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**PART I**

**Investing  
in  
Economic  
Knowledge**

The aim of economic research is to broaden economic knowledge; the use of economic knowledge — to aid in the solution of economic problems. To shore up defenses against business depression, strengthen the forces of economic progress, improve the efficiency of production and distribution — in some measure to help in such tasks is the reason for investing in economic science. It is reason enough, for the solution of economic problems is a way to better human lives.

But our generation has seen persistent and severe international tension bend the direction of this, as of other, endeavors. The solution of our economic problems is now also — if not primarily — a weapon in the struggle for survival as a free nation. Investment in economic knowledge is needed to arm ourselves with that weapon.

Events during the past year have not eased the pressure of this fact on those who devote themselves to economic research.

The girdling of the globe with an object thrown from the other side of the Iron Curtain has intensified interest in our rate of growth and in the question, What, if anything, needs to be done to match the pace of Soviet Russia? To this question people give various answers.

So, too, the business contraction that began at mid-1957 has raised disturbing questions. The threat of a major decline, most economists believe, can be averted by various means. But which of these means should be applied, when, and in what degree, if present or later costs in inflation and retarded growth are to be minimized? On these matters, too, opinions differ.

The differences of opinion reflect, in part, inadequacies of economic knowledge. They underscore, therefore, the continued importance of the National Bureau's objective: "to ascertain and to present to the public important economic facts and their interpretation in a scientific and impartial manner."

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This report was presented at the annual meeting of the Board of Directors of the National Bureau, held in New York City, February 24, 1958. I am indebted to my colleagues for helpful suggestions on Part One, and to Geoffrey H. Moore for taking charge of the preparation of Parts Two, Three, and Four.

Underscored, also, is the desirability of assuring the public that our work accords with this objective — that our responsibilities are being effectively discharged — that support of

our work is in fact a way to invest in useful economic knowledge. This is the business before our annual meeting.

## 1. Studies Completed

Between its formation in 1920 and the beginning of 1957, the National Bureau issued well over a hundred bound volumes and a somewhat larger number of other monographs and papers. If I had to convey the contents of these reports in a few words, I would say that they were all focused on the character, causes, and consequences of economic change, including man's individual and collective efforts to control or adjust to it. Economic change is the focus because economic change is at the heart of the country's major economic problems.

For the same reason, analysis of economic change is also the object of our recently completed reports, the dozen and a half books and

other publications issued during 1957 and early 1958, the additional dozen to be issued or put into press before the end of the year, and the half-dozen soon to be submitted to the Board for its approval. This emphasis will be seen by a glance at the titles, given in the accompanying list.

But titles barely hint at contents. Let us open some of the reports and see what they contain.

*A Theory of the Consumption Function*, by Friedman, deals with a major portion of the flow of expenditures that sustain, stimulate, or depress employment and production. Friedman's explanation of change in consumption

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## STUDIES

### REPORTS PUBLISHED SINCE JANUARY 1, 1957

*The Growth of Public Employment in Great Britain*, Moses Abramovitz and Vera F. Eliasberg, General Series 60

*Concentration in Canadian Manufacturing Industries*, Gideon Rosenbluth, General Series 61

*Patterns of Farm Financial Structure: A Cross-Section View of Economic and Physical Determinants*, Donald C. Horton, Studies in Agricultural Financing 2

*Suggestions for Research in the Economics of Pensions*, Exploratory Report

*The Demand and Supply of Scientific Personnel*, David M. Blank and George J. Stigler, General Series 62

*A Theory of the Consumption Function*, Milton Friedman, General Series 63

*Bank Stock Prices and the Bank Capital Problem*, David Durand, Occasional Paper 54

*Some Observations on Soviet Industrial Growth*, G. Warren Nutter, Occasional Paper 55

*Capital in Agriculture: Its Formation and Financing since 1870*, Alvin S. Tostlebe, Studies in Capital Formation and Financing 2

*Distribution of Union Membership among the States, 1939 and 1953*, Leo Troy, Occasional Paper 56

*The National Economic Accounts of the United States: Review, Appraisal, and Recommendations*, General Series 64

*Electronic Computers and Business Indicators*, Julius Shiskin, Occasional Paper 57

*Federal Lending: Its Growth and Impact*, Occasional Paper 58

*Federal Lending and Loan Insurance*, R. J. Saulnier, Harold G. Halcrow, and Neil H. Jacoby, Other Financial Studies 2

*Corporate Bonds: Quality and Investment Performance*, W. Braddock Hickman, Occasional Paper 59

*Financial Intermediaries in the American Economy since 1900*, Raymond W. Goldsmith, Studies in Capital Formation and Financing 3

*Seasonal Adjustments by Electronic Computer Methods*, Julius Shiskin and Harry Eisenpress, Technical Paper 12

*The Income-Tax Burden on Stockholders*, Daniel M. Holland, Fiscal Studies 5

*Corporate Bond Quality and Investor Experience*, W. Braddock Hickman, Studies in Corporate Bond Financing 2

runs primarily in terms of consumers' expectations concerning income. If consumers believe their current incomes to be below the average levels they expect in the future, the ratio of current consumption to current income will be higher than usual. If, on the other hand, they believe that current incomes are above expected incomes, the ratio of consumption to income will be lower. Naturally, expectations are influenced by developments in the past. Generally speaking, therefore, current consumption is correlated with the income experience of recent years. This empirical relation is very similar to the relation implied by the theory that consumption lags behind income because it takes time to adjust to change in income. But Friedman's analysis leads us to look ahead, not backward. The danger of missing special developments that may turn up to affect income expectations and thereby consumption is lessened. Further, the analysis embraces the idea that consumers take into account not only

income expectations but also expectations with respect to the prices and availability of consumption goods, when deciding what portion of income to spend. This seems to have been the explanation for the buying spurt that followed Korea, as Burns perceived in 1951.

It is evident that Friedman abandons the conception of the consumer as a mechanical link between current income and consumption, a notion that Keynes set forth in 1936 and that played a large role in economic thinking in the years following. Friedman returns to the older theory of consumer behavior, in which consumers' plans and decisions are influenced by the future as well as the present and the past, and his explanation is thus consistent with much that economists have learned about consumer behavior over the past century or more. At the same time, his analysis comes to grips not with the relatively stable situation with which the older theory was largely concerned, but with the world of change to which Keynes

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*The Volume of Mortgage Debt in the Postwar Decade*, Saul B. Klamman, Technical Paper 13

#### REPORTS IN PRESS

*The Labor Force under Changing Income and Employment*, Clarence D. Long, General Series 65

*International Financial Transactions and Business Cycles*, Oskar Morgenstern, Studies in Business Cycles 8

*The Postwar Rise of Mortgage Companies*, Saul B. Klamman, Occasional Paper 60

*The Role of Middleman Transactions in World Trade*, Robert M. Lichtenberg, Occasional Paper

#### REPORTS GOING TO PRESS

"City Expenditures in the United States," Harvey E. Brazer, Occasional Paper

"The Demand for Currency Relative to Total Money Supply," Philip D. Cagan, Occasional Paper

"Capital in Transportation, Communication, and Public Utilities: Its Formation and Financing," Melville J. Ulmer, Studies in Capital Formation and Financing

"Business Cycles and the American and British

Trade Balances, 1879-1955," Ilse Mintz, Occasional Paper

"Wages in Germany, 1871-1945," Gerhard Bry, General Series

"The Merger Movement in American Industry, 1895-1955," Ralph L. Nelson, General Series

"Personal Deductions in the Individual Income Tax," C. Harry Kahn, Fiscal Studies

#### REPORTS SOON TO BE SUBMITTED FOR APPROVAL

"Freight Transportation in the Soviet Union: A Comparison with the United States," Ernest W. Williams, Occasional Paper

"Postwar Market for State and Local Government Securities," Roland I. Robinson, Studies in Capital Formation and Financing

"Capital Financing in Mining and Manufacturing," Daniel Creamer, Sergei P. Dobrovolsky, and Israel Borenstein, Studies in Capital Formation and Financing

"Capital in the American Economy: Its Formation and Financing," Simon Kuznets, Studies in Capital Formation and Financing

"Statistical Measures of Corporate Bond Characteristics and Experience," W. Braddock Hickman, Studies in Corporate Bond Financing 3

drew the attention of so many economists. And Friedman brings to bear on the relation between income and consumption also much of what has been learned in recent years about the distribution of income. His analysis is a constructive interweaving of several strands of economic thought that has considerable implications for business forecasting and stabilization policy.

Other reports also contribute to the knowledge needed for effective stabilization policy. *Financial Intermediaries*, by Goldsmith, describes the development of nonbanking financial institutions over the past half-century, a trend that has significantly altered the environment within which monetary policy is applied. Hickman's new book, *Corporate Bond Quality and Investor Experience*, of which his recently published paper was a preview, reveals a good deal about investor behavior during business cycles — for example, the oversensitivity of investors to impending defaults so that corporate bonds were typically undervalued in the market at or near the date of default, judged by subsequent experience. *Federal Lending and Loan Insurance*, by Saulnier; Halcrow, and Jacoby, also summarized in one of the papers listed, sets forth the programs developed over the past thirty-five years by almost seventy federal agencies, and points up the problem, for a unified and efficient stabilization policy, that is raised by multiple federal credit programs designed to reach a variety of other objectives. Mintz's paper on the behavior of foreign trade balances during business cycles may instill some doubts in those who take the simple view that the United States exports depressions. And Long's book on *The Labor Force under Changing Income and Employment* is a thorough analysis of a variable in the important equation, unemployment equals labor force minus employment.

The two reports, *Electronic Computers and Business Indicators*, by Shiskin, and *Seasonal Adjustment by Electronic Computer Methods*, by Shiskin and Eisenpress, also are useful contributions to the understanding and control of business fluctuations. One of the major difficulties impeding the prompt analysis of cur-

rent business statistics, important in following the course of events closely, has been the heavy burden involved in eliminating the seasonal fluctuations and other changes that cloud the cyclical trend. The papers show how modern high-speed computers can very materially cut the amount of time and money required. The methods described are already being put to use by government agencies (including the Bureau of the Census, where Shiskin got the project started), by business concerns with which we have been in communication, and in our own work.

Modern methods of a less spectacular but far more important kind are readily seen in a drive through the farming regions of our country. More efficient methods, heavy investment in farm equipment, and greater reliance on the division of labor made possible by factory-produced supplies have turned agriculture into the most dynamic sector of the United States, measured by its labor productivity. Since 1910 farm output per worker has increased by something like 300 per cent. Tostlebe's *Capital in Agriculture* gives a broad view and analysis of this development and provides an interesting example of what our recent reports have to say on the crucial question of economic progress. The other reports from the study of trends in capital formation and financing — Ulmer's on the railroads and public utilities, the volume on manufacturing and mining by Creamer, Dobrovolsky, and Borenstein, and the capstone volume by Kuznets — will also be found to contain useful information on the process by which our country has grown in output and efficiency.

Nutter's *Some Observations on Soviet Industrial Growth*, the first published report from the study of Soviet output, presents a significant contrast between industrial output in this country and in Russia. After stating the levels of output reached in 1955 by 37 Russian industries (those for which relevant information could be obtained), Nutter asks when these levels were reached by the same industries in the United States. In the case of steel ingots, for example, Soviet output in 1955 equaled the U. S. output of 1926 — Russia lagged 29

years. The median lag for all 37 industries in 1955, so determined, was about 35 years; on a per capita basis, it was even greater. Nutter further points out that the average lag in 1955 was about the same as it had been in 1937, and somewhat longer than in 1913. Other ways to put the relation of Soviet to U. S. output give a rather different cast to the comparison, and Nutter mentions some of these in his paper. He is exploring various ways to describe what has happened to Russian output, and at a later point I shall refer to his recently calculated index numbers, which help round out the view.

That great care is needed to avoid too narrow a view of how Russian production compares with that of the United States is stressed in Williams' recently completed paper on *Freight Transportation in the Soviet Union*. Soviet railroad freight traffic, measured in ton-miles, grew between 1913 and 1955 much more rapidly than ours, and by 1954 had come to equal U. S. railroad freight traffic. The primary reason for this difference in rates of growth has been the great shift in the United States away from railways to other means of transportation — waterways and coastal shipping, motor trucks, and pipelines. By 1955 railroads accounted for only 42 per cent of total intercity freight traffic in the United States, a sign of our advantage in usable waterways and of our progress in developing new means of transport. In Russia, on the other hand, railroads carried 90 per cent of freight traffic in 1955, a fraction somewhat higher than in 1928 and considerably higher than in 1913.

Growth and stability are not the only problems confronting the American people, nor are they the only problems to which our recent reports have addressed themselves. *The Growth of Public Employment in Great Britain*, by Abramovitz and Eliasberg, deals with another major question, one which bears on stability and growth but also has its own interest. And the reports by Holland on *The Income-Tax Burden on Stockholders*, and by Kahn on *Personal Deductions in the Individual Income Tax*, contain information useful for assessing

the individual income tax and for analyzing the distribution of income.

*The National Economic Accounts of the United States: Review, Appraisal, and Recommendations* will help, eventually, to deal with virtually every broad economic problem. Like some other National Bureau reports, it was undertaken at the request of a public agency — in this case, the Bureau of the Budget — and is the outcome of deliberations by a committee of experts, including two members of our staff. It describes the nature and objectives of the economic accounts compiled by agencies of the federal government, considers their reliability and uses, and presents the committee's recommendations for improvement. The accounts discussed include not only the national income and product accounts that have become familiar, but also the newer flow-of-funds statements, input-output tables, and national balance sheet; and special attention is paid to their interrelations. The report is the latest in the series of National Bureau studies that began in 1921 with the publication of *Income in the United States* — long before the value of national income and similar economic accounts in the management of public and private economic affairs was widely recognized.

I have been able to mention only half the studies recently completed. But even this summary review should have suggested their significance for important economic problems. It may explain, also, the attention the reports receive from persons outside the National Bureau even before they are published. For use of our findings does not wait until the reports are off the press. Because *A Theory of the Consumption Function* deals with the major determinants of consumption, it was natural for a preliminary draft of Friedman's manuscript to be given a place in the discussion of consumption and economic development which the Universities-National Bureau Committee for Economic Research held in 1955. A summary of Goldsmith's *Financial Intermediaries* was published as an Occasional Paper in 1954, but even before then, he had presented some of his results and ideas at several conferences, and his full manuscript had been circulated to

our Advisory Committee on the Study of Capital Formation and Financing, to the Committee on Research in Finance, and to other experts. Hickman's work on the bond market has also been known and discussed in the financial community for a long time, and, as soon as his second volume was in sight, the American Bankers Association proposed arrangements to distribute his summary paper, together with a booklet (prepared by the Association) pointing out the usefulness of the findings to investment officers of banks and other institutions. Similarly, in response to a demand, a preliminary summary of the report of the National Accounts Review Committee was circulated to our contributors and to the members of the Federal Statistics Users' Conference, and then, upon its completion, the report was transmitted by the Bureau of the Budget to the Joint Economic Committee's Subcommittee on Economic Statistics, and its recommendations discussed at the Subcommittee's hearings. In this way, the substance of the report had an unusually wide and quick circulation before publication by the U. S. Government Printing Office, and helped support the federal statistical program proposed in the President's Budget Message last month.

In one form or another, we have had such experience with each of the other new reports listed. The reasons are simple. It is a normal part of our procedure to solicit assistance and

advice in formulating a project; to consult those who may have information and ideas useful in pursuing the study; to discuss our problems and tentative results with other investigators or men of practical experience; to circulate to experts drafts of the manuscript for their critical comments and their information; to make the results available, with due reservations regarding their preliminary character, to those with urgent need for them; to make progress reports at conferences, at professional meetings, and in our annual reports; to prepare releases and hold discussions with the economic writers of newspapers and other periodicals who will help to announce our reports; and when a report is large and will take a long time to pass through the press, to publish quickly a paper summarizing its main results. Along one or more of these paths, and before we are able to announce publication of the finished report, our researches reach the realm in which they can be put to use.

Perhaps we should do more to aid in the assimilation of our reports after they have been published. Only if they are assimilated can the results of our researches be said to have entered fully into the stock of social capital of which economic and other knowledge is a part. Yet publication has largely been the final step for us. And it must continue to be, if we are to devote our energies to the task in which we believe our competence to be greatest.

## 2. *Research under Way*

As is true of investment in other types of capital, adding to economic knowledge is a process requiring time.

That it is a long process, even before publication, I have already indicated. Our recent or soon-to-be published studies are the end-products of work done mainly prior to 1957. Indeed, the period of "production" of a study usually extends over years — sometimes many years. The studies we have under way at this time are not, in proportion to those published, what the submerged portion of an iceberg is to the part above water. But surely — it would be idle to try to count unfinished manuscripts

— the research in process is a multiple of the research that has reached publication since the beginning of 1957.

Unlike investment in most other types of capital, adding to knowledge is not a straightforward production process. By its very nature, research is a venture into unexplored territory, a journey that often involves retracing of steps, and, on occasion, failure. The research that went on at the National Bureau in 1957, and is now going on, consists, in part, of studies proceeding according to plan. In part, also, it consists of studies that are changing their scope or even their direction — be-

cause expected difficulties have melted away, or unseen difficulties have cropped up before the investigator, or the course of his work has led him to see his problem in a new light. And among these studies there may be some that will never reach the stage of publication because of initial errors in planning the work or choosing the personnel, or — even less avoidable in the uncertain venture of research — because difficulties in establishing reasonably firm conclusions prove insurmountable.

For these and other reasons, perhaps the best way for a member of the Board of Directors to grasp the nature and savor the quality of the research we have in progress would be to make an extended visit to the National Bureau. If, during his visit, he were to sit down for an hour or two with each member of the staff, attend our formal (and informal) staff meetings, and join the conversation at meal time, he might get a full sense of what we are doing and how we are doing it. His impressions would be of a livelier quality, at any rate, than can be gathered from the brief statements presented in Part Two of this report.

Nevertheless, our staff progress reports are rather unique in the amount of information they convey to the Board and to the public at large on the work we have in process. Those interested in particular topics will go to these staff reports; others, if they browse a bit, will discover — as have some of our newspaper friends — that there is at least the makings of a story in every section.

Consider, for example, the problem of protracted surges and relapses in the rate of growth of the United States, with which Abramovitz deals. He finds a striking relation between long swings in building construction — the great fluctuations that extend over decades — and the shorter business cycles. During periods when building was high in relation to its trend, years of prosperity were more numerous; when building was low in relation to its trend (except during wartime), years of prosperity were less numerous. Viewed somewhat differently, when the long swing in building was in its ascending phase, business expansions

averaged longer than usual, and business contractions, shorter; when building was in its descending phase, business expansions were relatively brief and business contractions relatively long. Abramovitz's explanation of these results, into which he brings other significant aspects of economic change, is still tentative, as he is careful to stress. If his further studies confirm the calculations and bear out his conjectures, understanding of the causes of severe business contractions will be significantly advanced. And we may be somewhat closer to knowing how best to avoid their disastrous consequences.

Toward the same objective, others of our studies are aimed. In the reports on the study of money supply, special attention is drawn to the relation between rate of growth in money supply and severity of business contraction, and to an explanation of severe cycles that is suggested by the analysis — an explanation that must eventually be reconciled with Abramovitz's. The credit quality study also bears on certain of the factors involved in severe cycles, and may be expected to contribute to an explanation of the phenomena. Relevant, too, is an experiment in gauging the severity of a business contraction before it has run its course.

A different specimen of our current research is offered by the studies of productivity — Kendrick's on its long-term trends, and Hultgren's on its cyclical characteristics. Together with related studies, some completed, some under way, they provide information that should be most helpful to men concerned with economic affairs. They establish, for example, that over the past sixty-five years physical output per manhour in the private economy has grown at an average rate that appears to be no less — and no more — than about 2.3 per cent per annum; that comparing output with a measure of labor input in which a highly paid manhour of work counts for more than a low-wage manhour yields a measure of productivity that grew over this period at a significantly smaller rate — about 1.9 per cent per annum; that a measure of productivity comparing output not only with labor input

(so determined) but also with capital, grew still less rapidly — about 1.7 per cent per annum; and that all these indexes of productivity in the private economy rose somewhat less rapidly than the corresponding indexes for the economy as a whole, if the usual measurements of government output and input are utilized. The studies show, further, that the change in labor productivity did not proceed smoothly, but in fact had a cyclical pattern. During the latter stages of a business expansion productivity tended to rise at less than the long-term rate, and during the first part of contraction to fall, with significant effects on unit labor costs. Even apart from cyclical fluctuations, productivity did not advance regularly, so that some periods showed significantly higher than average rates and some lower. Important are not only the productivity measurements themselves, but also the sharp differences made in the rates of growth by technical choices of which most people are unaware: whether output or input is defined in one way rather than another, or weights of components of output and input are determined by this rather than that method, or the average rates are calculated for a longer or shorter or different period.

The stories to which I have referred are a few among many that may be read in the section of staff reports. It is a varied collection of stories, for the studies we have in progress (like our completed studies) scrutinize different portions of the economy, or the same portion — or the whole — from different points of view. Some indication of the variety is provided by the distribution of the detailed reports in Part Two among the more or less conventional groups to which most economists have become accustomed. They could with equal logic be distributed in other ways. The system of national economic accounts, with its distinctions between stocks and flows and between gross and net items, among other things, could provide a classification. Differentiation among types of change — secular trends, long cycles, business cycles, and other fluctuations — could provide another. Walras' theory of general equilibrium also

gives a classificatory scheme that could be used (with some adaptation) as a guide to our current work; so does every treatise on the principles of economics. And there are other obvious possibilities.

Whatever the classification, many of the studies would be found to straddle two or more groups. This is interesting only because it indicates the variety of uses to which the findings of the studies will lend themselves. Hultgren's analysis of cyclical changes in real and money costs and in profits is also a study of productivity change. Bry's investigation of fluctuations in hours of work will tell us something about wages and employment, as well as business cycles. Mintz's study of cycles in imports and exports is obviously also a study in international economic relations. Woolley's examination of the structure of world trade and payments, together with the related analysis of the world's petroleum trade by Dwyer and Michael's study of international capital relations and movements, is an effort to understand not only international economic relations but also economic organization generally, as well as finance. Kuznets' capstone volume on trends in capital formation and financing is as much a study of finance as of national income and capital formation, and this is equally true of the work of his collaborators, such as the study of government financing by Copeland. The postwar capital markets project, in which Goldsmith, Robinson, Shapiro, Klaman, and Mendelson are joined, should contribute to our knowledge of capital formation, of finance, of economic organization, and of income. Gort's intensive analysis of sources of funds and determinants of investment in several important industries belongs under capital formation as well as business finance. Zarnowitz's study of cyclical change in manufacturers' orders is also in part a study of an early stage in the process of investment. Brazer's study of municipal expenditures is a study in collective consumption as well as in public finance. And Stigler's study of the mobility of capital among industries belongs in several different categories.

The studies we have in progress differ not

only with respect to "topic," but also in other respects. Some of our current studies seek links among the factors involved in economic change — Mack's exploration of "subcycles" and Hastay's work on businessmen's expectations are examples. Some are largely devoted to the character of change in particular institutions, as in the personal income tax study of Seltzer, Holland, and Kahn; or in particular economic variables, as in Stanback's investigation of inventory cycles, Long's, Rees's and Wolman's studies of money and real wages, and Easterlin's study of interstate differences in income. Some seek fruitful ways to measure changes in important economic variables, as in the study of the quality of credit. Some concentrate on ways to organize large bodies of interrelated materials that can provide a basis for considering the impact of change — the study of the structure of world trade and payments and the work on the quarterly flows of funds are examples. Some are content to develop methods of analysis or speedier ways to apply these methods to the analysis of changes in business conditions — as in the continuing work on the application of electronic computers.

In fact, however, few of our studies are completely specialized. Those of our investigators who are concerned primarily with interrelations among factors frequently find it necessary also to collect new data, make new measurements, and devise new methods of analysis. Those of our investigators who concentrate on developing or applying new methods of calculation or analysis seldom fail to see an advantage, even for their immediate purpose, in learning what the methods can teach when applied. Our exploratory studies

end up with some substantive results, as well as suggestions for research. And our other efforts give suggestions for further research as well as facts or explanations of relationships among facts.

Whatever the topic and however the approach, the studies complement one another, for they deal with the same economic world. The connections are closer than would be the case among economic studies generally, however. We do not pick subjects at random. We try to build on our earlier work and undertake investigations that will support one another. Thus, the study of trends in capital formation and financing complements the study of trends in production, employment, and productivity, and each makes use of materials borrowed from the other. The productivity trends study complements the study of cyclical fluctuations in productivity and costs, just as the latter is illuminated by and illuminates our past work on cyclical changes in wages and our current work on cyclical changes in hours, investment, and the like. The study of Soviet growth makes comparisons with indexes of American growth developed in our production studies, and the interpretation and analysis of the Soviet figures are guided by what was learned in the earlier work on production trends and in study of the production of industrial materials in World Wars I and II. Diverse as they may seem and necessarily influenced as they must be by accidents of availability of funds, personnel, data, and techniques, our current researches make up something like an organized effort.

Our new studies, for which I have reserved a separate word, also fit into our program of research.

### ***3. Studies Begun***

Twenty years ago, Wesley Mitchell pointed out that estimates of national income provide a useful guide to economic research. Today we would use as a "base map" for choosing and coordinating economic explorations the whole set of national economic accounts. This includes, or will ultimately include, estimates

of national income and product, interindustry and interregional flows of goods and money, and national wealth and balance sheets, each classified and cross-classified in various ways, and each linked with the others. If we pored over this map we would find plenty of dark areas that invite attention. Which we chose to

explore would depend primarily on the significance they promised for broad economic issues and their susceptibility to scientific treatment.

There are other criteria as well. We must start with some notion of how to deal with new areas. This means that we follow lines of research opened by our studies more frequently than we jump to entirely strange areas. Indeed, as I have implied, we count a study as less than satisfactory if it fails to uncover significant new questions or place old questions under a new light. We must also have, or feel able to find, the men with the interest and competence to deal with the kinds of problems that explorers of the new area will meet. Finally, since our general funds are limited, our choice is sometimes further restricted — more than it should be — to the studies for which special grants can be obtained.

During the year we were able to find the men and the means to pursue inquiries in a number of new areas. With the approval of the Executive Committee we began, or completed arrangements to begin, seven new studies. These relate to education, pensions, consumer purchases, wealth, housing, credit quality, and small business. Consideration of each of these areas gave rise to questions bearing on scientific or policy issues. In each we saw possibilities of worthwhile research that could add to economic knowledge.

Public and private expenditures on education run to many billions of dollars each year. Yet little has been done in any systematic and comprehensive way to view the educational process as in some degree a form of investment parallel to and complementing investment in tangible capital goods and in scientific and technical research and development. This is the aim of the new study on investment in education. Its immediate objectives are threefold. The first is to determine the volume of national resources devoted to education — including not only direct costs like teachers' salaries, but also the "use-value" of the stock of educational facilities, and the economic value of the time given by students, which is large even after allowing for the non-economic

activities in which students engage. A second objective is to measure the "returns" to education in so far as they are reflected by income differentials associated with differences in level of education, other factors held constant. These income differentials — the "education-premiums" — seem to have diminished over the years. It appears, however, that present premiums still imply high rates of return on investment in education. It would be valuable to estimate these implicit rates of return at different educational levels, and compare them with one another and with rates of return on other types of investment. The third objective is to devise a measure of the average educational level or "quality" of the labor force, a basic factor affecting the economic growth of the United States. Here, as in other sections of the study, it would be desirable to determine the comparative roles of formal and practical education; to separate the outlays on education that go to "maintain" the nation's total investment in education from the outlays that add to that investment; and to look into other relevant questions. But our first investigation will probably have to be limited to breaking ground for these inquiries. How far we can get is in any case uncertain; but even the modest study we have begun may help clarify thinking in the area of manpower and education by providing some quantitative indications of the economic costs and advantages of educational investment. The study is being financed by a grant from the Carnegie Corporation of New York, which has long been interested in this area, and is in the care of Gary S. Becker, of Columbia University.

A rather different area of public concern is the social security system and the private structure that stands by its side. In 1956, a committee of experts collaborated with our staff in a review of the work already done in one rapidly growing section of this area — organized provision for the aged and for surviving dependents, as embodied in public and private pension systems. The exploratory report of last year resulted from the discussions, which were made possible by a grant from the Life Insurance Association of America. We

hope the suggestions for research included in the report will stimulate further work by various agencies and scholars in this important area. On our part, certain of its suggestions will be followed up in two studies for which arrangements were recently concluded.

One study, supported by a grant from the Maurice and Laura Falk Foundation, will attempt to sketch a detailed picture of the public and private pension systems viewed as a whole. With the current structure delineated, the inquiry will then address itself to a number of questions: the rate of growth of the present system, as suggested by public discussions of the problem; the probable effects of the present and future system on the capital markets, taking account of the management policies and governmental regulations that influence the character and direction of investment of accumulated funds; and the probable effects of pensions on the level and composition of savings. The second study, financed by a grant from the Life Insurance Association of America, will concentrate on the character and significance of the commitments implicit in the pension system, and their bearing, particularly, on the distribution of income among various groups of the population. The questions involved in both studies are as difficult as they are important. Roger Murray of Columbia University will direct the project, and together with Daniel Holland and the other investigators in charge will try to gather information that can help clarify thought and guide policy in a controversial field.

Because of the importance of consumer purchases in the complex of factors that determine business conditions, serious efforts have been made in recent years to supplement the analysis of historical data by the direct questioning of consumers concerning their purchase plans. Virtually all these surveys have involved costly personal interviews. We were greatly interested, therefore, when we learned of the suggestive results obtained by Thomas Juster of Amherst College from an analysis of inexpensive mail questionnaires sent annually to its members by Consumers Union of the United States, a nonprofit, product-testing and

-rating organization. The replies obtained, far greater in number than available in most field surveys, lend themselves to cross-classifications in detail by significant demographic and economic factors. With the cooperation of Consumers Union, we arranged to subject the returns to detailed analysis, appointed Juster a Research Associate of the National Bureau, and placed him in charge. The cost of the investigation is being met in part by a grant from the Relm Foundation. Preliminary results obtained by Juster sustain our expectations that analysis of the Consumers Union materials will throw light on consumer plans and on the factors that mold the plans and determine the purchases actually made.

A major gap in economic knowledge concerns the distribution of wealth among individuals and the composition of the assets in individual balance sheets. Last year the Treasury Department made available to us their recent tabulation of 1953 federal estate tax returns. Robert J. Lampman of the University of Washington, appointed a Research Associate, has undertaken an analysis of the figures. Comparisons of the 1953 statistics will be made with earlier, less detailed, data previously analyzed.

National commitments to meet social needs as in housing can sometimes run into conflict with other national policies like the maintenance of economic stability. The history of home building and financing during 1953-57, which saw a sizable swing in volume of construction, the imposition and then relaxation of selective controls, and extensive operations of the Federal National Mortgage Association, among other developments, raises some interesting questions on this major issue. We are undertaking a review of these developments and a preliminary analysis of them. The study, primarily exploratory in character, is being directed by Leo Grebler. Grebler brings to it an extensive experience acquired in research and in governmental service.

In the course of our research on domestic corporate bonds, foreign government bonds issued in this country, urban mortgage loans on dwellings, urban mortgage loans on busi-

ness properties, and farm mortgage loans, we accumulated evidence that boom times may bring a relaxation of credit standards, thus greatly intensifying the problem of subsequent adjustment. This led us to pose the question whether objective measures of the quality of credit could be constructed on a current basis to guide lenders and others in responsible positions who have need for such information. In 1955, with the aid of a grant from the Association of Reserve City Bankers, we planned, and in 1956 with a grant from the Merrill Foundation for Advancement of Financial Knowledge, we began a study of credit quality in booms and depressions. The purpose of the study, as Moore reported last year, is to clarify the meaning of credit quality; devise and test different ways of measuring it; organize and analyze the data available in existing records; develop suggestions for the collection of new data; and extract, as well as can be done, the economic implications from the data viewed in the light of past experience and present conditions. Numerous types of data are being examined, among them the credit ratings of business firms, financial ratios of individual companies, examiners' appraisals of commercial bank loans and of agricultural credit, and loss and recovery rates on commercial bank credit in relation to type of loan extended.

During the course of the work on this project and on other studies at the National Bureau, we uncovered some important new materials inviting analysis. To enable us to take advantage of these opportunities, the Merrill Foundation provided additional funds. These will make it possible for us to extend the study a year or so beyond the original three-year term and carry it forward on a somewhat broader scale than originally contemplated. Topics to be added include: (1) an analysis of consumer credit quality, and the initiation, on an experimental basis, of a survey (perhaps quarterly) to provide current data not now available; (2) a study of the quality ratings on farm loans used by the Farm Credit Administration; and (3) an exploration of the possibilities of developing cur-

rent data on commercial bank loan quality and other useful financial information from bank examiner loan card files. Engaged in the study are Geoffrey H. Moore, George K. Brinegar, Donald P. Jacobs, Edward J. Kilberg, Philip A. Klein, and Victor Zarnowitz.

In November of 1957, the Chairman of the Board of Governors of the Federal Reserve System announced before the House Select Committee on Small Business that the System was embarking on a program of inquiry into small business financing. He mentioned also that a section of the study — the risks and returns in small business financing — would be the responsibility of the National Bureau. We were asked and we agreed to cooperate with the Federal Reserve System because of our interest in the problem of financing generally and because the particular study put in our charge could profit from and in turn contribute to our current study of credit quality. The study, for which Thomas Atkinson and Geoffrey Moore have chief responsibility, will attempt to develop and analyze information on credit experience by size of firm. It will try to show, also, whether and to what degree the cost and availability of credit is affected by differential credit standing among firms of various sizes under changing economic conditions.

The new studies of credit quality and of small business financing represent, as I have said, extensions or complements to studies still in process. All the new studies, however, illustrate in one way or another how our new research stems from work we have been doing and deals with questions to which we have devoted serious attention. The study of investment in education, for example, is a complement to the long series of studies of tangible capital formation that have been conducted by the National Bureau, and a sequel to our studies of income — for example, the study by Friedman and Kuznets on *Income from Independent Professional Practice*, the studies by Stigler on *Employment and Compensation in Education* and *Trends in Employment in the Service Industries*, and the study by Blank and Stigler on *The Demand and Supply of Scien-*

*tific Personnel*, as well as the several wage studies. The pension studies are closely connected with our studies of capital formation and financing, postwar capital markets, savings, and income distribution. Grebler's new study follows his own earlier research at the National Bureau on residential real estate, as well as the many studies others of our staff have done on housing and mortgages; and it

#### 4. *Conferences on Research*

The main work of the National Bureau consists of studies by its research staff. In this work we benefit greatly from the advice, assistance, and criticism of many collaborators: individuals, government bureaus, universities, research institutes, and business organizations. We are told the association is profitable also to our collaborators. Further, those of our staff members who are also on university faculties play a significant role in unifying and strengthening the efforts of the National Bureau and the universities to improve and disseminate economic knowledge.

Our collaborative efforts do not end here, however. In addition, the National Bureau acts as a center for cooperation in economic research by sponsoring and servicing two conference efforts, besides occasional special conferences. This activity provides an added opportunity for the National Bureau to contribute to research throughout the country. We also find the conferences stimulating to our own staff and helpful in planning and carrying out the research we undertake ourselves.

The regular conference groups include, at present, the Universities-National Bureau Committee for Economic Research, and the Conference on Research in Income and Wealth.

The Universities-National Bureau Committee was originally organized in 1935 and is now made up of representatives of twenty-nine universities offering graduate work in economics and emphasizing research, together with representatives from the National Bureau and several members at large connected with other organizations interested in economic re-

is concerned, also, with one of the significant questions raised, in a different context, in the recent report on *Federal Lending and Loan Insurance*. And the study of consumer purchase plans is related to and will profit by the research on the consumption "function," the study of businessmen's expectations, and the conference on anticipations data — one of the conferences to which I shall now turn.

search. It holds conferences designed to assess the state of knowledge and stimulate research in significant areas of economics.

The Conference on Research in Income and Wealth was organized in 1936 by the National Bureau in cooperation with several universities, government agencies, and other research institutions. Its membership consists of individuals both expert and active in its field of interest. Sessions are devoted to the presentation and discussion of reports on methodology, data, and substantive findings in its field, which it defines broadly to include not only income and wealth but also consumption, saving, investment, balance sheets, and the like.

Topics for conferences are discussed within the Universities-National Bureau Committee or Income Conference as a whole, determined by their respective executive committees, and planned in detail by special program committees set up for the purpose. For example, the conference on measurement and behavior of unemployment, the proceedings of which are reported in the accompanying list of conference publications, was planned by two experts from the federal government, two from universities, an official in a state government agency, a member of our own staff, and two other persons. Nine papers were prepared and circulated before the sessions began, and the discussion was led by formal discussants picked in advance. The conference was attended by experts invited from numerous institutions in different parts of the United States and Canada, who contributed actively to the proceedings.

The National Bureau provides the rather

modest funds needed by the conference groups, houses their secretaries, makes arrangements for the meetings, duplicates and distributes the papers discussed at the conferences, and edits and arranges publication of the proceedings when publication is recommended by the program and executive committees of the conference groups. Because the conference volumes are not reports on research by the National Bureau's staff (though they frequently include interim reports on these researches), they are exempted from the rules governing submission of manuscripts to, and critical review by, the National Bureau's Board of Directors. However, in every case the volumes are reviewed by the Director of Research and offered to the public as worthwhile contributions to the discussion of significant economic questions.

To date, there have been published nine volumes of papers, together with conference discussion and usually also an introduction, presented at conferences of the Universities-National Bureau Committee; and twenty-one volumes of proceedings of the Conference on Research in Income and Wealth, including several monographs by individual scholars prepared under its auspices or with its cooperation. In addition, the National Bureau has

issued five volumes prepared by or with the cooperation of the Conference on Price Research, no longer active, and one set of proceedings of a special conference called by the National Bureau itself. Recently published titles, titles of volumes soon to appear, and conferences arranged for 1958 are given in the accompanying list. Further information on the 1958 conferences, one on productivity and the other on the relation between population and economic change, is given in Part Three, below.

The volumes listed will have to speak as well as they can through their titles.

I should mention, however, that *Consumer Instalment Credit: Conference on Regulation* reports the proceedings of the special conference called by the National Bureau itself. The proceedings constitute two volumes in the six-volume Federal Reserve study of consumer instalment credit made at the request of the President of the United States. The conference was devoted to a discussion, by economists from leading universities and research institutions, of available evidence on changes in consumer instalment debt, the ways in which they affect and are affected by other processes of the economy, and the feasibility and desirability of controlling such credit.

## CONFERENCES

### PROCEEDINGS PUBLISHED

*Problems of Capital Formation: Concepts, Measurement, and Controlling Factors*, Studies in Income and Wealth 19

*The Measurement and Behavior of Unemployment*, Special Conference Series 8

*Problems in the International Comparison of Economic Accounts*, Studies in Income and Wealth 20

*Regional Income*, Studies in Income and Wealth 21

*Consumer Instalment Credit: Conference on Regulation*, Part II, Volumes 1 and 2

*Problems in International Economics*, Special Conference Series 9

*A Critique of the United States Income and Product Accounts*, Studies in Income and Wealth 22

### PROCEEDINGS IN PRESS

*An Appraisal of the 1950 Census Income Data*, Studies in Income and Wealth 23

### PROCEEDINGS GOING TO PRESS

"U. S. and Canadian Income and Investment in the 19th Century," Studies in Income and Wealth 24

"The Quality and Economic Significance of Anticipations Data," Special Conference Series 10

### CONFERENCES ARRANGED

"Output, Input, and Productivity," 1958 Sessions of the Conference on Research in Income and Wealth

"Interrelation of Demographic and Economic Change," 1958 Conference of the Universities-National Bureau Committee for Economic Research

To illustrate one of the chief functions of the conferences, I might say, further, that the conference on regional income was designed and made it possible to bring together into a fruitful discussion three groups of economists: those concerned with and experienced in conceptual and measurement problems at the national level — largely the members of the Conference on Research in Income and Wealth; investigators, mostly outside the Conference, scattered through a dozen or more states and occupied with the preparation of state, county, and other local-area estimates of income for administrative, marketing, and other uses; and persons interested in “spatial” economics, in which the geographical distribution of resources and production is a matter of prime interest and the cost of transportation a significant variable. The conference took place at Duke University, a center of research in regional economics.

The conference on nineteenth-century statistics of income and wealth was held by the Income Conference in cooperation with the Economic History Association. It provided an opportunity for the scholars of three disciplines — economics, history, and statistics — to meet one another and exchange views on a

subject of common interest, the quantitative aspects of the economic growth of two “underdeveloped” countries, nineteenth-century United States and Canada. Collaboration of this sort is one of the objectives also of the conference on the relation between demographic and economic change arranged by the Universities–National Bureau Committee for this year.

Thought is currently being given to future conferences on a variety of challenging topics. Closest to realization are one on the money-flows type of social accounting, which the Income Conference is planning, and the Universities–National Bureau Committee’s proposed conference on public finance. Others are mentioned in Part Three, below.

The conferences in which we and our collaborators join have proved to be useful educational devices, as well as instruments for fostering research. If additional funds were available, they could be made a still more effective means of education and training. Their potentialities, and also those of the Research Associateships to which at present we can appoint only one or two promising young investigators each year, deserve attention.

## ***5. The Road Before Us***

It is now over twenty years since the Great Depression gave rise to widespread fears of economic maturity and stagnation. These fears have receded but not vanished, and to them have been added other sources of concern about the years ahead. We ask not only whether our future rate of growth will equal or exceed our past rate of growth. We wonder what growth has been and will be in Soviet Russia. We ask whether our rate of growth will exceed that of Russia in the years ahead.

Our studies of Russian output, and the studies of others in this difficult area, can hardly be conclusive even about the past. Of the main reason, everyone is aware: the Soviet government’s policy of suppressing information. The policy is still largely in effect, despite the release during the past year or two of

several Russian statistical handbooks. But there is another reason. Measuring total output is inherently difficult because of the changes that accompany economic development in the kinds and qualities as well as quantities of products. Use of prices to make diverse outputs commensurate gives results that vary with the period to which the prices relate, for changes in relative prices also accompany economic development. And when the prices are set by government order, as in Russia, the ambiguities are multiplied. For these and other reasons, in our study of the rate of growth of Russian output we have largely confined our measurements to basic materials and products and have experimented with a variety of “bases” and methods of viewing Russian output. Nutter’s calculations,

which must be considered in full awareness of the fact that they necessarily use statistics published by the Russians, illustrate the range of results obtained.

Of two things we can be reasonably certain, however.

First, as Nutter and others have emphasized, the available Russian statistics on the output of individual industrial products and materials are inconsistent with the official Russian index of total industrial output. None of the indexes of Soviet industrial output that he and other Western scholars have calculated, not even those showing the most rapid rates of increase, come near the official Russian index. However, this is no ground for complacency. For Nutter's indexes suggest, second, a rate of growth of Russian industry, averaged over the period since 1913, that is approximately equal to that of American industry over the same period. If true, this is a remarkable fact. It means that despite the enormous setbacks suffered by Russia during World War I, the Revolution, the Civil War that followed, and the second World War, she has been able to force a high average rate of industrial growth. Of course, the comparison can be put rather differently, though no less accurately, as follows: Despite the very rapid spurts of Russian industrial output during some portions of the interwar period and since World War II, she has not yet been able to do more — after offsetting the declines mentioned — than attain a net rate of industrial growth about equal to ours.

This is not the whole story of Russian output. The failure of Russian agriculture to push output up at a rate much exceeding population growth, if indeed even matching it (the Russian statistics on agriculture are conflicting and scanty, as George Kuznets indicates); the Russian neglect of housing and the service industries; the heavy concentration of industrial output on investment and military goods, at the expense of consumer goods; the absence of slack in her use of productive capacity, vividly illustrated in Williams' forthcoming report on Russian transportation; the drain on satellite and conquered areas to build

up her capacity and output; the human costs of forced industrialization — all these must enter the account. They are relevant not only to the interpretation of past developments but also to the estimation of Russia's future rate of industrial growth.

Nevertheless, we are confronted with the present fact of rapidly growing industrial output in Soviet Russia; and the fact that, since the beginning of 1957, output in this country has been virtually level and then declining. There can be little question, therefore, of the need to accelerate our rate of growth. This means more resources, fuller utilization of resources, and progressive increase in their productivity. Apart from the problem raised by Russia's growing power, there still remain serious unsatisfied human wants among our people and large masses of the earth's population that only more resources and increased productivity will succeed in meeting.

It is clear to everyone that investment in physical and biological science, in technology, and in education will bring the increased knowledge essential to attain these objectives. It is not as widely recognized that growth, and effective national policy for growth, hinge in part also on the state of social science.

The work done at the National Bureau and other centers of economic research over the years has added to the stock of knowledge concerning the operations of the economy. A generation ago it would have been impossible to speak with confidence of the rate or character of growth in this country or elsewhere. Men of affairs and government officials charged with high responsibilities had only a vague notion of the change in business conditions or employment from one quarter to another, or what to do to maintain stability. The simplest facts about the distribution of income and the causes of poverty were matters for debate and each man had his own opinion about them. Less than a generation ago the field could be swept by a consumption function that had no future apart from its past.

Yet economic knowledge is still very far from satisfactory. Our responsibility to determine important economic facts and to in-

terpret these facts in a scientific and impartial manner continues to be well worth shouldering.

The world has changed in many respects, and so have the particular questions of concern to it. The particular subjects we study also have changed in various ways. Has much change occurred, however, in the importance of the basic questions to which we address ourselves, whatever the title of the project — questions concerning the nations' production, consumption, income, labor force, capital, business organization, trade, government activity, prices, and finance? This is highly doubtful. Whatever the current problem, knowledge of important economic facts can strengthen the hands of those who must deal with it. The "new" problem of inflation, for example, which troubled many people a year or two ago, and is troubling some now, may trouble many again before long. The studies of money supply, the business cycle investigations, the studies of wages and prices, the studies of productivity, the financial researches, the studies of wealth and of balance sheets — each deals with one or another fact important to anyone concerned with the causes, consequences, and means of controlling inflation. So long as the main features of our economy endure, basic research of the type we do will be put to practical use.

Few of our studies are directed to specific policy questions. As I have said, we must and we do have public issues in mind when we select subjects for investigation. Whether we should deal more directly with problems of public policy is one of the questions we must ask ourselves. Our practice of abstaining from policy recommendation does not preclude, and should aid, the critical examination of policy; we may find more work on policy questions beneficial to the basic research that is our prime function.

That the National Bureau's prime function is basic research, it is our duty to insist. The need for guidance in the practical conduct of social life seemed also to Alfred Marshall "never so urgent as now," and he emphasized that "we are bound, before entering on any study, to consider carefully what are its uses."

Yet, he went on to say,

"... We should not plan out our work with direct reference to them. For by so doing we are tempted to break off each line of thought as soon as it ceases to have an immediate bearing on that particular aim which we have in view at the time: the direct pursuit of practical aims leads us to group together bits of all sorts of knowledge, which have no connection with one another except for the immediate purposes of the moment; and which throw but little light on one another. Our mental energy is spent in going from one to another; nothing is thoroughly thought out; no real progress is made.

"The best grouping, therefore, for the purposes of science is that which collects together all those facts and reasoning which are similar to one another in nature: so that the study of each may throw light on its neighbor. By working thus for a long time at one set of considerations, we . . . make progress slowly but surely. The practical uses of economic studies should never be out of the mind of the economist, but his special business is to study and interpret facts and to find out what are the effects of different causes acting singly and in combination."<sup>1</sup>

If we should turn a larger share of our efforts in the direction of policy analysis, we should choose the subjects for study with several things in mind. One is the importance of the issue to the public at large. Another is the susceptibility of the issue to scientific treatment. Still another is the contribution that the analysis might make to general economic knowledge and thus to the resolution of other issues as well.

Is there any question of the solidity of the principles on which our organization takes its stand and which guide us in our work? Twenty-eight years ago the National Bureau's annual report was prefaced by a statement of these principles. They are worth repeating, and once again they appear at our masthead.

Concentration on matters of national importance, care in attacking them, interest in quantitative results, checks and tests of whatever results we get, full presentation of infor-

mation and methods used so that others also may check our results, divorce from policy recommendation (but not from analysis of policy), an organization and procedure to ensure that bias is kept out of our reports — this is the road we have traveled.

In a world beset with urgent problems it is easy to become impatient with this costly and time-consuming way. Some time and money could be saved if we made no mistakes. A good deal less of both would be needed if we cut corners, jumped to conclusions, refrained from seeking criticism, and published our reports without the full information required to satisfy ourselves and others that the results they contain are warranted. But this error we can avoid. It is essential to avoid it if research is to generate knowledge and not merely printed reports. This is something investigators in all scientific fields have learned from long experience.

Here is another voice that speaks to us across the years:

“... I have taken the pains, and been at the charge, of setting out those Tables, whereby all men may both correct my Positions, and raise others of their own: For herein I have, like a silly Schole-boy, coming to say my Lesson to the World (that Peevish, and Tetchie Master) brought a bundle of Rods wherewith to be whipt, for every mistake I have committed.”<sup>2</sup>

The scientific work of many generations teaches the lesson we try to take to heart.

SOLOMON FABRICANT  
*Director of Research*

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<sup>1</sup> *Principles of Economics*, London, Macmillan, 8th ed., 1920, pp. 42, 39-40.

<sup>2</sup> John Graunt, *Natural and Political Observations made upon the Bills of Mortality*, London, 1662. Johns Hopkins reprints of economic tracts, Baltimore, 1939, p. 18.