a lack of internal and external statistical data such as those in developing countries, it is advisable to assign the task of forecasting either to specialists within the firm or to those outside the firm. In short, a firm that is facing a difficult market environment is a firm that most needs scientific forecasting methods. Regardless of where the function finally rests, it was observed that, in firms doing sound forecasting, those who do the work and make the decisions are people who not only have

a good knowledge of their firm and industry problems, but also have an awareness of the general economic conditions. They have the ability to see the significant internal and external factors which will affect their business firm.

It is also important to remember that good forecasting requires team work, the best possible coordination among the many departments involved, general business and market research, sales, accounting, treasury, production planning and line production. Good forecasting and planning will not occur if each of these several departments work independently. Poor results are sometimes the result of too much emphasis on a department objective instead of a wiser emphasis on a company objective.

Business forecasting is usefully divided into two main categories. The first is the forecasting of the trend of general business or the forecasting of aggregate sales of an entire industry. This group of forecasts may be called, for convenience, external forecasts because the forecasts relate to conditions externanl to the individual firm.

The second group-internal forecasts-includes all the forecasts that are limited to the operations of a single firm. The sales forecast or the forecast of product demand is usually the key instrument in the planning of control of operations. This is because sales...the source of revenue for current and future operation...is certainly the most important determinant of a firm's future. Usually short-range forecasts of sales involve an advanced preiod of from 3 to 12 months. They are used to control production levels, inventories and purchasing schedules and over-all expense budgets. Long-range forecasts demand usually from 5 to 10 years and are used for planning long-range financial and physical requirements. Although long-range forecasting is still a minority practice among firms in the developing nations, it is a most important application in estimating a firm's basic direction, its rate of growth and its anticipated expansion needs.[5]

The sales forecast is based on external forecasts of the total market derived by using aggregate economic data such as gross national product, employment, production, money supply, foreign exchange reserves, etc. and/or by using a historical percentage of the total market which the firm can reasonably expect to obtain.

III. A BRIEF SURVEY OF FORECASTING METHODS

There exist four common methods of business forecasting; naive, barometric, opinion survey, and econometric methods.[6]

1. **Naive methods** These are less sophisticated, scientifically uninstructed pro-

jections based on guesses, mechanical extrapolations of his torical data, auto-corre-lations, and harmonic analysis. Under the naive methods, we have the "factor-listing method" which is a procedure whereby the analysis simply enumerates the favorable and unfavorable conditions that will affect business activity as he sees them. He then concludes with little or no evaluation or explanation that business will either be good, bad or the same as last year. Although this method is one of the oldest forms of forecasting and also one of the crudest, many firms are still using it. This method makes no provisions for quanti-tative evaluations of the facts and ignores the "weighting" of the forces that will have an effect on the business climate. Without analyzing factual and environmental relationships in quantitative terms, even if the prediction may turn out to be correct, it is a matter of mere chance.

Next we have "time series analysis"or the statistical method. This method is popular for forecasting business conditions in industry and should supplement the previous approach. Business conditions are usually influenced by four basicc forces: long-term growth trends, cyclical variations, seasonal fluctuations, and irregular forces. The time series analysis is used to discover, separate, and measure the forces which have caused a series to exhibit certain particular fluctuations, in the hope that causal factors may be projected into the future by a series forecast.

Of the foures, the seasonal fluctuations, which refer to variations due to weather and custom occurring during the same time each year, are fairly easy to measure and predict. The irregular forces such as strikes and wars are unpredictable and can be adjusted by a "smoothing out" process like the moving averages. This leaves only the trend and cyclical variation to be projected.

The method of trend projection assumes that the recent rate of growth or change of the variable will continue in the future. On this basis, expectations are established by projecting past trends, by either using the freehand or least square regressions approach. This kind of projection for determining future business environments is very popular in industries; however, the method has difficulty detecting the turning points in business cycls. It is also true that the projection of trends and cycles are useful only in long-range forecasting because such analysis is not sufficiently accurate for planning the month-to-month operation of a busi-ness firm. When the trend is removed from an economic series, there will often be a cyclical or quasi-cyclical structure in the resulting residuals. These harmonic characteristics of time series are the features which have generally been described as a business cycle.[7] Business cycles can be a result of many variables: money supply, inventory variations, innovations, and changes in capital investment

construction activities, etc.[8] There are several approaches used to isolate and measure business cycles. An exmple is the "Standard Cyclical Pattern Method", which involves an averaging of link relative changes in important series. But, the most commonly used approach is the "residual method". This method assumes a multiplicative structure which is usuallly expressed as O=TSCI. It then isolates and measures each of these four factors by separating out the total behavior O, the gradual long-term change T, the regular oscillations S occurring within a year, and the regular oscillations C occurring over several years. Each is measured independently of the others.[9]

Correlation analysis has been often used in sales ferecasting or demand projection. Such analysis discovers whether a relationship exists between fluctuations in the firms sales and some available statistical series, and if there is, then the degree of the relationship is determined. Obviously, correlation analysis is employed either to forecast a firm's own sales by measuring on the basis of fluctuations of another series which will act as a lead indicator or the analysis can be employed to supplement management's judgment as to future trends by relating the firm's sales to a well known readily available series. Yet, the methods of trend projection, cycles or correlation analysis, or any other mathematical processing of time serises are of limited use and are nothing more than an illusory explanation of systematic movements since the methods conceal interrelationships of fluid and dynamic life which is not measureable. Mathematical processing can never be a substitute for sophistication. And until one understands the forces that shape a particular structure in an economic time series and how these forces are related currently, business firms cannot forecast with confidence even though a firm may score a preponderance of successes. This fact may lead the time series analyst to naive forecasts.[10]

2. **Barometric methods** This is an approach to business forecasting based on extensive use of statistical indicators and pressure indexes. Barometric techniques differ from the naive methods in that naive methods imply that the future is some sort of an extension of the past, while the barometric techniques are based on the idea that the future can be predicted from certain happenings in the present. Specifically, this method involves the use of indicators which represent selected time series, such G.N.P., disposable income, employment and production indexes, money supply, etc., which, when used in conjunction with one another, can provide an indication of the direction in which the economy of particular industries are heading. There are three types of indicator: namely, coincident, leading, and lagging indicators.

The coincident indicators, such as G.N.P., industrial production, and retail sales, are moving approximately "in phase" with the aggregate economy, and help to appraise current business conditions. Leading indicators are those that tend to reflect future changes in business activity. The construction index (contracts) lead other general business activities because contracts by necessity preceed the procurement of materials. Moreover, the payroll and other income arising from the production of construction materials lead to demand for all types of goods and services. Therefore, contract awards should have leading characteristics. New orders for durable goods generally proceed other general indexes such as production, employment, payroll, and national income.[11] Lagging indicators are those such as consumer installment debt and the book value of manufacturing inventories which follow or trail behind general business activities.

For forecasting purposes, however, chief interest centers on the several economic leading indicators that measure quite consistently the upturns and downturns of business activity as a whole. The "leads" and "lags" can be readily detected and unusual cyclical developments spotted when the movements of the series are shown against the background of the expansions and contractions of the general business cycle.

To alleviate some of the limitations of the various indicators discussed above, "diffusion indexes" have been used to help measure and interpret the breadth and intensity of cyclical recessions. Diffusion indexes show the percentage of the series that experience increase over the time interval being measured. Often, the 50% mark is used as a guide; thus, if more than 50% of the leading indicators are rising it might be plausible to predict an upturn in aggregate business activity. Although diffusion indexes do not provide positive quantitative indications of the business condition, they are fairly useful in forecasting and detecting the turning points.[12]

In Korea a number of "leding" series are available monthly or quarterly, and they could be a very useful guide in business forecasting. However, it is important to understand the inherent limitation of the barometric approach. These are: (1) sometimes it is difficult to detect and interpret whether a signal has been given or not in the series. Also, the signal is sometimes shown too late to be of much value; (2) the exact turning point of cycles is hardly predictable; (3) the indicators may not be exactly disclosing the magnitude of the change. Because of its limitation, the barometric method of forecasting requires careful and continuous observation. A number of important series must be used in conjunction with other approaches.

3, **Survey method** The essence of this method is to gather the opinions of those who are directly involved with business decision making in industries or who exert influence on the business conditions of the future. The method is very subjective and the result could be a weighted or unweighted average of various opinions, attitudes or expectations. It may result in a sounder forecast of business conditions or demand projection than could be made by a single estimator. The best known among the survey studies for forecasting economic activities are: the survey of businessmen's intentions on plant and equipment expenditurer, the survey of consumer finance and buying power, and the survey businessmen's plans regarding inventory changes. [13]

Generally speaking, the more successful ones have been the first two surveys because they involve a planning period. Once a decision has been made, it is difficult to reverse it; this being especially true of the capital expenditures surveys of businessmen.

However, it should be noted that the survey of businessmen's intentions on capital expenditures in the developing nations are less reliable in predicting business activities because the public sector's investment is far larger than that of the private sector. In addition to this, most of the capital goods are imported from the advanced nations, and therefore businessmen must obtain the foreign exchanges from government sources. If this is the case, the intentions of business often are not realized due to the gevernment's control of foreign exchange and their prior provision of its allocation for industrialization. [14]

The survey of consumer intentions in Korea is popular and a by-product of political popular polling which has been conducted by many institutions. However, an application of this method of forecasting business and economic conditions may have some drawbacks due to the relatively lower purchasing power of the average consumer. If it is of any value, it should be used in the projection of short-run conditions because consumer intentions are highly susceptible to change.

Another type of opinion polling employed by many business firms is the forecasting of sales. This involves three approaches. (1) "Executive polling" where the views of top management are combined and subjectively averaged. [15] This is justified on the basis of safety in numbers and that the combined judgment of the group is better than the forecast of any single member. This approach has been quite successful in those companies where forecasts of probable events are derived after a careful sifting and analysis of market reports, sales data, and formal economic forecasts. Although sales forecast by the survey

of executives can be made easily and quickly without elaborate statistics, some
criticize the method because it is based entirely on personal opinions, requires the
use of costly executive time, and disperses responsibility for accurate forecasting.[16]
It is further argued that a composite outlook arrived at by averaging various
shades of diverse opinion is not necessarily more accurate. (2) "Sales force polling"
is another approach where a composite outlook is constructed on the basis of
information derived from those closet to the market. The advantage of this
method is that it utilizes the firsthand, specialized knowledge of those nearest to
the market. It also gives the salesmen greater confidence in their quotas
developed from forecasts. However, a disadvantage occurs because salesmen may
be quite unaware of structural hanges taking place in their markets and because
they may not have a sufficient amount of time to devote to this forecast.

　　4. **Econometric method** This approach attempts to explain past economic
activity and predict future economic activity by deriving mathematical equations
that express the most probable interrelationship beween a set of economic
variables. The forecasting type of econometric models could be divided into two
parts. One is a multiple of lead-lag correlation. The sales of firm's product, for
example, may be dependent upon several things, such as population growth,
consumer income, and consumption of fuel. Each has a certain degree of effect
upon the sale of the firm's products. Once the relative effect is known and the
correlation is found to be reliable, the firm is able to combine these factors
to obtain an indication of probable future sales or demand.　The second type is
similar except that there is no lead it is necessary to forecast the movement of
the basic factors before the formula can be used. Such is the case in forecasting
the sales of batteries.　Demand for batteries is affected by new-car production,
the number of cars in operation, the wearing qualities of batteries, and amount
of service they receive. Now, the job is to set up proper mathematical equations
for demand for batteries.

　　The model, in other words, is a simplified abstraction of a real situation,
expressed in equation form and employed as a prediction system that will yield
numerical results.[17] Econometrics, to a far greater degree than other forecasting
methods, is analytical in nature and process oriented in approach because its chief
concern is to indentify and measure changing cause and effect relationships
through time. In any forecast, certain strong forces always come into play and
tend to modify existing relationships.　The econometrician is aware of this and
constantly watches for the emergence of new forces or for changes in existing
ones, so that he can allow for these changes in his operating model. In this

way a good econometric model automatically incorporates a necessary degree of built-in flexibilty, thereby facilitating the model's use for forecasting purposes.

I believe it is appropriate at this time to point out that each of the above forecasting techniques should not be used as a self-used as a self-sufficient, go-it-alone forecasting device. What is needed here is a synthesizing of the various techniques so as to supplement one another. This is the point stressed by many economists. They believe that forecasting should be a group activity since the group has an inherent advantage over a single individual. It should also be a continuing exercise, i.e., it should be possible for a staff to give its uninterrupted attention to the business outlook and it should be a rather highly structured exercise with well-designed tasks, procedures and analytical doctrines.

IV. SOME CRITERIA FOR FORECASTING

There are no universal rules and forecasting systems that may be suited to all firms and all industries. A system which works well for one firm may not result in satisfaction to others. While there are no set rules in establishing a forecasting system, certain criteria can nevertheless be considered.

1. **Comprehension of the methods used** Forecasts are only as good as the degree of confidence placed in them by those who are responsible for decision making and forward planning. Therefore, not only is it a question of results achievable with a forecasting method but also of results achieved.

Simple methods of forecasting have many built-in advantages. When management can understand the methods used for forecasting, they have confidence in the result and will support it. When they don't comprehend how the forecasts are derived, they will have a tendency to doubt, discredit or ignore the result. What is important is to convert strange symbols and terms to layman's language so that the methods can be clearly understood. This does not mean, however, that we sould avoid the use of an elaborate and meaningful statistical or mathematical method in forecasting. This simplfying approach has the advantages of getting support from the various levels of people in the organization.

2. **Cost versus results** The problem of selecting a forecasting method to achieve the goal of the company is itself an economic problem; that is, the results achievable by a forecasting method must be weighed against the costs of the method. But the results that can be achieved by a forecasting method are difficult to estimate before the cost of making the forecast has been expended. Hence, the choice among available forecasting methods must be mabe on prior grounds as to which method is likely to give the best results for the

price. Nevertheless, it is argued that a good forecast will well repay the firm for the cost of making it.

3. **Timing** The forecasting system should be capable of producing results which are timely.[18] Ideally, the methods used should be geared to produce accurate forecasts with a minimum amount of elapsed time. The longer the "lead" the forecast has before the event, the greater its value. A somewhat less accurate forecast which can be made earlier in point of time may be more valuable than a more accurate forecast which becomes available later in time. Moreover, once a basis for a forecast is found that has a sufficient "lead", further costs incurred to make available sooner may not be warranted.

4. **Review** The forecasting method must produce an improvement over existing practices in its accuracy for estimating the future. Nothing can destroy confidence in forecasting as rapidly as a few bad forecasts. At the same time, if the margin of error is allowed to become too large, the usefulness of the tool is seriously impaired. If this be the case, it is essential to review frequently and revise the forecasts to bring them into line with changing conditions.

V. CONCLUSION

This article has attempted to put forward a point of view on the general approach of business forecasting and on the way it should be approached from a layman's standpoint. Borrowing Abraham Lincoln's words, "If we could first know where we are and whether we are tending, we could better judge what to do and how to do it." This the exact message I wish to leave in this paper; whether a firm is small or large, or a firm is situated in a developing country or not, they need forecasting, and the more explicitly and scientifically they do this forecasting the better.

Successful forecasting reduces the area of avoidable risk. Forecasting will seldom, if ever, be without some error, but forecasting can limit the area in which assumption and judgment are the only guides. The planned objectives of management can be realized only when there is a reasonably accurate forecast of the trend of general business, of sales income and of over-all cost. The businessman cannot act on the spur of the moment. Successful management requres that the businessman look ahead and make plans. In short, he must plan, and he must forecast in order that he may plan. Good forecasting is a vital modern business concern.

FOOT NOTES AND SELECTED READINGS ON
BUSINESS FORECASTING

1. R. A. Musgrave, "The Fiscal Outlook", Journal of Business, Jan., 1954, pp. 4~16. See also Arthur Smithies, "Leng-Run Projections and Government Revenue and Expenditure Policies", Long-Range Economic Projection, National Bureau of Economic Research(NBER), New York 1954, and Simon Kuznets, "Concept and Assumptions in Long-Term Projetions of National Product", Long-Range Economic Projection, Studies in Income and Wealth, Vol. 16, NBER, 1954, p.36.

2. Charles F. Roos, "Survey of Economic Forecasting Techniques", Econometrica, Vol. 23, No. 4, October 1955, pp. 363~364. See also National Industrial Conference Board (N.I. C.B.), Forecasting in Industry, Studies in Business Policy, No. 77, New York, 1955, pp. 5~6

3. John P. Lewis, "Short-Term General Business Conditions Forecasting: Some Comments on Method", Journal of Business, October, 1962, pp. 343~56. See also Roos, Ibid pp. 366~369

4. Frank D. Newburry, Business Forecasting, New, York, 1952, pp. 4~5 and 16~22. See also N.I.C.B., Ibid, pp. 11.

5. Kuznets, op. cit.

6. Milton H. Spencer and Louis Siegelman, Managerial Economics (Revised), Richard D. Irwin, Inc, 1964, See also Nobert Wiener, The Extrapolation, Interpolation and Smoothing of Time Series, Cambridge, 1942, pp. 92~107.

The term "Series", or "Time Series", refers simply to data for production, sales, etc., arranged in chronological sequence.

7. Roos, Ibid. pp. 365~366.

8. Thomas M. Standack, Jr., Postwar Cycles in Manufacturer's Inventories, NBER, New York, 1962, p. 127. See also J.R. Riggleman, "Building Cycles in the U.S., 1875-1932," Journal of the American Statistical Association, Vol. 28, 1933, pp. 174-183; The American Bankers Association, Forecsting Business Conditions, New York, pp. 73~87; L. Jay Atkinson, "Long-Term Influences Affecting the Volume of New Housing Units", Survey of Current Business, Nov. 1963.

As a rule, manufacturers adjust working stocks rather promptly in response to changes in sales, while changes in finished goods stocks usually lag. In business expansions, the prospect of rising sales initially affects inventories at the working materials stage primarily, and produces a marked response in the level of finished stocks only after a lag. Similarly, in periods of business contraction, inventory liquidation centers mainly in goods in process and purchased materials. Since the producer has less control over his holdings of finished goods, they may continue to expand in the face of declining sales.

9. B.G. Hickman, "Diffusion, Acceleration, and Business Cycles", American Economic Review, September, 1959, pp. 535~565. See also Arthur F. Burnes and W. C. Mitchell, Measuring Business Cycles, New York, 1946; Geoffrey Moore, "Analyzing Business Cycle",

The American Statistician, April-May, 1954, p.p. 13〜19.

10. NICB, Ibid, p.p. 23〜33

11. R.A. Gordan, "Alternative Approaches to Forecasting: The Recent work of the National Bureau", The Review of Economics and Statistics, Vol. 47, No. 2., pp. 285〜287. See also Geoffery H. Moore, Statistical Indicatistors of Cyclical Periods and Recessions, New York, NBER, Occasional Papers 31, 1950; Sherman Z. Maisel, Fluctuations, Growth, and Forecasting, John Wiley & Sons, Inc., New York, pp. 189〜190.

12. Arthur M. Okun, "On the Appraisal of Cyclical Turning Point Predictors", "The Journal of Business" April, 1960, pp. 101〜120. Also see. Julius Shiskin "Business Cycle Indicator: The Known and Unknown", Business Cycle Development, USDC, Sept., 1963; Julius Shiskin, "Reverse Trend ADjustment of Leading Indicators", the Review of Economics and Statistics, Feb., 1967, pp. 45〜49; National Industrial Conference Board, New Diffusion Indexes, Technical Papers No. 13, 1963; Geoffrey J. Moore, "The Behavior of Business Indicators in a Recovery Period," Evaluation and Using Business Incidators, American Management Association, Management Report No. 25, 1955.

13. Thomas M. Stanback, Jr. op. cit.

14. The American Bankers Association, Ibid, pp. 141〜142.

15. Franco Modigliani and Owen H. Sauerlender. "Economic Expectations and Plans of Firms in Relation to Forecasting", Short-Term Economic Forecasting NBER, New York, 1955. See also Arthur Okun, "The Predictive Value of Surveys of Business Intentions", American Eeonomic Review, Papers and Proceedings, May, 1962, pp. 218〜25; Roos, Ibid, pp. 318〜389.

16. Spencer, Ibid, pp. 59〜71.

17. Daniel B. Suits, "Forecasting and Analysis with an Econometric Model", American Economic Review, Sept., 1964, pp. 104〜132. See also James S. Duesenberry, Otto Eckstein, and Gary Fromm, "A Simulation of the U.S. Economy in Recession," Econometrica, XXVIII, October, 1960, pp. 749〜809; Lewis, ibid, pp. 350〜356.

An interesting actual econometric model was compiled by a Research Seminar in Quantitative Economics on the U.S. economy by Professor Daniel Suits, University of Michigan. The model consists of 32 equations, most of them least-square linear resessions. Although both the prewar and postwar periods were explored separately to determine whether there was any indication of a change in the coefficients of the equations, the final equations presented were fitted only to data drawn from the period 1947-60 to maximize their applicability to current problems. It may be concluded from this study that attempting to approximate the behavior of a complex economy by a set of 32 linear equations is a highly simplifying thing. However, experience has shown that the statistical model can be a useful and flexible device for economic forecasting.

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