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REPORTER

NATIONAL BUREAU OF ECONOMIC RESEARCH, INC.

APRIL 1977

Editorial Message

Springtime is characterized by the bracing air of renewal and change. The National Bureau's current issue of the *Reporter* comes to you in this spirit of revitalization. A look at the masthead gives one a clue: the old NBER *Report* has a new look.

And the name is not all that is changed. There is the streamlined format, for one thing. The NBER *Reporter* will come to you as a self-mailer, and far more frequently than before. This will enable the National Bureau to realize its long-standing aim of keeping you abreast of its current activities. Relevant news of ongoing research, of new grants fostering future research programs, of NBER-sponsored conferences that disseminate information on a global scale, of completed books and articles, and of the doings of outstanding NBER personalities will reach you much faster than in the past.

One of the standard features of the NBER *Reporter* that is already generating lively interest will be a section devoted to business cycle research under the direction of Geoffrey Moore. Occasionally, this will include the publication of some of the useful findings of business cycle studies even before their full completion. Certainly, a flow of up-to-date information from the Bureau, a leading authority in this area, is welcome news. The analysis of the forecasting record of the President's *Economic Report* featured in this issue is the first in this series.

Making the results of basic research as relevant and as currently available as possible is one of the goals of the NBER *Reporter*. Reader comment in this direction is cordially invited.

Table of Contents:

| | |
|--|----|
| Editorial Message | 1 |
| NBER'S Current Conference | |
| Program | 1 |
| New Grants | 3 |
| The President's <i>Economic Report</i> : | |
| A Forecasting Record | 4 |
| NBER Personalities | 12 |
| Recent NBER Publications | 14 |

NBER's Current Conference Program

April '77—Natural Resources Engineering

The National Bureau is cosponsoring a two-day conference with Clemson University to be held April 4-5 at the university. Entitled "The Charles Carter Newman Symposium on Alternatives for Growth: The Engineering and Economics of Natural Resource Development," the conference will initiate the Charles Carter Newman Endowed Chair program, a series funded by Clemson University for the study of natural resources engineering. The aim of the symposium is to assemble and promote a philosophical basis for the guidance of researchers, scientists, and policymakers in dealing with the complicated, and often conflicting, issues surrounding the utilization and conservation of natural resources. H. Guyford Stever, President Ford's chief science advisor, will be the moderator for the proceedings; and John J. McKetta, Jr., E.P. Schoch Professor of Chemical Engineering at the University of Texas-Austin, and Paul W. MacAvoy, Professor of Economics at Yale, will be speakers.

The following papers are on the agenda: "Engineering and the Natural Environment," by John R. Pierce, California Institute of Technology; "Resources, Economic Factors, Alternatives for Growth, Economic Trade-offs," by Gordon J. MacDonald, Dartmouth College; "The Natural Environment and Food Production," by P. Buringh, Agricultural University, Wageningen, the Netherlands; "Migration, Urbanization, Resources, and Development," by Andrei Rogers, International Institute for Applied Systems Analysis in Laxenburg, Austria. Discussants will be Harvey J. McMains of the U.S. Army War College; John R. Meyer of Harvard University, President of the NBER; Benjamin Dysart and T. Bruce Yandle, Jr., of Clemson University; Glenn W. Burton, research geneticist for the U.S. Department of Agriculture and the University of Georgia-Tifton Experiment Station; and James E. Halpin, Director-at-large of the Southern Agricultural Experiment Stations.

May '77—The Computer in Economic and Social Research

A group of sixty engineers and economists plans an interdisciplinary workshop on the computer in economic and social research to be held May 25-27 in New Haven, Connecticut. The meeting, to discuss mutual concerns regarding control of econometric models, modeling, identification, prediction and stochastic control techniques, depends on support from the National Science Foundation. David Kendrick of the University of Texas in Austin and Edison Tse of the Department of Engineering-Economics Systems of Stanford University will be cochairmen. The papers emerging from this conference, the agenda for which is presently undergoing review, are expected to be presented in a future issue of the *Annals of Economic and Social Measurement*.

June '77—Urban Development

A conference on "Alternatives for Urban Growth and Development," cosponsored by the National Bureau and the Joint Center for Urban Studies of MIT and Harvard University, will convene in Cambridge, Massachusetts, June 9-10. The purpose of the gathering will be to bring together about seventy-five leading scholars, industrialists, labor leaders, bankers, and government officials to explore and contribute to an urban development agenda for the nation. The honorary chairman for the proceedings will be Andrew Heiskell, Chairman of the Board of Time, Inc. and Chairman of the MIT-Harvard Joint Center Visiting Committee. Senator Patrick Moynihan, former director of the Joint Center, has been invited to give a keynote address at the dinner to be held in honor of Mr. Heiskell. It is hoped that the academic, industrial, and governmental interchange elicited by the conference will help produce constructive ways to satisfy the needs of an expanding urban population without sacrificing the quality of the living environment. Funding of this program is undertaken jointly by the National Bureau and the Lincoln Institute of Land Policy.

The papers commissioned for the meetings will be published in book form by the NBER. Some of the prospective titles are: "The Impact of Shifts in Family Structure, Life Style, and Demographic Patterns on Urban Areas" (William Alonso); "The Intrametropolitan Distribution of Industry and Jobs" (Roger Schmenner); "The Potential for Renewing our Core Cities" (Ira Lowry); "The Spatial Impact of the Federal Tax Code" (George

Peterson); "The Spatial Impact of Land Use and Environmental Controls" (Richard Babcock); "The Spatial Distribution of Federal Housing Programs" (John Kain and William Apgar); "The Environmental Attack on Homebuilding" (Bernard J. Frieden); "Energy Prices, Policies, Urban Structure" (Thomas Glennon); "Transportation and Urban Land Use" (Gregory Ingram); "The Intrametropolitan Distribution of Minorities" (Thomas Pettigrew).

Summer '77—Commodity Models in Latin America

An international workshop on Commodity Modeling and Planning in Latin America, jointly sponsored by the NBER, the Coffee Federation, and the Banco de la Republica of Colombia, originally scheduled to take place February 4-6 in Bogota, Colombia, has been postponed to sometime in the summer of 1977. It will be the eighth in a series of Latin American computer workshops under the leadership of the National Bureau. NBER's M. Ishaq Nadiri is organizing the conference, along with Walter C. Labys, Department of Mineral Economics of West Virginia University; Morris Harf, Assistant to the President of the Banco de la Republica of Colombia; and Jose F. Nunez del Arco, Senior Specialist of the Inter-American Development Bank in Washington, D.C. Commodity model builders, economists, and policymakers from government, business, and the academic community will be participating in this program.

The workshop will address itself to the following questions:

1. What are the factors responsible for the fluctuations in volume and price of the major commodities produced by the Latin American countries (fish meal, copper, sugar, coffee, cattle, minerals, et cetera)?

2. Can buffer stocks be organized for these commodities to stabilize their prices?

3. What kind of coordination can the Latin American countries develop to promote their commodity exports?

4. What kind of government policies would be most successful in promoting production, distribution, and marketing of these commodities?

5. What kind of international redistribution of income can take place through changes in commodity trade?

6. What are the impacts of commodity trade and production on the domestic activities of the

various Latin American countries?

7. How can these models be useful for planning purposes in the Latin American economies?

Some of the papers to be delivered include: "Can Modeling Help Latin American Policy Planning?" (Eric Thorbecke, Cornell University); "What Can Latin America Do in International Commodity Planning?" (Walter C. Labys, West Virginia University); "A Spatial Model of the Sugar Market" (Gordon Gemmill, Wye College, University of London); "A Temporal Model of the Sugar Market" (Merrill Bateman, Data Resources, Inc.); "Medium-Term Projections: Linkages between International Commodity Markets and Macroeconomic Activity" (Gerry Adams, University of Pennsylvania); "Long-Term Projections: Forecasting the Metal Markets for Investment Decisions" (Jim Burrors, Charles River Associates); "Commodity Fluctuations and the Coffee Sector" (C.F. Trench de Freitas, Instituto de Economia Agricola, Secretaria de Agricultura, São Paulo, Brazil); "Planning for Agricultural Development at the Commodity Level" (I.J. Singh, World Bank); "Planning for the Rural Sector" (Carlos Pomareda, World Bank); "Transnational Behavior and Commodity Markets" (Ted Moran, School of Advanced Studies, Johns Hopkins); "International Commodity Stabilization: The Compensatory Finance Mechanism" (Louis Goreux, International Monetary Fund).

New Grants

Change and Stability in the American Family

A new project to investigate the effects of family instability and of publicly provided social services on the role of the family in society has been awarded \$250,000 support by the Alfred P. Sloan Foundation and \$100,000 by Lilly Endowment, Inc. The research, expected to run two to three years, will be directed by Gary S. Becker, University Professor of the University of Chicago and Senior Staff member at NBER, and Robert T. Michael, Associate Professor of Economics at Stanford University and Associate Director of the National Bureau's Center for Economic Analysis of Human Behavior and Social Institutions. It will be

conducted through the Center, under Victor R. Fuchs, Vice President and Co-Director of NBER-West.

International Transmission of Inflation through the World Monetary System

This research program, already launched under the direction of Anna J. Schwartz, Senior Research Staff member of the National Bureau, with the participation of professors Michael R. Darby and Benjamin Klein of U.C.L.A. and James R. Lothian, Assistant Vice President of Citibank and NBER consultant, involves the formulation, estimation, and testing of a small-scale dynamic model applied to quarterly data of eight major countries. Originally underwritten by the National Science Foundation, the Relm Foundation, and the Alex C. Walker Educational and Charitable Foundation, the project has won new support from the Scaife Family Charitable Trusts to the amount of \$50,000 for two years. Robert E. Lipsey, Director of International and Financial Studies, is the NBER officer in charge.

Economics of Health Research Program

The Robert Wood Johnson Foundation has contributed \$274,091 in additional funding to continue this project, begun with support from the Department of Health, Education and Welfare, for another three years. Victor R. Fuchs and Robert T. Michael are in charge of the program and benefit from the collaboration of Michael Grossman, Associate Professor of Economics at the City University of New York Graduate School and member of the Bureau's Senior Research Staff. The program has two major aspects: (1) analysis of health industry manpower and (2) analyses of production of children's health and demand for children's health care.

A Stage-of-Process Sector Analysis of Productivity Change and Its Impact on the U.S. Rate of Inflation, 1954-1973

The National Science Foundation has granted \$108,600 for a period of fifteen months to support this project, directed by Joel Popkin, Director of the Bureau's Washington, D.C. office. The main objective is to provide information necessary to determine the sectors of the U.S. economy in which productivity improvement with respect to capital, labor, and materials can be expected to result in the largest reductions in overall inflationary pressures.

The President's Economic Report: A Forecasting Record

Geoffrey H. Moore

Keeping a scorecard on economists' forecasts is not an occupation calculated to please one's professional colleagues. If the forecasts turn out to be very different from one another, and obviously different from what will occur, some wisecracker is likely to remark that economists get rich by begging—to differ. If the forecasts turn out to be much alike, the same fellow will say if you've seen one economist's forecast you've seen 'em all. Nevertheless, forecasting records should be kept, exposed to public view, and analyzed. Only in this way can we learn to what degree they are dependable and how to improve their reliability.

For this reason in 1963 the National Bureau began to develop systematic records of forecasts and analyze the results. First we obtained a number of historical records and then, in 1968, began a quarterly survey of forecasters, in cooperation with the American Statistical Association. The survey not only provides current information on what some fifty economists who regularly produce forecasts are projecting for each of the next five quarters, but also summarizes the methods being used and the crucial assumptions underlying the forecasts. Hence it is a systematic record that had not been available previously.

One of the most widely scrutinized forecasts—not included in the above survey—is the one published each January in the *Economic Report of the President*. The practice of including explicit numerical forecasts in the *Report* began in 1961. Hence a record covering some fifteen years can be compiled and, since 1968, compared with the ASA-NBER survey of forecasters. How close to the mark did these forecasts come? Is the government's fore-

cast more accurate or less accurate than the private forecasts? Is there evidence of bias? How do forecasts of price change compare with forecasts of real growth? Could one do as well simply by extrapolating last year's experience? Have the forecasts been getting better or worse?¹

Since the *Economic Report* forecasts have been limited, for the most part, to annual totals for the year ahead of gross national product in current and in constant prices, and to the price level implied in current-dollar GNP, we restrict our analysis to these three variables (the ASA-NBER survey covers other items too, such as unemployment, industrial production, housing starts, et cetera). The most useful way to record and analyze these forecasts, I believe, is in terms of year-to-year percentage changes. Changes are harder to predict than levels, and percent changes are more comparable over time than dollar changes. By using them we also avoid some of the problems of revision in the level of the dollar figures and concentrate attention on what is of most interest—the rate of growth and the rate of inflation.

In measuring accuracy we compare the forecast percent change with the actual percent change recorded the following year (ignoring later revisions in the "actuals"), and calculate the mean error without regard to sign and the correlation (r^2) between the forecast and actual changes. The mean error simply tells how big the discrepancy in percentage points was, on the average, between the forecast and the actual change, while the correlation indicates on a scale from 0 to 1.0 how closely related the forecast and actual changes were. If the correlation is close to zero, there is

Note: The author is Director of Business Cycle Research, National Bureau of Economic Research, and Senior Research Fellow, Hoover Institution, Stanford University.

¹For some earlier studies on these questions, see the references cited at the end of this article.

Table 1
Measures of Error in Forecasts of Year-to-Year Percentage Changes in GNP and Prices

| Period Covered | Mean Absolute Error, in Percentage Points | | | Correlation (r^2), Forecast and Actual Change | | | | |
|--|---|------------------------|-----------------------------|---|------------------------|-----------------------------|------|------------------|
| | Economic Report (Jan.) | ASA-NBER Survey (Nov.) | Simple Extrapolation (Feb.) | Economic Report (Jan.) | ASA-NBER Survey (Nov.) | Simple Extrapolation (Feb.) | | |
| <i>GNP in Current Dollars</i> | | | | | | | | |
| 1962-1968 | 1.3 | n.a. | n.a. | 2.0 | .19 | n.a. | n.a. | .02 ^a |
| 1969-1976 | 0.8 | 1.0 | 0.6 | 2.6 | .83 | .76 | .89 | .00 |
| 1962-1976 | 1.0 | n.a. | n.a. | 2.3 | .65 | n.a. | n.a. | .02 |
| <i>GNP in Constant Dollars</i> | | | | | | | | |
| 1962-1968 | 1.0 | n.a. | n.a. | 1.7 | .20 | n.a. | n.a. | .22 ^a |
| 1969-1976 | 1.2 | 1.0 | 0.8 | 3.7 | .86 | .94 | .86 | .00 |
| 1962-1976 | 1.1 | n.a. | n.a. | 2.8 | .78 | n.a. | n.a. | .01 |
| <i>GNP Implicit Price Deflator</i> | | | | | | | | |
| 1962-1968 | 0.5 | n.a. | n.a. | 0.4 | .75 | n.a. | n.a. | .71 |
| 1969-1976 | 1.4 | 1.3 | 1.2 | 2.0 | .58 | .53 | .65 | .17 |
| 1962-1976 | 1.0 | n.a. | n.a. | 1.3 | .77 | n.a. | n.a. | .54 |
| <i>GNP Implicit Price Deflator: Change in Rate</i> | | | | | | | | |
| 1963-1969 | 0.6 | n.a. | n.a. | 0.5 | .03 ^a | n.a. | n.a. | .00 |
| 1970-1976 | 1.7 | 1.6 | 1.2 | 2.2 | .39 | .34 | .57 | .00 |
| 1963-1976 | 1.1 | n.a. | n.a. | 1.3 | .36 | n.a. | n.a. | .00 |

Source: Table 2.

^a R is negative.

little evidence of forecasting ability, even if the mean error is quite small. Finally, as another test of forecasting accuracy, we compare the forecasts with those that might have been made by simple extrapolation—assuming that next year's percentage change will be the same as that of the previous year. This provides a standard measure of the relative difficulty of forecasting during one

period compared with another or forecasting one variable compared with another and, as we shall see, is not always easy to beat.²

Charts 1-3 show the record of the forecasts from the *Economic Report* in comparison with the actual figures reported a year later. Clearly the two correspond to a considerable degree. The mean error for the whole period turns out to be almost

²This method of extrapolation is not necessarily the best. Victor Zarnowitz [7, 8], Jacob Mincer [3], and others have experimented with more effective methods, providing a higher standard against which to measure actual forecasts. One

method uses an average rate of growth over a longer period than merely the preceding year. Another uses the most recent quarterly information of GNP available and extrapolates from there.

Chart 1
Actual and Forecast Percentage Change
in GNP in Current Dollars,
President's Economic Report, 1961-76

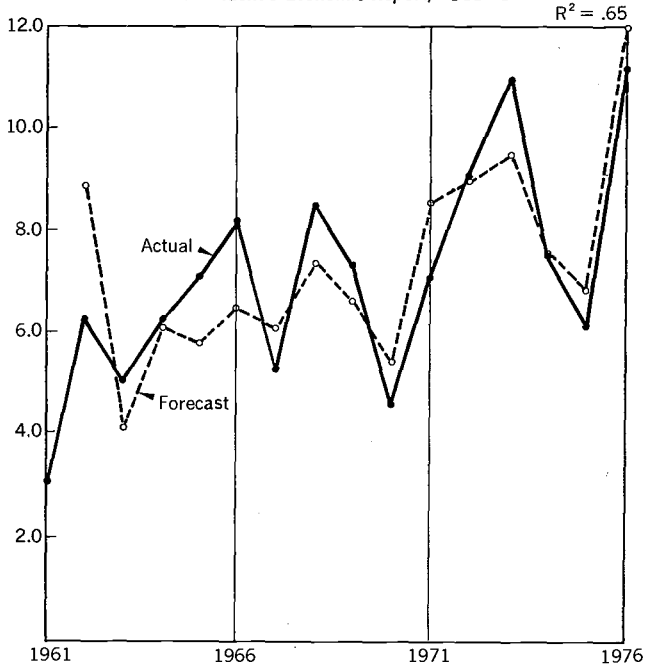


Chart 2
Actual and Forecast Percentage Change
in GNP in Constant Dollars,
President's Economic Report, 1961-76

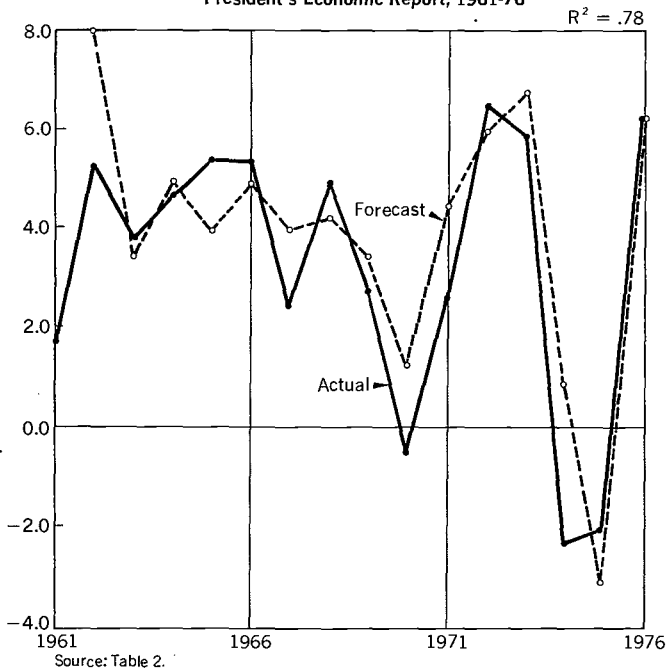
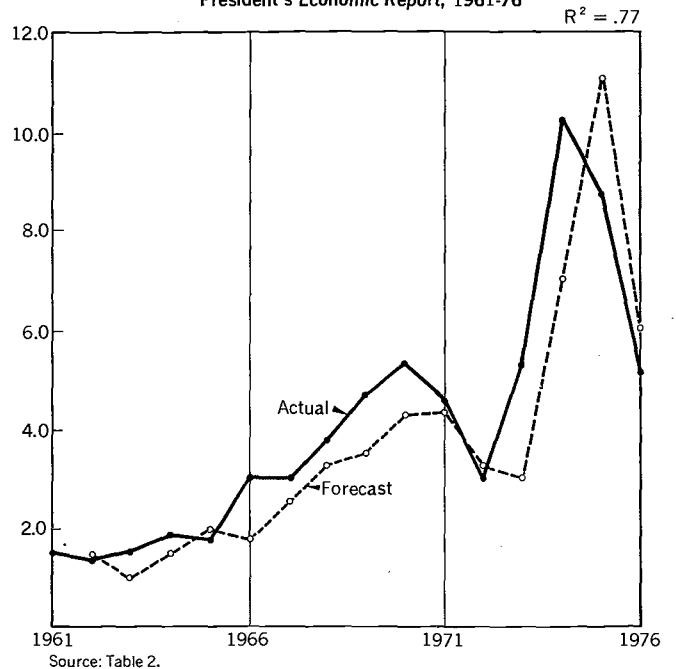


Chart 3
Actual and Forecast Percentage Change,
GNP Implicit Price Deflator,
President's Economic Report, 1961-76



the same—one percentage point—for current- and constant-dollar GNP and for the price deflator (Table 1, col. 1). That is to say, the government's economists have forecast the rate of nominal growth, of real growth, and of inflation for the year ahead all within an average margin of one percentage point during the past fifteen years.

Charts 1 and 2 also clearly show that there has been some improvement during the period in the fidelity with which the forecasts have tracked the actual changes in current- and constant-dollar GNP. At the same time, the swings in the rates of growth have become wider, which presumably adds to the difficulty of forecasting. The summary measures in Table 1, which divide the period roughly in half, show that the mean error in forecasts of GNP in current dollars dropped from 1.3 percentage points in the first seven years (1962-1968) to 0.8 points in the last eight (1969-1976).³ This was more of an accomplishment than

³Fellner [1] finds a similar improvement in the forecasting record of the *Economic Report* during approximately the same period.

appears at first sight, because between the same two periods the errors made by simple extrapolation of the previous year's change were increasing, reflecting the wider swings in the rates of change. The forecast errors dropped from about two-thirds of the extrapolative errors to about one-third. Also, the correlation between forecast and actual changes became very much higher.

For real GNP the average size of the forecasting errors did not decline between the two periods, but the errors of simple extrapolation became much larger (the swings in real growth rates increased much more than the swings in nominal growth rates). Hence, relative to the extrapolation standard the forecasts of real GNP improved just as much as the forecasts of nominal GNP. The correlation of forecast with actual changes also improved substantially.

The government's record for price forecasting is very different, despite the fact that the average error and the correlation for the entire period are virtually the same as for real and nominal GNP. A glance at Chart 3 reveals a clear tendency for the forecasts of the inflation rate to lag a year behind the actual rates. As a result, the price forecasts were no better than the extrapolative standard in the first half of the period, and only moderately better in the last half. The extrapolation automatically lags a year behind the actual changes. Furthermore, the correlation between forecast and actual price changes deteriorated, though not as much as it did for the extrapolation. Of course, the swings in the rate of inflation increased enormously in the 1970s.

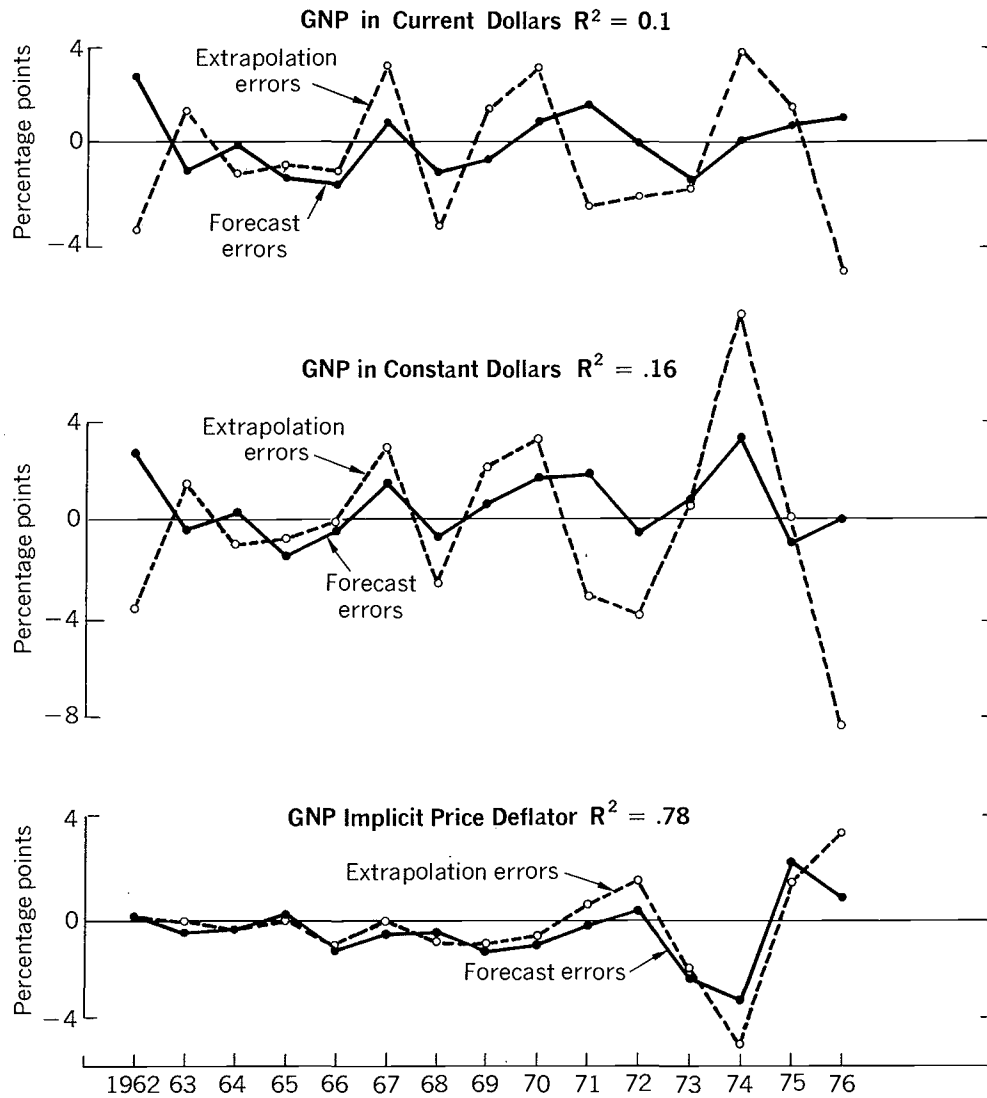
It appears, then, that at least in the early part of the period the rate of inflation had a far greater tendency to persist from year to year than did the rate of change in real GNP. It appears, too, that this tendency has influenced forecasts of the rate of inflation. This influence is demonstrated more directly in Chart 4, which compares the errors in the forecasts with the errors in extrapolation. For real and nominal GNP there is little or no relation;

the forecast errors simply hew much closer to the zero line than do the extrapolation errors. But for prices there is a close relation—the forecast errors move very much like the extrapolation errors. In price forecasting, forecasters have to a large extent followed the extrapolating route. Indeed, the *Economic Report* has often stated its expectation regarding prices in terms of extending the recent trend.

Because of the high degree of persistence in the rate of inflation it is of interest to know how well the *change* in the rate has been forecast. Here, of course, simple extrapolation does not do well. It assumes there is no change in the rates from whatever it was last year. Whenever the rate changes, the simple extrapolation will be wrong by the amount of the change. In recent years, when the changes have been large, the extrapolation errors have been large, too. This is also true of the *Economic Report* forecasts. Nevertheless, in recent years the mean error in the forecasts of the change in the inflation rate has been somewhat smaller than in extrapolations that say that the rate will remain the same, and the forecast changes show a moderate correlation with the actual changes. (See the bottom section of Table 1.) Forecasters have done more than just extrapolate the previous year's rate, but they still have a long way to go.

Chart 4 suggests a further observation: the errors in forecasting real GNP and the price deflator have tended to be offsetting, especially in the last half of the period. When the forecasts of real growth were too high, the forecasts of the rate of inflation were too low, and vice versa. The forecasts of GNP in current dollars benefited from these offsetting errors and turned out to be more accurate than one would have expected had the forecasts of real growth and inflation been arrived at independently. The situation resembles one in which the forecasters could forecast the change in nominal GNP quite well, but couldn't do well at splitting it into the real change and the price change. Most forecasters would, I think, agree that this is the case.

Chart 4
Forecasting Errors Compared with Simple Extrapolation



Source: Table 2.

Turning now to the comparison with the private forecasts as represented in the ASA-NBER survey⁴, we use the median forecast from both the survey taken in November or early December, before the President's *Economic Report* is published, and that taken in February, shortly after the *Report* is published. The mean errors in November survey

forecasts are virtually the same as in the *Report* forecasts, and the forecasts themselves are very highly correlated.⁵ One could say, therefore, that the November survey gives a very good prediction of what the forecasts in the *Report* are going to be, and just as good a prediction for the year ahead as that in the *Report*.

⁴A few government forecasters participate in the survey, but constitute only about ten percent of the sample.

⁵The R^2 for forecasts in the November survey and the *Report* are .85, .93, and .97 for nominal GNP, real GNP, and price deflator, respectively, 1969-1976. For the February survey and the *Report*, the corresponding R^2 are .92, .97, and .98.

The February survey forecasts, not unexpectedly, are even more closely correlated than the November survey forecasts with the *Report* forecasts (see footnote 5). But the accuracy record is, on the whole, slightly better than that of the *Report*. In other words, the February survey forecasts come closer to the recently published *Report* forecasts but also a little closer to the final outcome. In general, however, the survey forecasts display many of the same characteristics as the *Report* forecasts, and vice versa.⁶

On the matter of bias two things can be said on the basis of the record. One is that both private and government forecasts have erred on the side of optimism more often than not. Real growth was overestimated by the *Report* in five of the last eight years, underestimated twice; in 1976 the forecast hit the target precisely. The November survey forecasts overestimated six times, underestimated twice. The February survey turned in four overestimates, three underestimates, and one bull's-eye. On prices too, optimism has prevailed. The *Report* underestimated the rate of inflation five times, overestimated it three times; the November survey did likewise. The February survey was similar, underestimating inflation five times, overestimating it twice, and hitting the target once.

The second point is that the government's forecasts have been somewhat more optimistic than the private ones on real growth but for a lesser extent on inflation. The *Report* forecasts of real growth were higher than the November survey in six of the last eight years, and higher than the February survey every single year. On the other hand, its forecasts of the inflation rate compared to the November survey were higher five times, lower twice, and the same once, and compared to the February survey, were higher four times, lower twice, and the same twice. As a result of the *Report's* tendency to make higher forecasts of both real output and prices, its forecasts of nominal GNP exceeded both the November and the February surveys for seven out of the eight years.

As a further result of these difference—since

both government and private forecasts were too optimistic on real growth, and the former more optimistic than the latter—the government overestimated real growth most of the time. But on inflation, since the government's forecasts were higher than the private forecasts, which were too low, the government came closer to the target most of the time. The upshot is that for nominal GNP there is little to choose between the government and private forecasts. The average errors, taking the direction of error into account (unlike Table 1, where direction is ignored), are as follows for 1969-1976, in percentage points:

| | Report | November Survey | February Survey |
|-------------------------|--------|-----------------|-----------------|
| GNP in current dollars | 0.2 | -0.3 | -0.3 |
| GNP in constant dollars | 0.8 | 0.7 | 0.4 |
| Implicit price deflator | -0.5 | -0.9 | -0.7 |

Perhaps the most important point is that these differences are all less than one percentage point. Bias is not a dominant feature of the record of either government or private forecasts.

Finally, it should be noted that in all the above comparisons we have used the average (median) forecast from the ASA-NBER survey. In forecasting, as in other games of chance, there is safety in numbers. Over a period of time the average forecast by a group of forecasters tends to be more accurate than the individual forecasts of the majority in the group. The opportunity for errors to cancel out in the average forecast is lacking in the individual forecasts. Some forecasters will be optimistic, others pessimistic. Consequently, in an extended contest between the average forecast and any individual forecast, the average is likely to win out. The forecasts in the *Economic Report* are like the individual forecasts in such a comparison, though there are some elements of a consensus about them. Thus, the fact

⁶For an earlier comparison of this kind see Zarnowitz [8].

For 1962-1968 the mean absolute error in the average forecast percent change in current-dollar GNP, covering a large number of forecasters, was 1.3 percentage points. This is exactly the same as for the *Economic Report* (Table 1, above).

Hence private forecasters have evidently improved their performance since 1968 about as much as the government has. Zarnowitz's record of private forecasts for 1953-1963 shows still larger mean errors, suggesting that a trend toward improving accuracy may have persisted for twenty-five years or so.

Table 2
Prediction and Performance, 1961-1976

| | <u>% Change from Preceding Year</u> | | | | <u>Error, Percentage Points</u> | | | |
|--------------------------------|---|--|------|-----------------------------|---|--|------|---|
| | <u>Forecast,</u> <u>Economic</u> <u>Report</u> <u>(Jan.)</u> <u>(1)</u> | <u>Forecast,</u> <u>ASA-NBER Survey</u> <u>(Nov.)</u> <u>(Feb.)</u> <u>(2)</u> <u>(3)</u> | | <u>Actual</u> <u>(4)</u> | <u>Economic</u> <u>Report</u> <u>(Jan.)</u> <u>(5)</u> | <u>ASA-NBER Survey</u> <u>(Nov.)</u> <u>(Feb.)</u> <u>(6)</u> <u>(7)</u> | | <u>Simple</u> <u>Extra-</u> <u>polation</u> <u>(8)</u> |
| | | | | | | | | |
| <i>GNP in Current Dollars</i> | | | | | | | | |
| 1961 | .. | .. | .. | 3.3 | .. | .. | .. | .. |
| 1962 | 9.4 | .. | .. | 6.7 | 2.7 | .. | .. | -3.4 |
| 1963 | 4.4 | .. | .. | 5.4 | -1.0 | .. | .. | 1.3 |
| 1964 | 6.5 | .. | .. | 6.6 | -0.1 | .. | .. | -1.2 |
| 1965 | 6.1 | .. | .. | 7.5 | -1.4 | .. | .. | -0.9 |
| 1966 | 6.9 | .. | .. | 8.6 | -1.7 | .. | .. | -1.1 |
| 1967 | 6.4 | .. | .. | 5.6 | 0.8 | .. | .. | 3.0 |
| 1968 | 7.8 | .. | .. | 9.0 | -1.2 | .. | .. | -3.4 |
| 1969 | 7.0 | 6.6 | 7.0 | 7.7 | -0.7 | -1.1 | -0.7 | 1.3 |
| 1970 | 5.7 | 5.4 | 5.4 | 4.9 | 0.8 | 0.5 | 0.5 | 2.8 |
| 1971 | 9.0 | 6.8 | 7.1 | 7.5 | 1.5 | -0.7 | -0.4 | -2.6 |
| 1972 | 9.5 | 8.9 | 8.9 | 9.7 | -0.2 | -0.8 | -0.8 | -2.2 |
| 1973 | 10.0 | 9.6 | 9.8 | 11.5 | -1.5 | -1.9 | -1.7 | -1.8 |
| 1974 | 8.0 | 7.1 | 7.7 | 7.9 | 0.1 | -0.8 | -0.2 | 3.6 |
| 1975 | 7.2 | 8.1 | 6.6 | 6.5 | 0.7 | 1.6 | 0.1 | 1.4 |
| 1976 | 12.5 | 12.4 | 12.4 | 11.6 | 0.9 | 0.8 | 0.8 | -5.1 |
| <i>GNP in Constant Dollars</i> | | | | | | | | |
| 1961 | .. | .. | .. | 1.8 | .. | .. | .. | .. |
| 1962 | 8.0 ^a | .. | .. | 5.3 | 2.7 | .. | .. | -3.5 |
| 1963 | 3.5 ^a | .. | .. | 3.8 | -0.3 | .. | .. | 1.5 |
| 1964 | 5.0 | .. | .. | 4.7 | 0.3 | .. | .. | -0.9 |
| 1965 | 4.0 ^a | .. | .. | 5.4 | -1.4 | .. | .. | -0.7 |
| 1966 | 5.0 | .. | .. | 5.4 | -0.4 | .. | .. | 0.0 |
| 1967 | 4.0 | .. | .. | 2.5 | 1.5 | .. | .. | 2.9 |
| 1968 | 4.3 ^a | .. | .. | 5.0 | -0.7 | .. | .. | -2.5 |
| 1969 | 3.5 | 3.3 | 3.5 | 2.8 | 0.7 | 0.5 | 0.7 | 2.2 |
| 1970 | 1.3 | 1.1 | 0.7 | -0.4 | 1.7 | 1.5 | 1.1 | 3.2 |
| 1971 | 4.5 | 2.8 | 2.7 | 2.7 | 1.8 | 0.1 | 0.0 | -3.1 |
| 1972 | 6.0 | 5.5 | 5.7 | 6.5 | -0.5 | -1.0 | -0.8 | -3.8 |
| 1973 | 6.8 | 6.1 | 6.1 | 5.9 | 0.8 | 0.2 | 0.2 | 0.6 |
| 1974 | 1.0 | 1.1 | 0.6 | -2.2 | 3.2 | 3.3 | 2.8 | 8.1 |
| 1975 | -3.0 | -0.8 | -3.8 | -2.0 | -1.0 | 1.2 | -1.0 | -0.2 |
| 1976 | 6.2 | 5.9 | 6.1 | 6.2 | 0.0 | -0.3 | -0.1 | -8.2 |

Source:

Cols. 1 and 4: *Economic Report of the President*, January 1962 through January 1976. The actual changes are based on the first official estimates given in the *Report* following the year for which the forecast was made. Changes in constant-dollar GNP and in the price deflator are based on estimates in 1954 dollars for 1960-1961 to 1964-1965, in 1958 dollars for 1965-1966 to 1973-1974, and in 1972 dollars thereafter.

Cols. 2 and 3: Quarterly releases by the American Statistical Association and the National Bureau of Economic Research, "Business Outlook Survey". The figures are medians of the

forecasts reported by about 50 economists in business, government, and academic institutions.

Cols. 5, 6 and 7: Cols. 1, 2, and 3 minus col. 4.

Cols. 8: Actual change for preceding year minus actual change for current year (col. 4).

^a Inferred from statements in the *Report*. All other entries are based on figures (dollar levels, dollar changes or percentage changes) given in the *Report*. The inferred entries have been verified as approximately correct, though not in all cases precisely correct, by the Council of Economic Advisers.

(Table 2 continued)

| | % Change from Preceding Year | | | | Error, Percentage Points | | | |
|------------------------------------|--|--|-----|---------------|-------------------------------------|---|------|-------------------------------------|
| | Forecast, Economic Report (Jan.) (1) | Forecast, ASA-NBER Survey (Nov.) (Feb.) (2) (3) | | Actual (4) | Economic Report (Jan.) (5) | ASA-NBER Survey (Nov.) (Feb.) (6) (7) | | Simple Extra- polation (8) |
| <i>GNP Implicit Price Deflator</i> | | | | | | | | |
| 1961 | .. | .. | .. | 1.5 | .. | .. | .. | .. |
| 1962 | 1.5 ^a | .. | .. | 1.4 | 0.1 | .. | .. | 0.1 |
| 1963 | 1.0 ^a | .. | .. | 1.5 | -0.5 | .. | .. | -0.1 |
| 1964 | 1.5 | .. | .. | 1.9 | -0.4 | .. | .. | -0.4 |
| 1965 | 2.0 ^a | .. | .. | 1.8 | 0.2 | .. | .. | 0.1 |
| 1966 | 1.8 | .. | .. | 3.0 | -1.2 | .. | .. | -1.2 |
| 1967 | 2.5 | .. | .. | 3.0 | -0.5 | .. | .. | 0.0 |
| 1968 | 3.3 ^a | .. | .. | 3.8 | -0.5 | .. | .. | -0.8 |
| 1969 | 3.5 | 3.3 | 3.3 | 4.7 | -1.2 | -1.4 | -1.4 | -0.9 |
| 1970 | 4.3 | 4.7 | 4.7 | 5.3 | -1.0 | -0.6 | -0.6 | -0.6 |
| 1971 | 4.4 | 3.9 | 4.2 | 4.6 | -0.2 | -0.7 | -0.4 | 0.7 |
| 1972 | 3.3 | 3.2 | 3.0 | 3.0 | 0.3 | 0.2 | 0.0 | 1.6 |
| 1973 | 3.0 | 3.3 | 3.4 | 5.3 | -2.3 | -2.0 | -1.9 | -2.3 |
| 1974 | 7.0 | 5.9 | 7.0 | 10.2 | -3.2 | -4.3 | -3.2 | -4.9 |
| 1975 | 11.0 | 9.1 | 9.9 | 8.7 | 2.3 | 0.4 | 1.2 | 1.5 |
| 1976 | 6.0 | 6.0 | 6.0 | 5.1 | 0.9 | 0.9 | 0.9 | 3.6 |

that the *Report* forecasts compare closely in accuracy with the average forecasts in the survey is in itself a favorable result. Relatively few

forecasters in the survey group would do as well.⁷ This, of course, is one of the advantages of conducting the survey and using it as a standard.

⁷For a striking illustration of this see Zarnowitz [7]. Using forecasts of GNP in current dollars over spans of four quarters, 1956-1963, he showed that only five forecasters in a group of 47 had a smaller average error during the period than that of the average forecast for the group.

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NBER Personalities



Dr. Edward L. Ginzton

Dr. Edward L. Ginzton, Chairman of the Board of Varian Associates, Palo Alto, California, joined the Board of Directors of the National Bureau of Economic Research in the fall of 1975. He is not an economist but an electrical engineer, inventor, and educator of great distinction. Officially retired since 1968 from Stanford University, which renamed its microwave laboratory in his honor in 1976, Dr. Ginzton is still connected with the institution in an advisory capacity.

His career has been unusual in many ways. Born in the Ukraine, the son of an American father and a Russian mother, Dr. Ginzton received no formal education until the age of eleven due to the vicissitudes of the period following the Russian Revolution. His family left Russia in 1927, spent two years in China, and came to the United States in 1929. They settled in San Francisco, where he started school again in the first grade—at the age of thirteen—because he did not speak English. This did not hold him back very long: he graduated from high school in 1933 and three years later received his B.A. in electrical engineering from the University of California. He spent the following year as a graduate student at Berkeley conducting independent research on the theory of electron circuits and invented the balanced feedback principle, which he terms "not much of an invention"—but one that gained him a teaching assistantship at Stanford University. This permitted him to continue his graduate studies in electronics, and he received his Ph.D. in 1940.

At Stanford Dr. Ginzton became immersed in the microwave research conducted in the physics department by brothers Russell and Sigurd Varian and Professor William Hansen, the inventors of the klystron, an electron tube generating centimeter waves that was a forerunner of radar. Dr. Ginzton ascribes his own specialization in that area to his

close association with these three men. While still a graduate student, he, too, began to contribute inventions in the field. The Second World War provided a strong impetus to their research, applications of which led not only to radar but also to the development of high energy particle accelerators. In 1940 the research team was taken under the financial wing of the Sperry Gyroscope Company in New York, where Dr. Ginzton remained throughout the war.

He returned to Stanford University to teach in 1946 and two years later collaborated with the Varians in founding their own research laboratory "with six full-time employees and \$22,000 capital." He did not give up teaching, however, and became a full professor of applied physics and electrical engineering in 1951. From 1949 to 1959 he also served as director of the university's microwave laboratory.

At Varian, Dr. Ginzton helped establish the objectives of the company, slated to become a leading manufacturer of scientific instruments, electron tubes and devices, and machines for cancer therapy. In later years he participated as a member of its Board of Directors and its scientific policy committee and other advisory groups. In 1959, on the death of Russell Varian, Dr. Ginzton was elected Chairman of the Board and Chief Executive Officer. From 1964 to 1969 he also served as president of the company. In 1974 he relinquished the role of Chief Executive Officer, but remained Chairman of the Board. Since then he has been devoting his attention to the longer-range objectives of the company, particularly in the fields of medicine and solar energy.

Dr. Ginzton's first scientific contributions of some significance were made in the development of microwave principles when he was about twenty-four years old. In the following six years he invented "some forty or fifty devices." In his own judgment, his most important activities include the wartime development of microwave measurements, the development of the high-power klystron, and directing the development of the electron linear accelerator at Stanford University. The largest of these, the two-mile accelerator (SLAC), was approved by Congress in 1960.

At Stanford he also worked with Dr. Henry Kaplan on small linear electron accelerators for cancer therapy, and the first of these went into operation at the university's hospital in 1954. Dr. Ginzton went on to help Varian Associates initiate commercial production of these machines,

which have now become the preferred tool for the radiation treatment of cancer.

In view of these achievements it is not surprising that the list of professional honors heaped on Dr. Ginzton is overwhelming. For example, at the Institute of Electrical and Electronics Engineers (IEEE, formerly IRE), where he has been a fellow since 1951, he received the Morris Liebmann Memorial Prize in 1957, the Medal of Honor in 1969, and also served on its board from 1971 to 1973. He has been a member of the National Academy of Engineering since 1965 (and a member of the Council of the Academy from 1974 to 1977), of the National Academy of Sciences since 1966, and of the American Academy of Arts and Sciences since 1971. In the area of business, Dr. Ginzton received the "California Manufacturer of the Year" award from the California Manufacturers' Association.

The advisory committees and boards of directors Dr. Ginzton has served on are too numerous to mention in full. They include, among others, Stanford's School of Engineering, the School of Business at Berkeley, the Lawrence Berkeley Laboratory, the Stanford University Hospital, the Northern California Advisory Board of the Union Bank, and the Stanford Bank.

From 1971 to 1973 Dr. Ginzton was chairman of the Committee on Motor Vehicle Emissions of the National Academy of Sciences, which had been mandated by Congress to advise it on the technological feasibility of the Clean Air Act of 1970. He continued as a member of the committee for another year and also served on the Coordinating Committee for Air Quality Studies. In 1975 he served on a further committee to advise EDRA on the creation of a Solar Energy Research Institute (SERI). The same year he became co-chairman, with Harvey Brooks of Harvard, of the Committee on Nuclear and Alternative Energy Systems (CONAES), whose purpose is to recommend alternative strategies for the use of nuclear energy and, in particular, breeder reactors.

Of course, Dr. Ginzton's activities have not all been strictly related to his scientific and business interests. In 1964 he helped found the Stanford Mid-Peninsula Urban Coalition, serving for a few years as its cochairman, and has been on the board of its Housing Development Corporation since 1972. And finally, on a more personal note, Dr. Ginzton is an avid photographer and something of a chess player, and also enjoys skiing and rebuilding Model-A Fords.

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The horizons of research at the National Bureau are wider than ever. A look at the recent NBER publications listed below tells the story. Their broad scope makes important contributions to policymakers in business and government as well as to specialists and students in the academic community.

Take these three far-flung titles, for example: *The Formation and Stocks of Total Capital* (John W. Kendrick), *The Role of Health Insurance in the Health Services Sector* (Richard N. Rosett, editor), and the individual country volumes in the series on Foreign Trade Regimes and Economic Development.

The first of these, by John W. Kendrick, professor of economics at the George Washington University, is a long-awaited reference work that makes an important contribution to our understanding of economic growth. Essentially, economic growth is viewed by the author as a process in the formation of total capital—tangible as well as intangible, human and nonhuman. Interest in the factual and theoretical aspects of this study is worldwide: Professor Kendrick has been asked to present a paper based on his book at the August 1977 meetings of the International Economics Association to be held in Tokyo.

Our second example, the conference volume on health insurance edited by Richard N. Rosett, has immediate relevance to government policy making. Its most important implications concern the impact of the enactment of a national health insurance scheme on (1) the utilization of health services, (2) the cost of health services, and (3) actual health status—mortality and morbidity. Some of the details emerging from this volume should be useful tools in formulating actual health insurance schemes, and provide valuable insights to all those interested in the health field.

As to the series on Foreign Trade Regimes and Economic Development, the individual volumes provide a wealth of sorely needed information on the economic problems of the developing nations. They are written by specialists familiar with the specific problems of the countries under study and, again, will prove of great interest to readers in the business as well as academic worlds.

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