

## ECONOMICS - A HALF CENTURY OF RESEARCH 1920-1970

# 50th ANNUAL REPORT SEPTEMBER 1970 NATIONAL BUREAU OF ECONOMIC RESEARCH, INC.

ALL RIGHTS RESERVED

**44** 

NATIONAL BUREAU OF ECONOMIC RESEARCH, INC. 261 MADISON AVENUE, NEW YORK, N. Y. 10016

PRINTED IN THE UNITED STATES OF AMERICA

\* ...\*

COPYRIGHT © 1970 BY

ą

The National Bureau of Economic Research was organized in 1920 in response to a growing demand for objective determination of the facts bearing upon economic problems, and for their interpretation in an impartial manner. The National Bureau concentrates on topics of national importance that are susceptible of scientific treatment.

The National Bureau seeks not merely to determine and interpret important economic facts, but to do so under such auspices and with such safeguards as shall make its findings carry conviction to all sections of the nation.

No report of the research staff may be published without the approval of the Board of Directors. Rigid provisions guard the National Bureau from becoming a source of profit to its members, directors, or officers, and from becoming an agency for propaganda.

By issuing its findings in the form of scientific reports, entirely divorced from recommendations on policy, the National Bureau hopes to aid all thoughtful men, however divergent their views of public policy, to base their discussions upon objective knowledge as distinguished from subjective opinion.

The National Bureau assumes no obligation toward present or future contributors except to determine, interpret, and publish economic facts for the benefit of the nation at large, and to provide contributors with copies of its publications.

.

02/22/6 10,002

### RELATION OF THE DIRECTORS TO THE WORK AND PUBLICATIONS OF THE NATIONAL BUREAU OF ECONOMIC RESEARCH

1. The object of the National Bureau of Economic Research is to ascertain and to present to the public important economic facts and their interpretation in a scientific and impartial manner. The Board of Directors is charged with the responsibility of ensuring that the work of the National Bureau is carried on in strict conformity with this object.

2. The President of the National Bureau shall submit to the Board of Directors, or to its Executive Committee, for their formal adoption all specific proposals for research to be instituted.

3. No research report shall be published until the President shall have submitted to each member of the Board the manuscript proposed for publication, and such information as will, in his opinion and in the opinion of the author, serve to determine the suitability of the report for publication in accordance with the principles of the National Bureau. Each manuscript shall contain a summary drawing attention to the nature and treatment of the problem studied, the character of the data and their utilization in the report, and the main conclusions reached.

4. For each manuscript so submitted, a special committee of the Board shall be appointed by majority agreement of the President and Vice Presidents (or by the Executive Committee in case of inability to decide on the part of the President and Vice Presidents), consisting of three directors selected as nearly as may be one from each general division of the Board. The names of the special manuscript committee shall be stated to each Director when the manuscript is submitted to him. It shall be the duty of each member of the special manuscript committee to read the manuscript. If each member of the manuscript committee signifies his approval within thirty days of the transmittal of the manuscript committee withholds his approval, the President shall then notify each member of the Board, requesting approval or disapproval of publication, and thirty days additional shall be granted for this purpose. The manuscript shall then not be published unless at least a majority of the entire Board who shall have voted on the proposal within the time fixed for the receipt of votes shall have approved.

5. No manuscript may be published, though approved by each member of the special manuscript committee, until forty-five days have elapsed from the transmittal of the report in manuscript form. The interval is allowed for the receipt of any memorandum of dissent or reservation, together with a brief statement of his reasons, that any member may wish to express; and such memorandum of dissent or reservation shall be published with the manuscript if he so desires. Publication does not, however, imply that each member of the Board has read the manuscript, or that either members of the Board in general or the special committee have passed on its validity in every detail.

6. Publications of the National Bureau issued for informational purposes concerning the work of the Bureau and its staff, or issued to inform the public of activities of Bureau staff, and volumes issued as a result of various conferences involving the National Bureau shall contain a specific disclaimer noting that such publication has not passed through the normal review procedures required in this resolution. The Executive Committee of the Board is charged with review of all such publications from time to time to ensure that they do not take on the character of formal research reports of the National Bureau, requiring formal Board approval.

7. Unless otherwise determined by the Board or exempted by the terms of paragraph 6, a copy of this resolution shall be printed in each National Bureau publication.

> (Resolution adopted October 25, 1926, and revised February 6, 1933, February 24, 1941, and April 20, 1968)

#### OFFICERS

Arthur F. Burns, Honorary Chairman Theodore O. Yntema, Chairman Walter W. Heller, Vice Chairman John R. Meyer, President Thomas D. Flynn, Treasurer Douglas H. Eldridge, Vice President-Executive Secretary Victor R. Fuchs, Vice President-Research F. Thomas Juster, Vice President-Research Hal B. Lary, Vice President-Research Robert E. Lipsey, Vice President-Research Edward K. Smith, Vice President Joan R. Tron, Director of Publications

#### DIRECTORS AT LARGE

Joseph A. Beirne, Communications Workers of America

Arthur F. Burns, Board of Governors of the Federal Reserve System Wallace J. Campbell, Foundation for Cooperative Housing

Erwin D. Canham, Christian Science Monitor Robert A. Charpie, The Cabot Corporation Solomon Fabricant, New York University Frank W. Fetter, Hanover, New Hampshire Eugene P. Foley, Dreyfus Corporation Marion B. Folsom, Rochester, New York Eli Goldston, Eastern Gas and Fuel Associates Crawford H. Greenewalt, E. I. du Pont de Nemours & Company David L. Grove, IBM Corporation Walter W. Heller, University of Minnesota Vivian W. Henderson, Clark College John R. Meyer, Yale University J. Irwin Miller, Cummins Engine Company, Inc. Geoffrey H. Moore, Bureau of Labor Statistics J. Wilson Newman, Dun & Bradstreet, Inc. James J. O'Leary, United States Trust Company of New York Robert V. Roosa, Brown Brothers Harriman & Co.

Boris Shishkin, AFL-CIO

Lazare Teper, ILGWU

Donald B. Woodward, Riverside, Connecticut Theodore O. Yntema, Oakland University

DIRECTORS BY UNIVERSITY APPOINTMENT

Moses Abramovitz, Stanford Gary S. Becker, Columbia Charles H. Berry, Princeton Francis M. Boddy, Minnesota Tom E. Davis, Cornell Otto Eckstein, Harvard Walter D. Fisher, Northwestern R. A. Gordon, California Robert J. Lampman, Wisconsin Maurice W. Lee, North Carolina Lloyd G. Reynolds, Yale Robert M. Solow, Massachusetts Institute of Technology Henri Theil, Chicago Thomas A. Wilson, Toronto Willis J. Winn, Pennsylvania

#### DIRECTORS BY APPOINTMENT OF OTHER ORGANIZATIONS

 Emilio G. Collado, Committee for Economic Development
 Thomas D. Flynn, American Institute of Certified Public Accountants
 Nathaniel Goldfinger, AFL-CIO
 Harold G. Halcrow, American Agricultural Economics Association
 Douglas G. Hartle, Canadian Economics Association
 Walter E. Hoadley, American Finance Association
 Douglass C. North, Economic History Association
 Murray Shelds, American Management Association of Business Economists
 Willard L. Thorp, American Economic Association

DIRECTORS EMERITI

Percival F. Brundage Gottfried Haberler Albert J. Hettinger, Jr. George B. Roberts Jacob Viner Joseph H. Willits

#### SENIOR RESEARCH STAFF

Gary S. Becker Charlotte Boschan Philip Cagan Alfred H. Conrad James S. Earley Solomon Fabricant Milton Friedman Victor R. Fuchs Raymond W. Goldsmith Jack M. Guttentag Daniel M. Holland F. Thomas Juster C. Harry Kahn John F. Kain John W. Kendrick Irving B. Kravis Hal B. Lary Robert E. Lipsey John R. Meyer Jacob Mincer Ilse Mintz Geoffrey H. Moore\* M. Ishaq Nadiri Nancy Ruggles Richard Ruggles Anna J. Schwartz Robert P. Shay George J. Stigler Victor Zarnowitz

\* On leave.

## Contents

T D ADDR DRESENTED TO THE BOARD OF DIRECTORS	PAGE
AT THE SPRING MEETING, 1970	1
Introduction-John R. Meyer	3
On the Measurement of Economic and Social Performance-F. Thomas Juster	8
II. STAFF REPORTS ON RESEARCH UNDER WAY	25
1. ECONOMIC GROWTH	26
Productivity, Employment, and Price Levels-Solomon Fabricant	26
Price Trends and Economic Growth-Solomon Fabricant	<b>2</b> 6
Interrelated Factor Demand Functions-M. I. Nadiri and Sherwin Rosen	28
Problems in the Measurement of Nonresidential Fixed Capital–Robert J. Gordon	29
Problems in Predicting the Kate of Inflation-Kobert J. Gordon	30
Postwar Productivity Trends in the Onlied States—John W, Kenunck Other Studies	22
Dublic Finance	33
Introduction—John Bossons	33
Measuring the Effects of Tax Substitutions-John Bossons and Carl S. Shoup	34
Industry Price/Output Effects of Substituting a Value-Added Tax	
for a Corporate Profits Tax-Bruce L. Petersen	35
The Initial Differential Incidence of Alternative Income Tax Systems–John Bossons	35
The Cost and Incidence of Transfer Payment Programs in Canada—	
John Bossons, Colin J. Hindle, and T. Russell Robinson	36
Negative Income Laxation and Poverty in Ontario-Colin J. Hindle	30
Liject of I axaiion on Fersonai Eljori–Daniel M. Holiana The Effects of Alternative Unemployment Insurance Programs	20
John Bossons and James Hosek	38
Inter- and Intrastate Analyses of Grants-in-Aid and Local Fiscal Activity-	50
Stephen P. Dresch and Raymond J. Struyk	39
2. NATIONAL INCOME, CONSUMPTION, AND CAPITAL FORMATION	40
Introduction_F Thomas Juster	40
Household Capital Formation and Savings-F. Thomas Juster	41
The Design and Use of Economic Accounts–Nancy D. Ruggles and Richard Ruggles	43
Studies in the National Income Accounts-John W. Kendrick	44
Measurement and Analysis of National Income (Nonincome Income)-Robert Eisner	44
Capital Gains and the Theory and Measurement of Income-Michael B. McElroy	45
3. URBAN AND REGIONAL STUDIES	46
Introduction-John F. Kain	46
Modeling the Urban Housing Market-Gregory K. Ingram	48
The Detroit Housing Consumption-Residential Location Study-Stephen P. Dresch	49
Residential Location Decisions-Stephen Mayo	50
Metropolitan Moving Behavior-John F. Kain and H. James Brown	51
Housing Consumption, Housing Demand Functions, and Market-Clearing Models-	50
Manion K. Straszheim The Demond for Housing, Invine B. Silver	52
A Housing Market Model Inving P. Silver	55
An Analysis of Ghetto Housing Markets-John F Kain and John M Ouioley	54
Industrial Location within Metropolitan Areas—Franklin James and Raymond J Struvk	56
Ghetto Employment Problems-David Gordon	56
Migration and Employment in Southern Metropolitan Areas-Joseph J. Persky	57
Research on Regional Unemployment-Masanori Hashimoto	58

	PAGE
4. HUMAN RESOURCES AND SOCIAL INSTITUTIONS	61
Introduction-F. Thomas Juster and Gary S. Becker	61
Education Studies	63
Human Capital Analysis of Personal Income Distribution-Jacob Mincer	63
Education and Consumption Patterns_Robert T. Michael	64
Time Spent In and Out of the Labor Force by Males-Gary S. Becker	65
Economic Growth and the Distribution of Labor Income-Michael Tannen	65
Net Returns to Education-Paul Taubman and Terence Wales	65
Learning and Knowledge in the Labor Market-Sherwin Rosen	67
Education and Savings Behavior-Lewis C. Solmon	68 70
NBER-Thorndike Sample—F Thomas Juster	70
The Use Value of Education—Finis Welch	71
Aptitude, Education, and Earnings Differentials-John C. Hause	72
Comparison of Measures of the Growth in Educational Output-Roger E. Alcaly	
and V. K. Chetty	73
An Economic Analysis of the Courts-William M Landes	74
Participation in Illegitimate Activities and the Effectiveness of Law Enforcement—	/ 7
Isaac Ehrlich	76
5. BUSINESS CYCLES	78
Introduction—F. Thomas Juster	78
Money-Milton Friedman and Anna I Schwartz	79 70
Study of Short-Term Economic Forecasting–Victor Zarnowitz	81
An Analysis of the Forecasting Properties of U.S. Econometric Models-	
Michael K. Evans, Yoel Haitovsky, and George I. Treyz	82
Business Cycle Analysis of Econometric Model Simulations–Victor Zarnowitz,	
Charlotte Boschan, and Geoffrey H. Moore	84
Determinants of Investment_Robert Eisner	86
	00
6. FINANCIAL INSTITUTIONS AND PROCESSES	86
Interest Rates-Jack M. Guttentag	86
Interest Rates and Other Characteristics of Income Property Mortgage Loans-	07
Koyal Shipp, Kobert Moore Fisher, and Barbara Opper A Study of the Cibson Paradox, Thomas I Sargent	87 88
Institutional Investors and the Stock Market-Raymond W Goldsmith	89
Unions as Financial Institutions-Leo Troy	89
Performance of Banking Markets	90
Performance of Banking Markets in the Provision of Services to Business-	00
Donald P. Jacobs Banking Structure and Partormance in Consumer Credit Markets Paul F. Smith	90
Behavior of the Commercial Banking Industry, 1965-67: A Microeconometric	91
Study–David T. Kresge	91
Other Studies	92
7 STUDIES IN INDUSTRIAL ORGANIZATION	92
Economics of Health	02
An Econometric Analysis of Spatial Variations in Mortality Rates by Race	92
and Sex–Morris Silver	92
The Demand for Health: A Theoretical and Empirical Investigation-Michael Grossman	93
An Economic Analysis of Accidents-William M. Landes	95
Expenditures for Physicians Services—Victor K. Fuchs and Marcia J. Kramer Socioeconomic Determinants of Hospital Use—K. K. Ro	90 06
The Ownership Income of Management–Wilbur G. Lewellen	96
Diversification in American Industry-Michael Gort	97

	PAGE
8. INTERNATIONAL STUDIES	98
Introduction—Hal B. Lary	98
The Relation of U.S. Manufacturing Abroad to U.S. Exports-	
Robert E. Lipsey and Merle Y ahr Weiss	99
The Role of Prices in International Trade-Irving D. Kravis and Robert E. Lipsey The Diffusion of New Technologies-Altred H. Conrad	99 100
Exchange Control, Liberalization, and Economic Development—	100
Jagdish N. Bhagwati and Anne O. Krueger	103
The Pattern of Exports and Import-Substitution in an Outward-Looking Economy:	
Korea-Seiji Naya	104
Foreign Holdings of Liquid Dollar Assets—J. Herbert Furth and Raymond F. Mikesell Gradit Banking and Financial Flows in Fastern Furone—George Garuy	105
Credit, Danking, and I manetar I lows in Lastern Europe—George Gurvy	100
9. ECONOMETRICS AND MEASUREMENT METHODS	107
Analysis of Long-Run Dependence in Time Series: The R/S Technique-	
Benoit B. Mandelbrot	107
Analysis of Time Series–John C. Hause	108
Papers on Statistical and Economic Methodology-Yoel Haitovsky	109
Experimentation with Nonlinear Regression Programs—Sidney Jacobs	110
Thomas I Sargent	111
Thomas . Dargent	111
10. ELECTRONIC COMPUTER SERVICES IN SUPPORT	
OF ECONOMIC RESEARCH	111
Introduction—Charlotte Boschan	111
Operations of the Data Processing Unit-Charlotte Boschan	112
NBER Computer Operations at New Haven-Sanford Berg	113
Progress Report on Project RIPP-Richard Ruggles and Nancy D. Ruggles	113
Ine National Bureau Data Bank—Charlotte Boschan Programmed Determination of Cyclical Turning Point and Timing Measures	113
Charlotte Boschan	114
III. CONFERENCES ON RESEARCH	117
Conference on Research in Income and Wealth	118
Universities-National Bureau Committee for Economic Research	118
Universities-National Bureau Conference on the Application of the Computer	
to Economic Research	120
IV. REPORT ON NEW PUBLICATIONS	121
Introduction–Joan R. Tron	122
Reports Published Since June 1969	122
Publications Forthcoming	120
V ODC ANIZ ATION	107
V. OKGANIZATION	127
Directors and Officers—Douglas H. Elariage Desearch Fallowships Victor P. Fuchs	128
Staff Seminars—W M Landes	130
The National Bureau's Fiftieth Anniversary Program–Nancy Steinthal	132
VI. ROSTER OF NATIONAL BUREAU STAFF	135
VII. PUBLICATIONS 1920–1970	139
	107
VIII. FINANCES AND SOURCES OF SUPPORT	153
	100

Papers Presented to the Board of Directors at the Spring Meeting, 1970

÷ 17

## INTRODUCTION

### John R. Meyer

Strong historical antecedents support the view that economic research has been best when it has been relevant. Certainly, that historical lesson seems authenticated when one looks back over the NBER's first fifty years. Indeed, the Bureau was started because men of affairs, of many political and philosophical viewpoints, perceived a strong need to establish as objectively as possible the facts about certain economic policy issues of their times.

At the Bureau's inaugural, two central policy questions dominated all others. The first of these was how income and wealth were distributed among different groups in society. The second was a concern with how to avoid major economic depressions and all the social and human losses attendant thereon. Both of these issues, that of distribution of the national wealth and the avoidance of business cycles, still remain with us. But I think it is safe to assert that the urgency and perceived severity of these issues, particularly the cyclical one, is a good deal less today than it was fifty years ago—and in no small part because of the NBER's contributions. The distribution question, for example, though it remains quite cogent, has assumed new dimensions. No longer is the focus exclusively on the allocation to different wealth classes. Increasingly, the issues of concern are how different minority groups, regions, and organizations participate in the national wealth and its growth over time.

In its fifty years of existence the NBER has not concentrated, of course, on only two problems. As the years have gone by, the Bureau has undertaken research in many other areas of policy concern. To a considerable extent these other interests have focused on what makes the national economy grow. Among the questions addressed have been: How do we measure productivity? How do we mobilize financial resources for investment in the human and physical capital needed to increase productivity? How do we organize our industry and market structure so as to provide the proper incentives for growth?

Certain practical lessons about quantitative economic research seem also to have been learned over the course of the last half century at the Bureau. We have learned, for example, that good quantitative research in economics can be expensive, both in terms of time and money. We have also learned that, to be done properly, it usually requires some minimum scale, again of time and money. As a rough rule of thumb, I would guess that effective quantitative research in economics involves projects of at least two or three years duration and no fewer than three to four professionals simultaneously. But I should immediately confess that these numbers are based more on intuition than on any hard empirical research or information!

Nevertheless, if correct, certain important conclusions about the organization of good empirical research flow from these observations. The first of these, quite simply, is that the basic problem in designing quantitative research programs in economics is to identify problems as early as possible, and ones that are likely to be with us for some time into the future.

The negative inferences to be drawn from this rule are quite as important,

perhaps more so, than the positive ones. The rule obviously suggests, for example, that the more transitory policy problems are probably well avoided as topics for serious quantitative research. It would imply, in short, a focus on structural problems—on avoiding investigation of the symptomatic as contrasted with basic causal or behavioral relationships.

An emphasis on longer-term structural problems has several implications. First, in today's context it suggests a concentration on the study of growth processes. Second, it implies the need for a fairly broad historical perspective underlying the research design. Third, it suggests an emphasis on dynamic as contrasted with static models. Fourth, it would argue for less concern about equilibrium conditions and more involvement with the processes by which we move from one equilibrium to another. Finally, it would point toward a very considerable focus on technological change and the processes by which that change is achieved.

All this was very well summarized years ago when it was said, I believe by Schumpeter, that "the really important economic problems are typically identified with what the economist puts in *ceteris paribus*." Changes in technology, tastes, and income distribution are typical items economists hold constant, and they are surely among the least constant of forces in our real world.

In designing a good research program in quantitative economics the major problem thus becomes that of identifying the substantive issues that will concern economic policy makers five years or a decade hence. That must be the constant preoccupation. With that in mind, we at the Bureau have sought the help of others in making such identifications, and have organized the effort into a series of colloquia to commemorate our fiftieth anniversary. The details of these colloquia are discussed elsewhere in this report (p. 132). Suffice it to say here that we have organized these meetings under six major headings, representing research interests of long-standing concern and involvement: (1) business cycles and forecasting; (2) public finance and expenditures; (3) human capital and its development; (4) financial institutions and markets; (5) the processes of economic growth; and (6) industrial organization and the functioning of markets.

As we begin this systematic survey of our research priorities for the next decade, I suspect that we shall find that the future policy problems quite naturally fall under three major headings. The first of these will be what we might call problems that "constitute more of the same." The second will be mutations or adaptations of present interests and problems. The third, and by far the most difficult to identify, will be entirely new departures and policy interests.

Thus, I shall hardly be surprised if we conclude that some problems of the 70's are nothing other than a continuation of problems already with us. To include these in our research interests it is really only necessary to decide that they are not likely to be solved quickly. A few examples quickly come to mind: understanding urban structure, that is, the ways in which urban complexes evolve and change over time in response to economic, political, legal, and social conditions; better comprehension of the impact of inflation and changes in industrial, demographic, and market composition on the ways in which we save and allocate investable funds; the relationships between local, state, and federal public finance as outlined in our last *Annual Report* by Bossons and Shoup; or the problems and questions raised by changes in international comparative advantage as suggested by Lary's survey in last year's *Annual Report*. One hardly needs much insight to suspect that all of these problems will be of concern for at least one more decade or so!

Similarly, certain problems of the 70's can be forecast simply because they will represent mutations of present problems. For example, economists almost surely will try to measure some of the negative aspects or externalities of economic activity. Certain environmental effects, such as air and water pollution, are perhaps the most obvious subjects for such attention; at least the most widely discussed. But there are many others. For example, deterioration in performance caused by increased congestion on major public transport facilities, such as highways or airports, clearly constitutes another area of important negative externalities worthy of investigation.

In general, the study of negative externalities is a quite natural extension of efforts, already under way at the Bureau, to better understand the contributions of nonmarket activities in our economy. Thomas Juster discusses these problems, the measurement of externalities and nonmarket activities, more thoroughly in a special report which immediately follows this one.

Concern with negative externalities, moreover, may lead us into some entirely new departures and research interests. We may be led to substantially rework our entire theory of consumer behavior, for example, to reflect new information and concepts on the allocation of time, or on the role of expectations in conditioning savings behavior under different regimes of price stability or instability. Perhaps, too, this new theory of consumer behavior might be more psychological and behavioral and less normative than the conventional theory. Furthermore, it might lead us into some radically different policy conclusions, perhaps by providing us with an improved capability to forecast the effects of tax or other policy changes under inflationary expectations.

I suspect that an interest in negative externalities will also lead us to investigate how we might use the price system in rather new and different ways, particularly to achieve stipulated social objectives in sectors where we have not relied extensively on the price system to date. The only alternative to better use of the price system to mitigate some problems may well be detailed planning beyond the present state of the art or conventional planning capabilities. Several possible areas for application of the price system to achieve efficiency or other objectives suggest themselves: major airports, urban streets and highways, parking facilities, postal services, legal and court services, communication services, common carrier freight services, commuter and transit services, military manpower recruitment, airline fares, and medical and hospital services. One can see by scanning the staff progress reports later in this Annual Report that many of these problems are already of concern to economists. Incidentally, only by better understanding the price system, its applicability and its limits, will we be able to estimate many of the benefits of various public and private programs aimed at correcting environmental and similar problems. And, only by the application of the price system

will we be able in many cases to keep the costs of corrective action for such problems within reasonable bounds. After all, only in that way will we be able to identify the relevant margins of costs and benefits to be equated in an efficient solution.

This very brief list of new research possibilities is of course not exhaustive. I am sure that our fiftieth anniversary colloquia will uncover many suggestions and possibilities totally unrelated to those mentioned. Furthermore, I am sure that as a result of our deliberations we shall be able to define our research interests and objectives far more precisely than now. In essence, this list represents nothing more than a very simple and exceedingly brief summary of where we stand in our staff evaluations at this point in time.

Defining research priorities also involves, of course, more than simply recognizing or forecasting future areas of policy concern. There are also important problems of "research logistics," that is, of providing supporting data and methods to do the research. Indeed, one might suspect that an organization like the Bureau has at least as much of a role to play in meeting these needs as in the research itself.

I advanced some speculations in last year's *Annual Report* as to what some of these new methodological developments might be. One particular aspect of these developments that warrants special emphasis is the role of the computer and the technological revolution it is creating in economic research. As suggested earlier, there are reasons for believing that the emphasis in economics will increasingly be on complex dynamic models, often of a continuous disequilibrium character. The only feasible way now known for handling such efforts is through computer simulation. With the computer one can embody in the model nonlinearities, interdependencies, and other complications that defy simple mathematical representation. Mathematical modeling may also undergo a revolution in language as a result of the computer, with macrocomputer languages replacing the calculus and algebra as the major mode of expression.

With complex computer models, complex data bases will also be needed. During the next ten years the multivariate cross section will probably be the basic data source for most empirical research in economics. These cross sections, moreover, will increasingly be augmented by special surveys and censuses. The emphasis on cross-sectional microdata follows almost automatically once it is observed that these samples must contain as much information as the aggregates created from them. The major reason for relying exclusively on the aggregates in the past has simply been that we did not have the capabilitity to handle the bookkeeping or data reduction problems posed by these large cross-section samples. And, of course, there are important privacy or secrecy problems that should keep us from using totally disaggregated and identifiable data on individual businesses, households, or establishments. The computer, properly used, provides a sensible way of meeting some of these problems; that is, of doing the data reduction and the bookkeeping while still maintaining the privacy and guarding the identity of individual sources.

As suggested in last year's *Annual Report*, and as many of the individual staff progress reports within this report indicate, new statistical techniques

6

may also be required when employing these new data bases. In general, I suspect that these new data will increasingly move us beyond the traditional econometric preoccupation with regression analysis, and will involve economists increasingly in other multivariate analytic techniques.

This new emphasis on microdata does not mean, however, that economists will lose all interest in the economic aggregates. These will continue to be of prime importance in setting and evaluating much of fiscal and monetary policy. Even here, though, particularly in the analysis of aggregate time series, there is considerable room for improvement. Specifically, we in the profession need better ways of disseminating our macromodels, so as to facilitate their replication and further development. We also need faster, more accurate, and less expensive ways of maintaining widely used time series data on aggregate economic performance.

Toward meeting these various needs, the Bureau has now established its third "Conference Series," a collaborative effort with other institutions and individuals. The initial objective of this new undertaking is to improve the dissemination of computer software and "machine-readable data" to those doing quantitative research in economics. We have also continued to explore the possibility of establishing an experimental "computer utility" for economic and related research, an innovation which could do much to meet the identifiable needs for better aggregate data and time series analyses.

We have also given considerable thought during the past year to realizing Wesley Clair Mitchell's ambition, expressed in the *Fifteenth Annual Report*, that the Bureau become truly national in reality as well as in name. As a step toward that goal, we hope to establish within the next several months or so a West Coast branch of the Bureau, on land leased gratis to us by Stanford University. The proposed site would be just off the Stanford Campus and directly adjacent to the Center for Behavioral Studies. The major remaining obstacle to the creation of this establishment is to assemble the financial resources needed to construct and furnish the building that will house the forty or so researchers and aides planned for the facility. Toward that goal, the Bureau has already received a commitment of approximately \$250,000 from an anonymous donor; however approximately \$200,000 to \$250,000 more is needed before the undertaking can be formally launched. If this experiment with a detached branch facility proves successful, it could be a prototype for similar experiments elsewhere, if and as resources permitted.

In sum, the problems and techniques of economic research, even its physical locale, have been and are undergoing change. We at the Bureau should respond to these changes as they emerge. I am sure that we can and will. In that way, but only in that way, can we have as productive a second fifty years as we have had in our first fifty.

7

## ON THE MEASUREMENT OF ECONOMIC AND SOCIAL PERFORMANCE

### F. Thomas Juster

### Introduction

Although most economic concepts remain a mystery to the majority of even well-informed laymen, the "Gross National Product" has become part of our everyday vocabulary. The widespread use of this concept, both at professional and popular levels, attests to the fact that GNP is generally thought to be a simple, unambiguous, and comprehensive measure of economic performance. But what has always been recognized by professionals is now beginning to be recognized by others: that the GNP is neither simple, nor unambiguous, nor comprehensive; and that it is not necessarily a good measure of economic performance.

The National Bureau, and, in particular, Simon Kuznets, played a major role in developing a conceptual and empirical framework for the measurement of national income and output. The structure of the U.S. National Income Accounts was largely the creation of Milton Gilbert and his colleagues at the U.S. Department of Commerce, while the present system of accounts in the U.S. has been greatly influenced by George Jaszi. Kuznets' work tended to focus more on the normative aspects (what should be included in real national output and has total output grown or declined?), while Gilbert, Jaszi, and their colleagues have tended to focus more on the behavioral aspects (what economic activities have firms, households, and governments actually engaged in).<sup>1</sup>

Many of the conceptual problems raised in the course of developing the

<sup>&</sup>lt;sup>1</sup> The concept and measurement of aggregate income and output are discussed in several National Bureau publications. In particular, see Simon Kuznets, National Income and Its Composition, 1919-1938, 1941, Vols. I and II. Also, Kuznets, National Product in Wartime, 1945.

The structure of the U.S. accounts in their formative stage is discussed in Volume 10 of Studies in Income and Wealth, 1947. The framework underlying the U.S. National Income Accounts system is discussed in Jaszi's "The Conceptual Basis of the Accounts: A Re-examination" in A Critique of the United States Income and Product Accounts, Vol. 22 of Studies in Income and Wealth, 1958.

U.S. system of National Income Accounts (let us call them simply the "accounts") were never satisfactorily resolved but simply ceased to be discussed, and the conventions adopted by the Department of Commerce gradually came to be accepted by both producers and users of the data. But the early problems still remain, others that were not well understood then are better understood now, and still others that have always been widely recognized have become more important in a quantitative sense.

Our present system of accounts represents the application of two principal criteria to the measurement of economic activity: first, that output is best defined to include only goods and services bought and sold in the market; second, that a few selected nonmarket activities should be included in output because they are analytically indistinguishable from closely related market activities. The latter criterion is designed to prevent shifts of functionally identical activities from the market to the nonmarket sector, or vice versa, from changing measured ouput.<sup>2</sup> In short, the existing income and product accounts focus on the measurement of economic activity in the market, supplemented by imputed measurements for a few nonmarket activities with a close correspondence to market activities.

## Sources of Dissatisfaction with GNP Accounts

National income statisticians have always expressed dissatisfaction with various aspects of the present system of accounts, but their discontent has not resulted in much change in practice—possibly because no one thought that the results would really look very different if the accounts were adjusted to reflect various suggested changes, and partly because many of the suggestions could not easily be implemented empirically. Both of these arguments have become less compelling in recent years, and there have been a number of studies aimed at providing the empirical groundwork for a restructured set of accounts that incorporate conceptual changes which many have long thought to be desirable.<sup>3</sup>

The current disaffection pertains to a number of specific areas: (1) the treatment of nonmarket activities; (2) the way in which output is classified between consumption and investment; (3) the widespread use of input costs

9

<sup>&</sup>lt;sup>2</sup> To illustrate, homeowners do not actually pay rent to themselves for housing services, while renters buy housing services in the market. Thus the market criterion would count the services of rental housing as output, but not the services of owner-occupied housing. But such a treatment is so clearly incongruous that the builders of the accounts long ago decided in favor of imputing a value for the services of owner-occupied housing, using the rental price of equivalent housing to measure the flow of services. Over the years a substantial array of similarly motivated imputations have been included in the accounts as part of measured output. Imputations are made for the value of food consumed on farms, for the value of checking account services rendered by banks, etc.

<sup>&</sup>lt;sup>8</sup> The recent study by Richard and Nancy Ruggles (*The Design of Economic Accounts*) suggests a number of alterations in the conceptual framework of the accounts, and provides some empirical estimates. Both John Kendrick and Robert Eisner have been directing NBER research projects designed to provide empirical estimates of economic activities that are presently excluded from the accounts. These range from the imputed cost of students' time and the value of free consumpion provided by business firms to employees, to the impact of capital gains on both aggregate income and income distribution.

to measure the amount of output; and (4) the adequacy of the accounts as a measure of social and economic welfare. In technical terms, these can be thought of as problems relating to the measurement of output in current prices (the first and to some extent the second), problems relating to the deflation of current price output (the third and in part the fourth), and problems relating to the analytical functions to be served by the accounts (the second and fourth).

For nonmarket activities, the problems cover income-producing activities that are omitted from the accounts as well as excluded activities that produce negative benefits. Use of the market criterion for defining output means that a secular shift in activity from the market to the nonmarket sector, or vice versa, will tend to produce a growth rate for measured output that is either too high or too low. For example, if an increasing fraction of house-wives enter the labor force, the growth of measured output will tend to be biased upward because paid jobs constitute output but housewives' activities do not. If young people tend to stay longer in school and thus do not enter the labor force until they are older, and if, as a result, "student hours" grow more rapidly than labor force hours, the growth rate of measured output will contain a downward bias because student "work" is not considered to be output. And an increase in environmental deterioration over time would not show up as a decline in real output to begin with.<sup>4</sup>

The second area (the distribution of output between consumption and investment) has long been a source of concern to national income statisticians. The accounts do not even claim to measure total investment, since they count as investment only additions to the stocks of business capital assets and residential housing. All other output is either intermediate product (coal into steel) or consumption. Yet households possess a very large stock of durable goods (in addition to housing) which yield future services and thus constitute capital assets; governments possess an increasingly large stock of capital assets in the form of schools, highways, etc.; business firms accumulate assets in the form of knowledge acquired through research and development, an activity which has grown substantially in the postwar period and, if included, would now constitute an appreciable fraction of total business capital outlays; and investment in humans (schooling, to take the obvious case) is not only a rapidly growing form of capital outlay but one that probably represents the largest single component of total investment in the economy. Yet we continue to use a system of accounts that fails to recognize these forms of capital accumulation as investments.<sup>5</sup>

<sup>&</sup>lt;sup>4</sup> Programs designed to reduce environmental deterioration—investment in pollution control, for example—are quite apt to show up as increased real output, as indeed they should if the benefits from the program exceed the costs. However, the level of output would still be overstated relative to the level in past years when there was no need for pollution control because there was less pollution.

<sup>&</sup>lt;sup>5</sup> Some rough estimates of investment in knowledge, human capital, household durables, and public durables are contained in F. T. Juster, *Household Capital Formation and Financing*, 1897-1962, 1966. John Kendrick is currently engaged in an NBER study designed to provide comprehensive estimates of investment in the United States along the lines discussed above.

The third source of concern has more to do with deficiencies in the measurement of real output, given the present scope and structure of the accounts, than with concept or coverage. In significant areas of economic activity, what the accounts record as output is measured entirely by inputs or costs. For products like automobiles, steel, clothing, etc., the accounts measure the value of output directly using expenditures and an index of output prices. But for most publicly provided services, for the production of services like health and education, and for the production of goods and services where changes in the quality of output are important but difficult to estimate, output measures do not exist: instead, the quantity of inputs is used to measure the quantity of output.<sup>6</sup>

To illustrate: Most services rendered by governments are conventionally valued by the salaries paid to public employees plus the cost of any complementary inputs purchased in the market. Thus, the "output" of police services is measured by salaries paid to members of the police department, the cost of police cars, etc., not by the social and economic value of crimes prevented or violators apprehended; the value of education, whether public or private, is measured as the cost of teachers' salaries, teaching equipment purchased in the market, the cost of school buildings, etc., not by the value imputable to the gain in pupil knowledge; and the value of health services is measured by the cost of doctors' fees and drugs, not by the reduction in mortality rates, the reduction in time lost on account of illness, etc.

Although this class of problems is endemic in the service industries, it is by no means absent in the traditional goods industries. During wartime, for example, we usually measure the value of munitions output by adding up the cost of the inputs required to produce them: the reason is our inability to design a meaningful and independent measure of output prices. And in any product category where technological change is important and where the product has a multidimensional utility to users, the same difficulty tends to arise although in a somewhat disguised form. For example, measures of clothing output will be unaffected by changes in either durability or maintenance costs associated with changes in the mix of material inputs, *unless* the change adds to production costs. To the national income accountant, in effect, "a suit is a suit"—unless it costs more (or less) to make.

Finally, it has become apparent even to nonprofessionals that GNP is not an adequate measure of social or economic welfare. This will come as no surprise to the national income statistician: the accounts were quite consciously *not* designed to measure welfare. But most people, including economists, have always supposed that GNP and welfare were, in fact, closely enough related so that changes in the one could be identified by looking at

<sup>&</sup>lt;sup>6</sup> The basic problem here is largely one of constructing an appropriate deflator for converting current-price output into real or constant-price output. For measuring current-price output, it makes no difference whether we use input costs or output values since the two must be identical. But for constant-price measures, it is clearly undesirable to infer changes in output from changes in input costs unless productivity change can be measured independently. In practice, moreover, even the current-price measures are apt to be distorted in the public sector, since not all the inputs are likely to be counted. In particular, because capital accounting in the public sector is notoriously poor and usually nonexistent, capital costs are likely to be understated.

changes in the other. It is increasingly clear that such an assumption is unwarranted.

Just to cite a few of the more dramatic specifics that cause GNP and welfare measures to diverge, virtually any type of disaster-personal or nationalwill cause the GNP to rise rather than fall. If a man's wife is killed in an automobile accident and he is thus forced to hire a housekeeper to care for his children, the GNP will rise because housekeepers' services are counted and housewives' services are not-and the stock of human capital is not reduced because it was not counted to begin with. A tornado that sweeps through Texas and destroys millions of dollars worth of capital assets will almost certainly cause the GNP to rise: workers must be hired to clean up the debris and rebuild the destroyed assets, and at least some of these resources would have preferred leisure (which is not measured) to market activity (which is). Moreover, the capital loss involved in destruction of property and lives does not explicitly enter the accounts at all, and is unlikely to have much if any influence even in subsequent years. Finally, social catastrophes like wars will often cause GNP to rise,<sup>7</sup> partly because work is substituted for leisure and partly because we have no way of measuring the loss in efficiency that usually results from shifting economic resources from peacetime to wartime uses.

Other manifestations of the GNP-welfare distortion are the treatment of time allocation, of "free" goods and services, and of by-products that yield negative benefits. Moreover, an aggregate measure like GNP cannot register the fact that welfare does not depend solely on aggregate performance but is sensitive to the way in which at least some of the aggregates are distributed among the population.

For time allocation, the problem is simply that only time spent at paid activity is counted as part of output. Hence, an increase in leisure or in time spent at unpaid (nonmarket) activities will not cause any direct increase in GNP, while time taken from leisure to sit in traffic jams or to wait for the appearance of the local commuter train will not make the GNP any less. Similarly, outputs that are "free goods," and therefore do not have to be produced in the market, are ignored in GNP despite the fact that these products are apt to have precise counterparts which *are* included in GNP in other economies precisely because they are *not* free and must be produced. For example, residents of the Virgin Islands need neither heating nor cooling equipment, since their fortunate location provides an unlimited supply of 70° weather for which Americans pay substantial sums every year; their requirements for clothing and shelter are reduced for the same reason. But this natural bounty is wholly ignored by the GNP statistician.

The problem of negative by-products has been discussed above: the basic difficulty is that no accounting is made for the decline in utility resulting from the unwanted side effects of economic activity—rivers that cannot be used for recreation, parks that are cluttered with disposable bottles, etc.<sup>8</sup>

 $<sup>^{7}</sup>$ A really destructive event like a major earthquake or a war that devastates large parts of the country will probably show up as a decline even in measured real output.

<sup>&</sup>lt;sup>8</sup> In the literature, the classic case of unwanted side effects was the rise in the costs of maintaining the exterior of a house because of soot emanating from neighboring factory smokestacks.

Finally, a perhaps inescapable shortcoming of the GNP accounts from a welfare viewpoint is the fact that they focus entirely on aggregates and pay no attention to the distribution of these aggregates. An economic system which generates conspicuously high incomes for some classes of its citizens and much lower incomes for other classes is unlikely to be as viable as one which provides a more even distribution of rewards. A system in which the distribution of the tax burden is widely regarded as unfair and inequitable is unlikely to have the same prospects for future performance as one in which the same burden is distributed with fewer perceived inequities. And a system in which the same total population is heavily concentrated in a small number of geographic areas is likely to generate a substantially higher level of negative social and economic by-products than one in which population is more widely dispersed.<sup>9</sup> These aspects of welfare are in principle much more difficult to quantify than many of the others discussed above, although it is conceptually feasible to quantify the costs of removing many of the outward manifestations of distributional distortions.

## Framework of the Present Accounts

In examining the problem of social and economic measurement, it is useful to recall the origins of our present system of national accounts. This system was shaped and developed during the 1930's and 1940's when the most obvious forces affecting the level and movement of economic activity were initially cyclical, subsequently national defense. During major cyclical swings in the level of economic activity, focusing on market output produced a measure whose welfare implications were probably very similar to those that would have resulted from focusing on a much broader range of activities. And during a major war, the emphasis was naturally on productive capacity for military output, for which a measure like GNP is reasonably well suited. Hence, given the catastrophic decline in market activity during the Great Depression and the subsequent recovery with the eruption of World War II, many of the conceptual problems that had been extensively discussed during the formative period of the income accounts gradually came to be regarded as of little practical or analytical significance, and the accounts came to be largely a reflection of "activity" regardless of the purposes to which the activity was devoted.

Thus the present national income and product accounts of the U.S. are basically designed to measure cyclical changes in total activity. In such a framework, the focus is on flow of inputs and outputs; stocks of assets are important only insofar as they cause cyclical movements in the related flows.<sup>10</sup>

<sup>&</sup>lt;sup>9</sup> This statement is not inconsistent with the observation that population shifts have historically been from sparsely populated rural areas towards densely populated urban areas, rather than the reverse: The balance of gains and losses can be positive even if the losses are substantial.

<sup>&</sup>lt;sup>10</sup> The investment part of the accounts consists only of business plant and equipment and residential housing, which, during the 1930's, were the major sources of cyclical variability in investment activity. The relative unimportance of the assets themselves in the structure of the accounts, as distinct from the investment flows which add to assets, is underscored by the almost exclusive reliance in current usage on *gross* national product

Similar reasons explain the preoccupation of the present accounts with that portion of time allocated to market activities: If cyclical variability is the major concern, the critical labor—time variables are the amount of market employment and unemployment, not the amount of time that people choose to allocate to nonmarket activities, leisure, etc. Hence, the allocation of labor time has always been treated as a simple flow of inputs yielding market income, with no attention paid to the fact that time allocated to the market is only one of many possible uses.

Given this background, it was natural for the emphasis to be on a system of accounts designed to trace variations in output, employment, and productivity in the market sector, where performance during the 1930's had been so unsatisfactory. Moreover, it was entirely reasonable during this period to equate changes in output thus measured with changes in economic and social welfare, since changes in the one dominated changes in the other. But during the past few decades, the combination of sharply reduced cyclical movements in market output and the changing importance of nonmarket activities have made market output an increasingly poor measure of economic and social well being.<sup>11</sup>

## **An Alternative Framework**

In general terms, economic and social output can be thought of as a flow of satisfactions or utilities generated by combining the services of various types of capital assets. A wide variety of such assets exist in the system, and these assets produce a number of different kinds of utilities. The assets themselves can be classified into five broad categories: (1) tangible capital assets (equipment and structures); (2) intangible capital assets (knowledge); (3) human capital assets (skills and talents); (4) physical environmental assets; (5) sociopolitical environmental assets.

Tangible capital assets comprise business assets, consumer assets divided into housing and durables, and government assets.<sup>12</sup> Intangible assets result

rather than *net* national product: the difference between GNP and NNP is, of course, simply the amount of capital stock estimated to be used up in the process of producing current output. Yet one rarely hears any mention of NNP (or its cousin, national income). One important reason is that most economists use the accounts to measure cyclical changes, and the capital consumption component of gross investment has little or no cyclical content.

<sup>&</sup>lt;sup>11</sup> It is important to keep in mind that analysis of cyclical variability in output is still, and will presumably continue to be, a major use of any system of national accounts. Hence the emphasis should be on extension and refinement of the existing accounts to make them more useful for the analysis of trends in social and economic welfare, while at the same time insuring that a market subsector is retained to facilitate cyclical analysis.

In point of fact, a greatly expanded set of accounts with a "market activity" subsector might well be *more* useful for cyclical analysis than the present system. It is hard to believe that the quantitatively important collection of imputations now included in the accounts (e.g., housing services) adds anything to their usefulness for analysis of cyclical behavior.

<sup>&</sup>lt;sup>12</sup> As noted above, only business tangible assets and housing are treated as capital assets in the present system of accounts. At some stages of economic development, defining capital assets in this way might have been appropriate and useful. But in a world where business firms spend upwards of \$20 billion a year on research and development

from the application of human capital and other resources to research and development problems. This process results in the production of socially useful knowledge, a type of asset that is analytically distinct from the skills and talents of the people who produced that knowledge. Human skills and talents represent both innate ability and training, the latter ranging all the way from parental time spent with children through formal schooling and on to work experience designed to aid future productivity. Physical environmental assets can be thought of as comprising natural resources as traditionally viewed: mineral and agricultural wealth; other natural assets like temperature, precipitation, water, and air; and partly man-made assets like forest preserves and parks. The assets comprising the physical environment and the sociopolitical environment overlap to some degree. While welfare-producing assets like the amount and distribution of water resources and the quality of the atmosphere clearly belong in the physical environment category, environmental assets like population density are partly physical and partly social. The major assets in the sociopolitical category are difficult to define precisely, but are meant to cover such concepts as equity, security, freedom, social and economic mobility, privacy, and so forth.

Specifying a structure of economic and social accounts in which outputs (benefits) are derived from these assets seems both useful and possible, at least in principle. Empirical implementation is another matter; while clearly feasible in some cases, it is not possible at present for others and may not be realizable at all for some. Nonetheless, the exercise seems worthwhile, since the purpose of a system of accounts is to provide a conceptual framework for all meaningful and measurable aspects of social and economic performance.

Net economic and social output can be defined as the sum of direct consumption benefits yielded by this collection of assets, plus or minus net changes in the assets themselves. For most goods and services that pass through the marketplace, the suggested set of accounts would differ little if at all from the present accounts: net output would still consist of the flow of consumption goods and services plus net changes in the stock of capital assets used to produce the output.<sup>18</sup> However, there would be major differ-

<sup>(</sup>which clearly adds to the stock of useful knowledge and hence to future output); where the single most important capital asset in the economy is not business capital equipment but the stock of human skills and talents; where consumer and government capital assets in the form of roads, dams, automobiles, furniture, appliances, etc., are much larger than business-owned capital assets (the only difference being that consumers and governments use capital assets to produce services that are not bought and sold in the market); and where our natural resource and environmental assets are, in the view of many, being depleted and despoiled at a rapidly expanding rate; it seems just as incongruous now to exclude these facets of economic and social activity from being reflected in the national accounts as it must have seemed forty years ago to exclude residential housing.

<sup>&</sup>lt;sup>18</sup>To produce market output, business firms combine the services of capital assets with material and labor inputs to produce goods and services which yield, directly or indirectly, a flow of utilities to consumers. In measuring results or performance, GNP represents the total value of all goods and services produced, depreciation represents the amount of capital equipment used up in producing these goods and services, and net national product is the total value of output less depreciation. The measurement of net output recognizes the fact that capital assets may be used up in producing a current

ences. First, a much wider range of outputs would be recognized as contributing to economic and social welfare, including some that are free for some countries or regions while only obtainable through the use of scarce resources for others. Second, changes in stocks for a much wider range of assets would be explicitly taken into account, with a resulting tendency to increase or reduce measured net output depending on whether assets were being augmented or reduced as a consequence of activity in the system. For example, deterioration of the physical environment because of various types of pollution—air, water, noise, waste—means that the flow of benefits from this asset has been reduced. Thus, where the process of economic growth deteriorates the physical environment, an augmented set of accounts would register the usual increases in net output resulting from growth in the market sector, but they would also record an offset consisting of the degree to which physical environmental assets had been depreciated, with a consequent reduction in the flow of future benefits.<sup>14</sup>

## A Preliminary Look at Concepts

Empirical implementation of this suggested structure for economic and social accounts cannot be seriously explored here, but a few of the more far-reaching conceptual changes are worth examining in more detail. Before proceeding, it would be well to recognize the basic value structure ordinarily embedded in economic accounts. The implicit assumption underlying almost all measures of aggregate monetary output is that goods and services are worth their value "at the margin" as determined by the least anxious buyer—not, for example, what they are worth to the average buyer nor what buyers would pay if required. It is also assumed that marginal value is equal to marginal cost as measured by resource inputs. Thus, automobiles are valued at prices like \$3,000 per unit and cans of tomato juice at prices like 30¢ per unit, reflecting an assumption that "at the margin" one automobile could be turned into 10,000 cans of tomato juice in terms of resources required to produce them and in terms of utility to consumers.

#### **Time Allocation in the National Accounts**

The valuation of costs and returns implicit in the accounts suggests that the total return to an extra hour of leisure time must, at the margin, be equal to the return from an extra hour of work, provided that consumers have a

flow of goods and services, with a consequent reduction in the capacity to produce future goods and services. If some of the goods produced are themselves capital assets, and if their value exceeds the wearing out of existing assets so that future production of goods and services is enhanced, net output will consist of consumption goods and services plus additions to the stock of assets.

<sup>&</sup>lt;sup>14</sup> Alternatively, the community might choose to halt or reduce further deterioration, or to reduce accumulated deterioration, by diverting scarce resources to that end. In that case, the flow of benefits from the physical environment would either not be reduced as much as otherwise because environmental assets are more fully maintained or, if the level of accumulated deterioration were actually reduced, environmental assets and the consequent flow of future benefits would be increased because net environmental investment would have taken place.

continuous range of choice about the division of time between work and leisure. Time spent at earning income in the market yields an indirect flow of utilities in the form of purchased goods and services, while time spent at all other activities yields a direct flow of either present or future utilities that should be valued at the market wage rate. The same valuation would presumably apply to time spent in activities designed to maintain human capital (sleeping, eating, etc.), to activities that involve net investment in human capital (studying to increase one's future productivity, or spending time in training one's children so as to increase theirs), or to activities that involve direct consumption benefits (going to a baseball game or to the opera).<sup>15</sup>

In principle, we would want to count as output all of the services yielded by the application of human skills to welfare-producing activities. The total returns would constitute gross output, while net output would be the total less the amount of activity required to maintain the stock of human capital. Gross output could include either positive or negative net investment, depending on the extent to which activities added to the stock of skills through additional training or reduced skills because they failed to offset obsolescence and depreciation. At present, the accounts essentially specify that only the application of human skills to activities that result in money earnings are to be counted as output, and no adjustment is made for either positive or negative net investment in the stock of human capital. Hence, students, housewives, hospital volunteers, unpaid members of civic or social agencies, vacationers, and Wednesday afternoon golfers are all presumed to be engaged in nonproductive activity.

The possibilities for anomalies are boundless: we can get some insight into the appropriate treatment by noting some of the characteristics of the existing treatment which are clearly unsatisfactory. For example, according to the present system, output is increased if a woman stops putting in ten hours a week at a remedial reading clinic for ghetto youngsters and begins to work ten hours a week as a dental technician; output will be increased if a clinical health program manned by volunteers becomes funded through a government grant and the volunteers thus receive pay; output is increased if a man who ordinarily takes off one afternoon a week to relax is coerced into earning income during that afternoon; output is reduced if, to cite the traditional case, a man marries his housekeeper; and so on.

<sup>&</sup>lt;sup>15</sup> Two points should be noted. First, it is not at all clear that the market wage rate is the appropriate measure of productivity in all (any?) nonmarket activities. If people allocate time rationally, however, there is much to be said for adopting that convention as a first approximation.

Second, it is interesting to speculate about the policy implications of the investment in human capital that takes the form of parental training of children. The total amount of this type of investment might well be appreciable compared with the investment in human capital that takes the form of regular schooling. If market wage rates measure the value of parental time inputs, there would necessarily be marked differentials in the amount of such investment by parents in different socioeconomic groups, given equal time inputs. Hence, there would be large differences in the estimated quantities of "capital" with which youngsters begin formal schooling, since they would have been exposed to a large amount of parental "investment" valued at markedly different imputed wage rates. The differential would be even wider if the amount of parental time invested in children were positively correlated with wage rates, as may well be the case. In short, compensatory education might have a very large differential to overcome, perhaps of the order of several years worth of investment in formal schooling.

Another aspect of the current treatment concerns the handling of depreciation and depletion of human skills. An implicit allowance for these factors enters the present accounts because all nonmarket allocations of time are ignored, including blocks of time used for the maintenance of human capital time spent in sleeping and eating, as suggested above. While these types of activities could be considered as gross output, they are clearly not net output. But consider what would happen if a pill were invented that revitalized and restored the human body and mind in the same way that sleep does but without a time cost of seven or eight hours per day. Under the present system of accounts, this gain of 50 per cent in available time would not increase output except to the extent that the time was used to earn money income in the market. Otherwise, the present accounts would say that nothing has changed.

Finally, what of involuntary idleness? In some respects, the present convention of valuing only time spent at market employment is perfectly adequate: if someone is employed only part-time who would prefer to work fulltime, or if someone is wholly unemployed, conventionally measured output is lower than it would otherwise be. Since time allocation is clearly suboptimal when unemployment exists, a welfare-oriented measure should indicate a decline in output. The appropriate treatment, in principle, would put a low or zero value on time spent in being involuntarily underemployed, given the market wage rate: being involuntarily idle is obviously different in a welfare context from choosing not to work on Saturday or on Wednesday afternoon (for pay) and to do something else instead.<sup>16</sup>

However, even the present conventions do not take full account of the effect on human capital of long periods of involuntary idleness. Surely one of the major costs of the depression of the 1930's was the erosion of human skills and talent due to prolonged and involuntary inability to use those talents in income-earning jobs. If human capital were recognized by the income accounts, prolonged and involuntary idleness that resulted in an acceleration of depreciation would reduce output to an even greater extent than the loss of currently produced goods and services, because of its effect on the stock of human capital and, in turn, on future output.

#### **Physical and Sociopolitical Environmental Assets**

One of the oldest questions troubling income theorists concerns the proper treatment of activities, mainly but not entirely governmental, designed primarily to prevent a reduction in social or economic welfare, e.g., the use of resources for national defense purposes. During the Second World War the United States devoted close to half of its total resources to military purposes: Should this have been considered net output in a welfare sense or a cost of maintaining the social environment? One suggested solution was that government-provided goods and services should be counted as net output to the extent that they were paid for by taxes, on the theory that willingness to pay

<sup>&</sup>lt;sup>10</sup> Implementation of the "full output" notion thus requires much better information than we now have on the extent of involuntary idleness, defined to mean the difference between the amount of time people would prefer to work in the market, given the wage rate, and the amount they actually work.

taxes indicated a willingness to pay the price (foregone private goods and services) of these services. Hence, in the military output case, the community must place at least as much value on maintenance of the social environment as on the private consumption that could otherwise have been obtained. While this criterion correctly indicates that the community is better off using resources for national defense than not doing so, it does not register the simple fact that a deterioration of the sociopolitical environment will impose costs and thereby reduce welfare. This is to say, using resources for national defense may impose a lower welfare penalty than not doing so, but some welfare penalty cannot be avoided.

In principle, it is thus hard to see the objection to a criterion which says that the costs of maintaining a "given" social and political environment constitutes gross but not net output. A country which needs, or thinks it needs, to spend a quarter of its resources to maintain a military establishment for defense against actual or potential enemies is less well off than one which needs to spend only one-tenth or one-twentieth of its resources in this way, other things being equal. And a shift in the political stability of the world community which results in the need, real or imagined, for all nations to expand military expenditures from 10 to 20 per cent of total output has clearly diminished the social and economic well-being of the entire community.<sup>17</sup>

It is not of course only military outlays that fit this category. A community or world that needs to spend more resources on policemen, firemen, burglar alarms, safety locks, night watchmen, etc. is clearly worse off than a community or world in which these outlays can be kept to a minimum. No one buys police or fire protection, or hires night watchmen, because these services

In the former case, however, it is far from clear that deterioration of the sociopolitical environment, as manifested by the need to maintain a large defense establishment, is a direct consequence of the functioning and growth of the economic and social system. One could conceive of circumstances in which that might be the case; e.g., an aggressor nation that builds up its military strength in order to conquer other countries and thence derive future economic benefits. But in general the causality is unclear.

If the size of a defense establishment is basically unrelated to the functioning of the system but is simply an exogenous event, should one "penalize" the system by registering defense outlays as costs of maintaining the sociopolitical environment? If the objective is to measure social and economic welfare, it seems that the answer should be yes: resources used for defense cannot be used elsewhere, and I cannot see that it matters for purposes of measurement whether defense needs are a cause of one's own actions, are real but exogenous to one's actions, or are wholly imaginary. It does, however, make a great deal of difference for purposes of policy decisions whether or not the system has caused its own defense needs. If this is the case, there is a large hidden cost to a change in social policy that increases the optimum size of the defense establishment, just as there is a large hidden cost to a growth policy that produces deterioration in the physical environment as an inevitable concomitant of growth.

If defense needs are unrelated to economic and social policy, however, the appropriate analogy is to phenomena like earthquakes, floods, and other natural disasters: welfare is willy-nilly reduced, and there is nothing that can be done about it. But the reduction is real and needs to be registered in the accounts.

<sup>&</sup>lt;sup>17</sup> There is an interesting difference between the case in which real or imagined needs for defense cause a country to use x per cent of its resources for military purposes, and the case in which deterioration of the physical environment causes the country to use the same x per cent of resources to control pollution. In the latter case, there is a strong presumption that deterioration of the environment is a direct consequence of the normal functioning and growth of the economy: if so, the accounts clearly overstate the flow of benefits from economic growth unless they include an allowance for the negative by-products of growth.

are desired per se: if there were no crime or fires, and no risk of either, there would be no expenditure on crime or fire prevention and everyone would be better off.<sup>18</sup>

It is interesting to contrast these preventive or environmental maintenance activities with those that involve the production of "positive" benefits. The two can be distinguished by asking whether society will always receive additional benefits from devoting additional resources to the activity. In the case of preventive activities, the answer is no: once resources are sufficient to reduce the level and risk of damage to zero (i.e., once we have hired enough policemen) no benefit accrues from hiring more. But this would not be true of resources devoted to producing houses or operas or baseball games: there is no natural limit to the amount of resources that will yield additional benefits in the aggregate for these activities, although there is of course a zero marginal utility point for any specific product and individual.

This analysis has quantitatively important implications for the measurement of net output. Not only do we in the United States spend a large fraction of total output on national defense and related activities, but it appears we have also been spending a growing proportion of output on public and private preventive activities of various sorts—policemen, firemen, private guards, weapons, safety locks, etc.

The analytically appropriate treatment is to view the social and political environment as an asset which yields direct consumption benefits in and of itself and also permits other productive activities to be carried on without interference. Like any asset, the social and political environment can deteriorate or depreciate, and it may do so for reasons having no causal association with activities designed to increase material well-being. Expenditures required to "maintain the asset intact" would thus constitute gross but not net output of the system. In the case discussed above, wars, crimes, and fires are some specific manifestations (costs) of environmental deterioration, while resources spent to suppress these manifestations must be presumed to have enabled environmental assets to be better maintained than in their absence. Thus, "depreciation" of the asset "sociopolitical environment" can be estimated as the sum of two components: first, costs imposed by the amount of deterioration that has been permitted to occur (as reflected by the damage resulting from crimes, fires, wars, etc.); second, costs incurred to maintain the asset at its present level (the resources represented by the services of policemen, firemen, members of the Armed Forces, etc.). In the absence of maintenance expenditures, or in the event of their reduction, it must be presumed that the asset would deteriorate further and that the costs represented by the specific manifestations of deterioration would thus increase. Optimum social policy, of course, consists of equating at the margin the cost functions associated with these two activities.

Before proceeding to examine similar problems relating to the physical environment-air and water pollution, waste accumulation, etc.-it is worth

<sup>&</sup>lt;sup>18</sup> The relevant class of activities actually extends far beyond the national or personal security outlays discussed here. For example, resources used for medical care are largely in the same category: few people go to hospitals because they enjoy the rest and the good food!

noting that the distinction between gross and net output is a much more treacherous problem in social and economic accounts than is generally realized. To be precise, much of what economists have always considered to be output might be described more appropriately as intermediate product (a cost of producing output) rather than net output. As a simple illustration, take the treatment of laundry services-washing machines, clothes dryers, commercial laundromats, cleaning establishments, and so forth. Conventional income accounts treat outlays for these products and services as current consumption. But they really comprise a collection of inputs designed to maintain a stock of clothing at a given level of cleanliness and neatness. The real "net output" associated with these expenditures is not the expenditure itself but the flow of utility that comes from wearing clothes that are clean and pressed rather than soiled and rumpled. Evidently, if clean clothes could be obtained without the need to incur these costs, real output would not be reduced at all. Thus, the accounts should in principle treat the stock of clean clothes as an asset, the amount of dirt and other foreign matter introduced into clean clothes by the normal process of wearing them (or by living in a heavily polluted urban environment) as depreciation, and expenditures for laundries, dry cleaning, and washing machines as costs associated with maintaining the asset.

#### **Physical Environment**

By now the appropriate analytical treatment of the much-discussed subject of environmental pollution should be evident. A community starts off with some stock of environmental assets—air and water of a certain degree of purity, roads that are free of abandoned cars, playgrounds and streets free of discarded newspapers, broken bottles, and so forth. As a (perhaps inevitable) part of the process of industrialization and economic growth, these environmental assets tend to deteriorate or depreciate, thus reducing the flow of benefits from environmental assets. Expenditures designed to slow down or reduce deterioration are clearly costs associated with the maintenance of the asset rather than an output of the system. As with the sociopolitical environment discussed earlier, the full cost of deterioration is the sum of the reduced yield on the asset plus any costs incurred to prevent even greater deterioration.<sup>19</sup>

It is not easy to see how, in practice, one would measure the social and economic costs of environmental deterioration. One possibility is to estimate the cost of restoring the environment to some specified (previously attained?) level of purity, viewing these costs as a measure of the welfare loss from the actual level of deterioration. This procedure would almost certainly tend to overstate the true cost: The welfare loss from deterioration is likely to be an increasing function of the amount of deterioration, while the costs of prevent-

<sup>&</sup>lt;sup>19</sup> Alternatively, one could view industrialization and economic growth as producing a series of dis-products and dis-services—various kinds of impurities and undesired products introduced into the physical environment and left there. In the absence of expenditures designed to reduce environmental deterioration, real net output is decreased by the negative value of these dis-products and dis-services.

ing deterioration are likely to rise sharply as the zero deterioration level is approached. That is, at very low levels of pollution, an increase in the amount of pollutant probably involves little or no welfare loss at the margin, but the loss is likely to rise rapidly as the pollution level increases to the point where discomfort, illness, or death begin to appear. And the marginal costs of removing the first 10 per cent of existing pollutants is likely to be small compared with the costs of getting rid of the last 10 per cent once 90 per cent has been removed. Hence, it might not be socially worthwhile to bring the environment back to some "100 per cent pure" state, given the probable high costs and modest benefits realized from removing the last small amount of impurity and the competing demands for resources.

#### **Social and Physical Environment: Some Comparisons**

As indicated above, the conceptually appropriate treatment for the contribution of sociopolitical and physical environmental assets is much the same. But there are some interesting differences in the problems associated with these two types of environments, and some of these differences can be usefully discussed even in the absence of quantitative information.

One of the differences can be illustrated by asking the question: What is the likely time-path of changes in real output, given that either of these environments has initially been permitted to deteriorate? That is, if the sociopolitical environment has deteriorated by x per cent (measured somehow), what will it take to restore that environment to its original state, and is the relationship different for the sociopolitical than for the physical environment?

It is more difficult to analyze the sociopolitical than the physical environment, since we know much less about the factors that influence or change it. It might be argued that deterioration of the sociopolitical environment, once permitted to begin, has a greater tendency to be cumulative and is more difficult to reverse. To illustrate, in recent years there appears to have been a marked increase both in the incidence of illegal activity and in air and water pollution.<sup>20</sup> Both are a manifestation of environmental deterioration-the first in the sociopolitical environment, the second in the physical environment. But the deterioration reflected by rising crime rates seems more likely to be self-reinforcing: Behavior that reflects an increasing irresponsibility toward persons or property is likely to encourage similar behavior on the part of others, simply because near-universal disapproval may be one of the major inhibiting forces to begin with. Thus one would argue that a rising rate of illegal activity will, in and of itself, produce a change in the social and political environment which will lead to a further rise, other things being equal. And to the extent that the basic sanction against illegal activity is widespread disapproval in the community, a reduction in the pervasiveness of disapproval will itself tend to increase the amount of disapproved activities. Moreover, if this change in environment is ignored by society, it is hard to see any reason

<sup>&</sup>lt;sup>20</sup> The empirical facts are not entirely clear in either case, especially for the incidence of illegal activity. We are certainly more aware now of both types of deterioration, but that is a different proposition from knowing that the situation has objectively deteriorated.

for stabilization or reversal. Even if its basic causes were to be removed or alleviated, it might reasonably be expected that the sociopolitical environment would continue to deteriorate.

In the physical environment, in contrast, the same cumulative process may not be at work. An increased level of air pollution is a consequence of the fact that, in the absence of an appropriate penalty structure, various sorts of productive activities are conducted so as to expel waste materials into the atmosphere. Because productive activities tend to be concentrated geographically, the result is an atmosphere that is contaminated to a perceptible degree at selected (mainly urban) locations. But these concentrations of contaminants are continually in the process of being dispersed and diffused by natural forces. If contaminants were to be evenly spread over the entire atmosphere, the resulting contamination level would probably be so low that the welfare loss could safely be ignored. Assuming this to be the case at present (and foreseeable?) contamination levels, a worsening of the physical environment thus means that new contaminants are being injected into selected local areas at a greater rate than existing contaminants in these areas are being dispersed, a situation that might be remedied fairly easily and at moderate cost.

Suppose, for example, that a penalty structure were introduced which succeeded only in reducing the injection rate of new contaminants to the point where it was lower than the dispersal rate of existing ones. That change would be sufficient to reduce the contamination level, and the reduction would continue as long as more contaminants were being dispersed than were newly injected. If this analysis is correct, air pollution constitutes a self-liquidating rather than a self-perpetuating or cumulative type of deterioration.

Much the same argument applies to water pollution, where natural regenerative processes at work in most bodies of water have a persistent tendency to reduce pollution. The pollution level is increased only if more new pollutants are injected than are being removed through these natural processes. Thus, to reduce the pollution level, it may be sufficient to reduce the injection rate of new pollutants.<sup>21</sup>

It may thus be the case that the social and economic cost of a given amount of environmental deterioration is greater for the sociopolitical environment than for the physical environment. Not only might deterioration in the physical environment be arrested by simply cutting back on the amount of impurities being currently injected, but the methods of controlling deterioration are likely to be much better understood because they are essentially technical and scientific rather than behavioral. That is to say, society clearly has enough knowledge to reduce at least certain types of environmental deterioration to lower levels than at present: what is lacking is simply a political decision to

<sup>&</sup>lt;sup>21</sup> This analysis, of necessity, greatly oversimplifies the problems of deterioration in the physical environment. For example, the dispersal rate of existing pollutants may be so slow that the injection rate of new pollutants might have to be reduced virtually to zero. Also, certain types of long-lived pollutants appear to move from one part of the physical environment to another and to produce cumulative effects that have not yet been fully registered: DDT seems to be a case in point. Finally, the "natural regenerative processes," which are clearly at work in many instances, can probably be rendered inoperative if pollution levels get to be sufficiently high. In that case, deterioration will either not be self-liquidating at all, or the process of regeneration will take so long that it will amount to the same thing for practical purposes.

incur the costs needed to realize that objective. But for the sociopolitical environment, not only do we probably need to do more than simply reduce new sources of social and political discontent below what they have been, but we may need to go a good deal further in order to overcome the cumulative effects of past social and political discontents. Moreover, we know much less about the relevant technology—the probable consequences of programs designed to change the sociopolitical environment—and thus we know less about how to use resources in order to achieve the desired objective.<sup>22</sup> Hence, the great public outcry over environmental pollution, and the interest and energy with which that problem is being attacked, may represent a misplaced emphasis. It might be much more important to concern ourselves with deterioration in the sociopolitical environment than in the physical environment.

<sup>&</sup>lt;sup>22</sup> This proposition is discussed in F. Thomas Juster, "Microdata, Economic Research, and the Production of Economic Knowledge," in *Papers and Proceedings of the American Economic Association*, May 1970.

Staff Reports on Research Under Way

## Productivity, Employment, and Price Levels

Policies to attain "prosperity without inflation" are bound to be highly controversial. Opinions differ sharply, as each day's news makes clear, on the relative values of the several goals subsumed under the quoted catch phrase: rapid economic growth, low unemployment, and a stable general price level. And the differences extend also to the worth of these goals when balancing the short-run against the long. It would be too much to hope that scientific research, no matter what its auspices or scale, could quiet all controversy over these policies. Yet, to a significant degree, the differences of opinion do reflect inadequate knowledge of the facts and the relations among facts. We may reasonably expect that the differences can be narrowed by the work reported in this section, which groups together studies aided by a grant from the Alfred P. Sloan Foundation and studies on related topics. Included are an examination of the reliability of the available price and employment data, analyses of the historical behavior of prices and productivity, an effort to develop theoretical models of price formation, and the construction of econometric models of the determination of prices, costs, and productivity.

The first National Bureau publication in this group was *The Behavior of Industrial Prices*, by George J. Stigler and James K. Kindahl, which was recently published. Several related articles have appeared or will soon appear elsewhere. These include Nadiri and Rosen's "Interrelated Factor Demand Functions," in the *American Economic Review*, September 1969, and two articles by Fabricant: "Prices in the National Accounts Framework: A Case for Cost-Benefit Analysis," which will be published in the *Review of Income and Wealth*, and "Inflation and the Lag in Accounting Practice," which will be in a volume on "Contributions to Accounting by Other Disciplines," to be published under the auspices of the University of Kansas.

The individual studies still in progress are reported on in the following pages of this section.

Members of the National Bureau's Board of Directors have sometimes expressed the wish that, when an occasion offered itself, advantage should be taken of the opportunity to prepare and issue a Bureau volume, addressed to the public at large, on a broad theme of widespread interest. Such a volume should use the main findings of National Bureau studies, properly integrated and stripped of technical discussion and detail, regardless of the project under which they happened to be financed or the heading in the *Annual Report* under which the studies might be classified. The problem of inflation provides such a theme.

A report on the problem of inflation could help point up the relevance of the National Bureau's research, and—written in appropriate language—should help convey its results not only to specialist and nonspecialist economists, but also to other members of the concerned public, among whom are the National Bureau's supporters. I hope to use the next year to put such a volume together.

Over the next few years the National Bureau's studies in productivity, employment, and price levels will be aided by a new grant from the Walker Foundation.

Solomon Fabricant

### **Price Trends and Economic Growth**

Several economists have recently attempted to measure the effects upon wages and price levels of the guidepost policy followed during 1962-66, and of its abandonment afterward. The planned paper on "Wage and Price Guideposts in a Growing Economy" is being ex-

tended in order to weigh and to compare the validity of the very different conclusions reached. To judge from the review so far, it is doubtful whether any of the econometric equations or other analyses that have been made public yield significant evidence on the degree of effectiveness of the guideposts. For one thing, the available statistical data are for this purpose simply too poor in quantity and quality. Consider, for example, the rather wide discrepancies between the list prices used in these analyses and the prices actually realized, that are reported by Stigler and Kindahl. Given these data, the factors affecting short-term changes in wages and prices are too numerous and too powerful to permit disentangling and determination-with even minimally acceptable confidence-of the separate effect of the application of the guidepost policy. That equations which give very different results are all accompanied by high coefficients of multiple correlation can merely reflect the fact that the equations are the end results of a trial and error search by different people. The paper on the guideposts will, of course, discuss in some detail the considerations-theoretical and empirical-that lead to these conclusions.

During the year, work continued on an aspect of another subject of great current interest. This is the connection among changes in monetary and fiscal policy, changes in business conditions, and changes in price levels. It was widely expected that the tightening of monetary and fiscal policy that began during the winter of 1968-69 would soon be reflected in a slowdown in general business and, as a result and more or less simultaneously, in a significant reduction, if not a complete halt, in the pace of price inflation. That the pace of inflation still shows little evidence of a slowdown has surprised and troubled many people, especially since signs of a decline in general business have been mounting for some time.

But even a cursory inspection of the historical facts indicates that the short-term behavior of prices cannot be characterized as simply as has been assumed. Several facts tend to be overlooked. First, price behavior is not the same throughout the price system. Second, the behavior in no part of the price system is always the same. Third, the response of prices to a tightening of monetary and fiscal policy may initially take the form, for a while, of an end to acceleration. And fourth, some groups of prices may continue to rise rapidly—sometimes even continue to accelerate—because of demand and supply factors peculiar to them.

To be more specific, the index of wholesale prices (or better, the index excluding farm and food prices, which conform poorly to business cycles) typically turns at about the same time as does general business. This is why the index is included in the National Bureau's list of "roughly coincident indicators." In contrast, the index of industrial material prices typically turns up or down before general business does; the index is a "leading indicator." In different contrast, retail prices and wage rates—the prices on which many people concentrate when worrying about inflation—tend if anything to lag behind turns in general business.

These uniformities are far from perfect, as Mitchell and the others who have worked on business cycles at the National Bureau have warned their readers. Departures from the usual behavior of the Wholesale Price Index, to continue with that example, have occurred in a significant proportion of business cycles. The departures sometimes ranged well outside the limits that one might infer from the term, "roughly coincident." And, as I have already hinted, the Consumer Price Index and the available indexes of wage rates, as well as indexes of prices in some other sections of the price system, have so infrequently been marked by downward movements that they could not properly be classified as "lagging indicators" -series that typically turn downward some time after a peak in business has been reached. The response of retail prices and wage rates to declines in business has often been visible only in a slowing down of their rates of growth.

Finally, the persistently rapid rises in the prices of health services and of construction costs, often cited as reflections of continued inflationary pressure, may instead be better examples of the importance of special demand and supply factors.

The country's experience with prices during the past year should be less surprising when viewed in the light of its broader experience, of which I have given just a few examples.

There are also other grounds for not expecting a rigid relationship between changes in prices and changes in business. The impact of a given monetary-fiscal policy is bound to vary from time to time, if only because what happens to business in general and to prices in particular is influenced also by the policy that came before and the policy that is expected to come later.

Various studies under way at the National Bureau, such as those by Friedman and Schwartz, deal with these complicated matters in one way or another. In the present study, attention is being focused on the behavior, and variation in the behavior, of the several categories of prices during different periods in our history.

Work has also begun on a topic that may be thought of as bearing on the competition among national goals. This is the question, in what direction, to what extent, and for how long may efforts to attain or maintain a stable economy be expected to influence the rate of growth of national output, or more particularly, the rate of growth of a major factor of output, namely, output per man-hour worked. It is a subject to which rather less attention has been paid than the trade-off between full employment and inflation, to which Gordon refers in his progress report below. The question necessarily involves a good deal of speculation. What I shall be doing is to set down some of the factual and theoretical considerations useful in guiding and disciplining this speculation. These include the factors determining the trend of labor productivity, on which Kendrick has been working, and the factors-not altogether different-that cause fluctuations around the trend during successive stages of the business cycle. The latter subject was studied by Hultgren some time ago. New data make it possible to extend and check some of his results. The Nadiri-Rosen study, reported below, also should be helpful.

#### Solomon Fabricant

#### **Interrelated Factor Demand Functions**

The purpose of this work is to integrate empirical investment and employment functions and to link both of these with capacity considerations, i.e., hours of work per man and utilization of capital equipment. Thus, we specify and estimate a complete dynamic model for all input demand functions, which allows interactions and feedbacks among these variables over time, and which integrates some existing empirical work into a unified structure.

The model has been fitted to aggregate manufacturing data, and the results are very good. Implied distributed lag responses show that physical capital is relatively fixed compared with other inputs. They also show that the primary role of variations in utilization rates is to adjust output levels rapidly in the face of the slow adjustment of capital stocks, as is predicted by our a priori hypotheses. These estimates are also capable of accounting for low estimates of the elasticity of employment with respect to output found in previous short-term employment function studies. In those studies, large short-run returns to inputs of labor seem to be due to the omission of input utilization rates, particularly that of capital.

The model has now been extended to include changes in inventories as another variable among the interrelated factors of production. We have completed the collection and processing of the quarterly time series data for seventeen two-digit manufacturing industries for the period 1947-68. The model has been re-estimated for these subindustries, and we are preparing to explore the interindustry differences in the estimates.

> M. I. Nadiri Sherwin Rosen

## Problems in the Measurement of Nonresidential Fixed Capital

The purpose of the project is to revise existing capital input estimates to take better account of technological change in capital goods and of changes in service lives and utilization rates. The project is divided into six subtopics, on each of which considerable progress was made during 1969-70.

1. Principles of Capital Measurement. Analysis based on a theoretical model has suggested several principles. Deflators for investment spending should be adjusted for all changes in quality, whether or not they require a change in the base-year cost of production. But, in studies of economic growth, perpetual inventory capital stocks should be examined in accordance with three concepts of real investment. Using the first such concept, stock is corrected for all changes in quality; in the second, stock is corrected for changes in quality which increase the base-year cost of production of capital, and in the third, stock is completely uncorrected for changes in quality or productivity. Differences in the growth rates of the three stocks form the basis of studies of the sources of economic growth. This theoretical analysis has been set out in an article titled "The Advance of Knowledge and Measures of Total Factor Productivity."

2. Techniques of Price Measurement. In recent years considerable attention has been devoted in the literature to the possibility of adjusting price indexes for quality change through the use of the "hedonic" regression technique. The Census Bureau is now using the hedonic method in a new price index for single-family residential houses. A close analysis suggests that the Census price index and others may be biased upward, since the method cannot identify costless quality change in quality dimensions which are excluded (because of multicollinearity or data limitations) from the hedonic regressions. In the future more emphasis will have to be placed on detailed engineering studies to measure improvements in the ability of capital goods to produce output.

For the next few years, construction price indexes used to calculate capital stocks may have to be based on interim methods like those I proposed in the *Review of Economics and Statistics*, November 1968.<sup>1</sup>

3. Revisions of Existing Price Deflators. To supplement my earlier study of construction price deflators, I have done some work to assess the accuracy of the U.S. equipment price deflators. At present, most categories of equipment investment distinguished in the U.S. national accounts are deflated by product-class indexes of the Wholesale Price Index. A set of alternative data sources suggests that the WPI data contain a serious upward bias of as much as 2 per cent per annum during the period 1954-63. A National Bureau-type reference cycle analysis of cyclical fluctuations in the ratio of transactions to list prices suggests that the present official U.S. indexes understate cyclical fluctuations in equipment prices. While the information so far collected is not sufficient for a trustworthy estimate of the magnitude of this cyclical inaccuracy, government statistical agencies could sponsor research to extend my methodology. Such a study would be valuable not only in the study of capital stocks and economic growth, but also in revealing possible weaknesses in previous studies of the demand for investment goods, the results of which usually depend heavily on the cyclical path of real investment spending.

4. Revisions of Investment Estimates. Further Defense Department data have been collected. These will be used in future revisions and extensions of my original estimates of government-owned capital used by private contractors, as reported in the June 1969 American Economic Review.

5. Utilization Estimates. Detailed annual estimates of capacity and utilization in a large group of industries have been prepared from data for periods ranging back to 1910. The

<sup>&</sup>lt;sup>1</sup> Robert J. Gordon, "A New View of Real Investment in Structures," *Review of Economics and Statistics*, November 1968.

data suggest that in many industries utilization rates in the late 1920's were low relative to the 1950's and 1960's. The time pattern of utilization rates in different industries is being examined in an attempt to determine the relative roles of aggregate demand and technical progress in causing the secular rise in utilization rates. Whatever the cause, changes in utilization rates were a major factor contributing to economic growth in the 1929-50 period and to the accompanying decline in the capital-output ratio.

6. Changes in Service Lives. Although data on changes in service lives are the most unsatisfactory of any used in this project, an attempt is being made to determine the rough order of magnitude of service-life changes in structures and equipment. Preliminary work suggests that service lives were stretched out during the 1929-50 period, contributing to an increase in the figure showing the ratio of actual capital stock to conventional capital stock. This figure was derived on the erroneous assumption of no change in service lives.

As the results of the six sections are completed, they are being written up in the form of a monograph, which it is hoped will be completed before the end of 1970.

Robert J. Gordon

#### **Problems in Predicting the Rate of Inflation**

How rapidly would the general price level increase if the U.S. unemployment rate were to remain forever at the low rates reached between 1966 and 1969? Widely diverse answers to this controversial problem have been proposed in recent research. The most common empirical approach, employed by Perry, Brechling, and others, fits a stable Phillips curve and predicts that at steady 1969-type rates of unemployment the rate of inflation would be stable at between 3 and 4.5 per cent. Diametrically opposed to this approach are recent papers by Friedman and Phelps, who

argue that any attempt by policy makers to maintain forever the low 1969 unemployment rate would lead not to a stable but to an accelerating rate of inflation. In order to dampen and eliminate the accelerating rate of inflation, the unemployment rate must be raised to the "natural rate" at which there is no excess demand for labor. There is thus no permanent, stable trade-off between unemployment and inflation, as implied by the previous Phillips curve investigations. According to Friedman and Phelps, previous Phillips curve studies, like that of Perry, have fitted the wrong curve. Instead of attempting to estimate the Phillips curve relating the change in the nominal wage to the level of unemployment, previous studies should have used the change in the expected real wage as the dependent variable.

The present study is an attempt to appraise the two approaches by translating the implicit verbal argument of Friedman's 1967 Presidential Address to the American Economic Association into an econometrically testable model. Equations are derived which explain the growth of both wages and prices. The econometric equations are of the form:

(1) 
$$g_{w/q'_t} = a_{10} + a_{11}m_t + a_{12}g_{m_t} + a_{13}g_{p_t}^* + e_{1t}$$
  
(2)  $g_{p_t} = a_{21}g_{w/q'_t} + a_{22}g_{w/q_t} + a_{23}g_{m_t} + a_{24}g_{8t} + e_{2t}$ 

Here g means a proportional rate of growth, w/q' is "standard" unit labor cost, w/q is actual unit labor cost, m is the employment rate, p is the actual and  $p^*$  the expected price level, S is the ratio of new orders to shipments, and e is an error term. The first equation states that the rate of increase in standard unit labor cost is a function of the level and rate of change of the employment rate and of the rate of change of the expected price level; the second states that the rate of increase in the actual price level is a function of the rates of growth of standard and actual unit labor cost, the em-

ployment rate, and the ratio of new orders to shipments.

Considerable emphasis in the research is devoted to sensitivity tests of the results. Regressions are run with and without corrections for serial correlation, in levels and one- and fourquarter changes, for different subperiods of the postwar years, and for different methods of generating the expected price level  $(p^*)$ . The sensitivity analysis demonstrates that the coefficients on some of the variables are much more stable than those on others. Among the innovations is a new "unemployment rate of man-hours" which corrects the more familiar published unemployment rate both for disguised unemployment and for partial unemployment. When it is substituted for the published unemployment rate, this new variable improves our explanation of postwar inflation. This unemployment rate was high relative to the published rate in 1962-64 and low in 1969. It therefore helps to explain the low rate of inflation in the former period and the high rate in the latter. Considerable attention is also devoted to correcting the wage (compensation) data for changes in the industrial mix of employment.

While, at the present time, the statistical results are tentative, they tend to confirm the Perry-Brechling view of the inflationary process. The coefficient on expected prices  $(a_{13})$  in the wage equation is consistently .5 or less in all of the numerous regressions which employ several different methods of generating estimates of expected prices. Since the coefficients on standard and actual unit labor cost  $(a_{21} \text{ and } a_{22})$ add up to 1.0, the results for wages and prices together suggest a damped inflationary process in which workers fail to adjust completely to changes in expected prices but nevertheless maintain their share of the national income because there is a rigid relation of prices to wages, as indicated by the price equation.

A preliminary version of the theoretical discussion and empirical results has been written up in the form of a journal article. Subsequent stages of the research will involve dynamic simulations of the wage-price model under alternative economic policies and formal comparisons of the results with those of earlier investigators.

Robert J. Gordon

## Postwar Productivity Trends in the United States

A manuscript of this monograph has been sent to a staff reading committee for review. A basic objective of the study was to update the estimates and analyses of productivity in the U.S. economy contained in *Productivity Trends in the United States* (NBER, 1961), with particular reference to the post-World War II period, 1948-66. Extensive use of the series contained in *Productivity Trends* indicated the desirability of extending them, particularly since governmental statistical agencies have not yet provided regular estimates of total real capital stocks for the economy, by sectors and major industries, nor the derived capital and total factor productivity estimates.

The concepts behind the estimates are essentially those introduced in *Productivity Trends*, with the addition of gross real capital stock, gross capital productivity, and gross factor productivity measures. The sources and methods underlying the estimates are described in detail in an appendix, which also contains more than eighty basic tables with time series of output, input, and productivity estimates for the U.S. economy by major industry divisions and groups. The estimates were prepared with major assistance from Maude R. Pech prior to her retirement from the National Bureau in early 1969.

Some of the main findings of the study may be summarized as follows:

The trend-rate of increase in total factor productivity in the private domestic economy does not appear to have accelerated since World War II. At 2.3 per cent a year in 1948-66, the trend-rate is the same as that which prevailed in 1916-29, and again in 1936-66 following a downward shift during the Great Depression. The 2.5 per cent rate between 1948 and 1966, obtained by the compound interest formula, reflects the fact that 1948 was somewhat below the trend, while 1966 was above. The slower average rate of growth from 1966 to 1969 at 1.2 per cent a year has brought total factor productivity back below the trend.

Output per man-hour and per unit of labor input (weighted man-hours) increased at average annual compound rates of 3.4 and 3.1 per cent, respectively, in 1948-66—an acceleration of 0.8 per cent in each compared with the 1919-48 rates. Over and above the trend considerations noted above, the acceleration reflected substantially higher rates of increase in capital per man-hour than in the 1919-48 period.

Real Net National Product increased at an average annual compound rate of 4.1 per cent between 1948 and 1966 (after a small upward adjustment to allow for a 1 per cent a year average increase in government productivity). Thus, the total factor productivity advance of 2.3 per cent a year accounted for well over half of economic growth as measured by real NNP.

Real average hourly labor compensation rose at an average annual rate of 3.3 per cent between 1948 and 1966–0.2 percentage points more than output per unit of labor input. The 0.2 per cent a year rate of increase in unit labor cost also indicates the rate of increase in the labor share of factor income originating in the business economy—from 69.7 per cent in 1948 to 72.5 per cent in 1966.

The relationship between the relative decline in labor input and the relative increase in the real price of labor indicates a historical elasticity of substitution of between .65 and .70. This is quite similar to the elasticities computed for earlier periods, when the labor share also increased mildly as the rate of relative increase in the real price of labor was proportionately greater than the rate of relative decline in the quantity of labor input.

There is a significant positive correlation between 1948-66 rates of change in output and in the productivity ratios for the thirty-two industry groups of the "industry" sector (excluding agriculture, finance, and services), and for the twenty-one manufacturing groups. There is also a significant positive correlation between rates of change in output and output per manhour for 395 four-digit manufacturing industries, 1954-63. Fuchs also found a significant positive correlation for seventeen trade and service sector industries. Our results confirm Fuchs' finding that the relationship does not hold for the ten one-digit industry segments.

A major theoretical explanation of the output—productivity relationship is that rates of change in productivity and in (net) price of outputs are negatively correlated, as are those between rates of change in price and in output, assuming that the effects of price elasticities of demand are not outweighed by other demand elements.

For the manufacturing and broader industry groups, there is a significant negative correlation between rates of change in productivity (total and labor) and in output prices. This is reinforced by the associated finding that rates of change in productivity and in factor prices are not significantly correlated.

To complete the chain of relationships, we can note that industry rates of change in price and in output have a significant negative correlation for the period 1948-66.

The degree of positive correlation between relative industry changes in output and in productivity is higher than can be explained by the negative relationships between rates of change in productivity and price, and between price and output changes. This fact suggests that scale effects reinforce the positive relationship between rates of change in productivity and in output.

In the case of the nine one-digit industry segments, the chain of relationships breaks down with regard to relative changes in price and in output, which are not negatively correlated. It appears that price-elasticity effects are outweighed by income elasticities and shifts in tastes operating in the opposite direction. This is notably the case for the extractive and service segments; relative output of the former has declined despite relative price declines, while the opposite is true of services.

n-

d-

or

re

en

n-

.s-

nt

ıd

m

ot

t-

of

of

se

t,

of

d

y

1-

y

S

S

S

e

e

1

2

2

Our basic hypothesis as to the causal factors in productivity growth is that the rate of productivity advance is chiefly a function of the rate of growth of real intangible stocks of capital per unit of the tangible factors in which they are embodied, affecting their "quality" or productive efficiency.

Real intangible capital stocks grow as a result of net intangible investments designed to increase the output- and income-producing capacity of the tangible human and nonhuman factors. The chief types of intangible investment for which we developed estimates are research and development, education and training, health, and mobility.

Total intangible investment grew from 14.5 per cent of GNP in 1948 to 21.5 per cent in 1966. The relative upward movement represents a continuation of earlier trends. Real gross intangible stocks, obtained from the investment estimates, increased at an average annual rate 2.6 per cent higher than the growth rate of real tangible factor inputs in 1948-66 closely comparable to the rate of increase in total factor productivity.

Shorter-term productivity movements are closely related to the rates of utilization of productive capacity, and the ratio of employment to labor force.

The average age of tangible, reproducible fixed capital goods, as a proxy for the rate of diffusion of technological advance, also appears to be significantly related to productivity trends. The average age has declined between 1948 and 1966.

John W. Kendrick

#### **Other Studies**

A draft of Phillip Cagan's study on "The Flexibility of Prices," which examines the speed of adjustment of prices to changes in demand and supply conditions, was reviewed by a staff reading committee. It now awaits revisions by the author, who has been on leave to serve on the staff of the Council of Economic Advisers.

### **Public Finance**

#### Introduction

Public finance is a field in which the potential for doing useful research has been broadened by recent technological progress to a greater degree than in many other fields of economics. This broadening has arisen from two sources. The increased availability of large-scale microdata sets, consisting of sizable cross-sectional samples of individuals and/or firms with data on a large number of characteristics of these decision units, has resulted in increased opportunity for detailed microeconomic studies of behavioral adjustments to tax differentials. The development of solution procedures to deal with large nonlinear models, such as the Brookings-SSRC model, has made feasible the development of complex general-equilibrium tax policy models which can potentially be used to measure the many interacting effects of changes in the structure of taxes, transfer payments, and certain types of public expenditures.

These advances in technology are of course attributable to the rapid rate of technological progress in computer hardware and software. Even in the very recent past, it was not technologically possible to measure all of the relevant effects of policy changes, such as the restructuring of the income tax system, the reform of unemployment insurance schemes, the introduction of a negative income tax, or the implementation of a substantial change in the mix of taxes collected by governments. It has been possible to predict some of these effects in an incomplete general-equilibrium context. Harberger, for example, has made important contributions to the measurement of welfare losses that are caused by the inefficient allocations resulting from tax distortions.<sup>1</sup> Until re-

<sup>&</sup>lt;sup>1</sup>See Arnold C. Harberger, "The Incidence of the Corporation Income Tax," *Journal of Political Economy*, June 1962, pp. 215-240; Harberger, "The Measurement of Waste," *American Economic Review*, May 1964, pp. 58-76.

cently, however, it has not been feasible even to consider development of a general-equilibrium model in which redistributive effects, effects on allocative efficiency, and effects on aggregate savings and investment could all be incorporated. It has accordingly not been feasible for public finance economists to measure the trade-offs among effects on growth and redistributive effects which are at the heart of the crucial political issues involved in assessing structural reform of the tax/expenditure system.

The variety of effects that need to be analyzed and the nature of the analyses required have been described elsewhere.<sup>2</sup> From a policy viewpoint, the most relevant empirical question regarding any proposed structural change is normally the long-term effects of the change when accompanied by whatever compensating changes in monetary and fiscal policy are required to offset any effects of the proposed change upon the current level of aggregate demand or upon the current balance of payments. Measuring such compensated effects requires a complex general-equilibrium model that will not be easy to specify. The specification problems are compounded by the necessity of substantial disaggregation in analyzing many tax substitutions and by the usefulness of incorporating microeconometric models utilizing relatively large-scale microdata sets.

Much of the National Bureau's current research activity in public finance is concerned either with how to proceed in specifying a largescale general-equilibrium tax policy model or with utilizing microdata sets to study the impact of changes in the structure of tax and transfer systems. The work on approaches to generalequilibrium model specification has been largely limited to analysis of the effects of substituting a value-added tax for all or part of the corporate profits tax, and is described below in separate reports by Bossons and Shoup and by Petersen.

Current analyses of the impact of structural changes in tax and transfer systems are largely focused on four topics: (1) the differential initial incidence of alternative income tax systems, (2) the differential secondary incidence of alternative transfer payment systems, including both negative income taxes and income maintenance programs, (3) analysis of the effect on labor effort of changes in the structure of the current income tax and unemployment insurance programs, and (4) an analysis of the impact of intergovernmental grants. Research on the first topic was begun last year and is described in a progress report by Bossons. The new research projects on the second topic are described in reports by Bossons, Hindle, and Robinson and by Bossons and Hosek. Current research on the third topic includes a continuing study by Holland on the effects of taxes on the work effort by managers and entrepreneurs in new businesses and an analysis by Bossons and Hosek of the work disincentive effects of unemployment insurance. The effects of intergovernmental grants have been analyzed in a study by Dresch and Struyk.

In addition to these projects, which are decribed below in separate reports, a previous study of corporate taxation and corporate growth by Challis Hall, interrupted by Hall's untimely death in September 1968, is being completed by Norman Ture.

John Bossons

### Measuring the Effects of Tax Substitutions

Following the priorities suggested in the outline of research on tax substitutions which we proposed last year, we have concentrated our initial attention on attempting to organize and clarify the research that will be required in order to build a general-equilibrium tax policy model that is adequate for the analysis of the redistributive, allocative, and growth effects of substituting a value-added tax for a corporate

<sup>&</sup>lt;sup>2</sup> John Bossons and Carl S. Shoup, "Analyzing the Effects of Large-Scale Changes in Fiscal Structure: A Proposed Systems Approach," in *New Challenges for Economic Research*, 49th Annual Report of the National Bureau of Economic Research, New York, 1969, pp. 11-26.

profits tax. In the course of this discussion, two papers have been written to clarify some of the issues involved:

> John Bossons, "Evaluating the Substitution of a Value-Added Tax for the Corporate Profits Tax."

> Stephen P. Dresch, "An Urban-Regional Component for the General Equilibrium Tax Policy Model: Preliminary Considerations."

In addition to work done on these papers, a new, more detailed proposal embodying the results of discussions on the appropriate staging and likely costs of the proposed research has now been prepared.

> John Bossons Carl S. Shoup

## Industry Price/Output Effects of Substituting a Value-Added Tax for a Corporate Profits Tax

In my study of the economic effects of substituting a value-added tax for the U.S. corporate profits tax, I have altered the direction of my research from balance-of-trade effects in terms of a general-equilibrium model, as I reported in the last *Annual Report*, to a partial equilibrium analysis of the short-run price/output effects of the tax substitution for a single industry. The reasons for this shift in emphasis are twofold.

First, the refinements necessary to describe adequately the tax substitution for the United States in terms of a simple general-equilibrium trade model are too many to provide useful a priori estimates of the tax substitution's trade effects. Although this type of model has been employed by Harberger, Mieszkowski, and others to yield interesting propositions on the incidence of broad-based taxes, it does not seem well-suited to answer questions about the trade effects of these taxes. The more elaborate general-equilibrium analysis that is needed would require more resources than I have at my disposal. A second related reason for my shift in emphasis is that such a large-scale general-equilibrium analysis has been proposed as a major research effort for the National Bureau. (See the 1969 Annual Report, pages 11-26.) I have therefore decided to concentrate on one necessary input to this analysis: the short-run price and output effects of the value-added tax/profits tax substitution.

The necessity for examining such price and output responses to the tax substitution arises from the possibility that oligopolistic interdependence in an industry will result in differing pricing policies for different industries, and that pricing policies, together with industry demand and cost conditions, will produce a variety of price and output responses to the tax substitution. To undertake any aggregate analysis of the effects of such broad-based taxes as the value-added tax and the corporate profits tax, it is therefore necessary to examine price and output effects for specific industries.

To accomplish this task, I am constructing a three-equation model which will incorporate an industry's price policy, demand conditions, and cost conditions. Substantial work has been done by others on the specification and estimation of demand and cost functions for various industries, but the price function remains the subject of considerable controversy and requires the most work. In addition to the general exploration of work already done on each of these functions, I am in the process of selecting a particular industry for which the short-run price and output effects of the value-added tax/ corporate profits tax substitution may be estimated.

Bruce L. Petersen

## The Initial Differential Incidence of Alternative Income Tax Systems

Since this project was described in last year's *Annual Report*, only current work will be summarized here. Work on this project is proceeding in two areas: (1) the analysis of alternative

income tax systems, and (2) the specification of a model of the joint distribution of income and wealth. The latter model will be used as the basis for a more accurate analysis of the differential impact incidence of a tax change, as well as for analysis of the effect of a tax change on asset prices.

Two papers on alternative income tax structures have been completed this year:

> "Integration versus Dividend Deductibility."

"The Effect of Tax Rates on the Impact of Tax Reform: The White Paper vs. an Alternative."

The first of these papers discusses alternative means of overcoming the effects of the "double taxation" of corporate income under the corporation and personal income taxes; the second discusses the impact of a new set of tax reforms recommended by the Canadian government in its White Paper of November 1969. Another paper on the design of rate schedules under different tax reforms is in progress.

Work on specifying a model of the joint distribution of income and wealth is proceeding in two stages. An initial paper analyzing individual responses to a 1963 Federal Reserve Board survey, a sample of 100,000 1962 income tax returns, and 1962 state tax data is near completion. This work is in part supported by the study described in Section 6 of this report by Raymond Goldsmith. Subsequent research will focus on the patterns of individual ownership of different types of assets as well as on updating the model.

John Bossons

## The Cost and Incidence of Transfer Payment Programs in Canada

The primary purpose of this work is to analyze the relationship between family income and the characteristics of families. Data on the composition of family income by intrafamily recipients and by income components is to be used to examine the sources of income as a family moves through its total life cycle. Among other things, this work should yield insight into the causes of income differentials and the incidence of socially perceived poverty. In addition, the results will be used to assess the costs and incidence of the net fiscal transfers resulting from alternative negative income tax schemes.

In all of the forgoing, "incidence" is defined to mean the differential secondary incidence of a change in the tax/transfer structure that leaves the existing government deficit unchanged but allows for changes in labor force participation rates. Both interregional and urban/rural incidence patterns are to be examined, as well as the incidence of a scheme for individuals in different income and family status classes. For all the analyses, the primary data source being used is a sample of approximately 18,000 families obtained in the 1968 Survey of Consumer Finances in Canada by the Dominion Bureau of Statistics. Workeffort, behavioral adjustment equations will in part be based on the results of the companion study by Bossons and Hosek.

Work to date has concentrated on designing efficient computation procedures and on specifying a model of the source of income differentials. In addition, a preliminary analyses of a smaller sample of Ontario families has been undertaken by Colin Hindle; this study is decribed in a separate report. It is expected that this project will soon be completed.

> John Bossons Colin J. Hindle T. Russell Robinson

## Negative Income Taxation and Poverty in Ontario

The objectives of this research are to determine the incidence of poverty in Ontario and to test the efficiency of alternative means of eliminating poverty. Poverty is measured as the amount by which adjusted disposable family income falls beneath the "poverty standard." In this case the poverty standard is set equal to existing provincial general welfare assistance rates. These rates provide benefits, differentiated according to family size and composition, for food, shelter, clothing and other living expenses. Adjusted disposable family income consists of net money income plus imputed house rent for owner-occupiers, minus personal income taxes.

The process of negative income taxation is modelled by employing essentially static, initial incidence theory. The substitution of one system of negative taxes for another is assumed to leave all behavior, except work effort, unchanged. Adjustments in work effort are assumed to occur instantaneously in response to the impact of changes in net taxes or transfers. In the absence of further work on labor force participation effects, behavioral equations for heads of households and for spouses, estimated separately by Leuthold, have been used.<sup>1</sup> Decreases in work effort, of course, have the effect of increasing the cost of a negative income tax scheme.

The extent of cost increases due to decreased work effort provides some gauge of the desirability of different schemes. Other measures of relative efficiency, such as the amount of total poverty eliminated and poverty eliminated per dollar of negative tax paid, are determined by the pattern of secondary incidence. Programs that make payments to the nonpoor are, of course, less efficient when judged in this manner. However, differences also occur among schemes that transfer an equal proportion of their total payments to the nonpoor. Some exhibit what may be termed "poverty overkill," providing more funds for a given family within the set of families classed as poor than are necessary to completely extinguish poverty.

The effects and efficiency of various hypothetical negative income tax schemes have been generated by means of a computer simulation utilizing microdata. These data are drawn from the 1966 Survey of Consumer Finances, Dominion Bureau of Statistics, and consist of a 1 per cent sample of Ontario "census families." The census family definition is a very close approximation of the nuclear family concept frequently mentioned as the most suitable negative tax unit. In addition, simulations have been carried out to measure the efficiency of existing Canadian programs—family allowances and old age security benefits. At the time of the survey, these schemes made payments to all children under sixteen years of age and all persons over sixty-nine years of age, respectively.

Preliminary results indicate that Ontario poverty is concentrated in urban areas and is most prevalent among unattached individuals, as is shown in Table II-1.

#### TABLE II-1

#### Distribution of Families Below "Poverty Standard," by Family Characteristics, Ontario, 1965 (per cent)

	Nonfarm	Farm	Total
Unattached individual	44.4	3.9	48.3
Married couple	7.0	2.3	9.3
Married couple with children	15.5	6.3	21.8
Male head (no spouse) with children	0.4	0.0	0.4
Female head (no spouse) with children	19.7	0.5	20.2
Total	87.0	13.0	100.0

Existing Canadian grant programs turn out to be a relatively inefficient means of eliminating poverty. More poverty could be eliminated by using equal-cost, universal negative income tax plans, as shown in Table II-2. In all cases, the poverty gap is defined as the difference between disposable income excluding the transfers being analyzed and the poverty standard previously defined. In the case of universal negative income taxes, each of the three negative income taxes analyzed is defined with

<sup>&</sup>lt;sup>1</sup> Jane Leuthold, "Formula Income Transfers and the Work Decision of the Poor," unpublished Ph.D. dissertation, University of Wisconsin, 1968.

rates yielding a net cost after work-effort adjustments equal to the cost of the grants which it replaces. The ratio of total poverty eliminated (measured in terms of the dollar amount by which the aggregate poverty gap is reduced) to the aggregate cost of each program is a measure of program efficiency.

#### TABLE II-2

## Efficiency of Alternative Transfers (per cent)

I	Ratio of Total Poverty Eliminated to Total Cost	Fraction of Poverty Gap Eliminated
Existing programs		
Family allowance	es 7.6	4.5
Old age security	43.6	36.5
Universal negative		
Replacing F.A.	63.5	59.6
Replacing OAS	77.4	56.2
Replacing F.A. and OAS	56.0	82.4

Among negative tax schemes proper, best results (in the sense of program efficiency) are achieved by utilizing proportional taxation as opposed to either progressive or regressive taxation.

Colin J. Hindle

### **Effect of Taxation on Personal Effort**

The design and scope of this project have been described in earlier reports. A preliminary account of some of the findings was presented to the Annual Conference of the National Tax Association in October 1969. This paper, which is to be published in the *Proceedings* volume of that Conference, covers the main findings from the interviews with respect to four general points: (a) The "price" effects on executive effort exercised by the income tax; (b) The influence of taxation on engineers and scientists who have gone into business; (c) The time spent by executives on management of personal tax affairs; (d) The time demands of corporate tax management.

I expect to complete soon a first draft of the study.

Daniel M. Holland

## The Effects of Alternative Unemployment Insurance Programs

Research on this project is to center on two topics: the disincentive effects of unemployment insurance schemes and the analysis of alternative unemployment insurance schemes. Research on the first topic would focus on how unemployment insurance payments affect the duration of unemployment, studies being done for several different labor groups. The second topic involves an extension of an existing model, developed for the Canadian Unemployment Insurance Commission in 1968-69 to permit analysis of alternative unemployment insurance schemes in Canada. The extended models would incorporate information gained from study of the first topic as well as from other supplementary investigations and, in addition, would be expanded to allow study of further alternative programs.

The research will be based primarily on analysis of a large sample of Canadian individuals for whom data on labor force participation, wages, income, age, and family characteristics have been obtained from Unemployment Insurance Commission records and from income tax returns. The data set, a 5 per cent sample of Canadian individuals in the labor force in 1965 and 1966, has been assembled by the Dominion Bureau of Statistics, the Unemployment Insurance Commission, and the Department of National Revenue in Canada. The project is partially supported by the Canadian Unemployment Insurance Commission.

One measure of the efficacy of an unemployment insurance program is the degree to which it affects the size of the employed labor force, both through its effects on the duration of unemployment and through its effects on labor force participation rates for various groups in the population. Surprisingly little work has been done on this subject. It is not clear whether the duration of unemployment is significantly affected by unemployment compensation, nor is it known whether different labor groups react differently to such payments.<sup>1</sup> Lack of adequate data has precluded empirical measurement of these effects and, at the same time, has blocked development of theories of behavior of the unemployed, particularly a theory of duration of unemployment. The data source developed by the Unemployment Insurance Commission is thus highly useful.

ζ

3

ł

We propose initially to do a study concentrating on married men, ages 25-50. Since these men typically do not leave the labor force when unemployed, changes in their labor force participation rates will be minimal. Thus the participation decision will tend to be independent of decisions regarding job search and duration of unemployment. Also, by studying only married men we avoid the question of how the presence or absence of a wife affects the unemployment behavior of male participants; this question can be analyzed later. Subsequent studies will probably focus on elderly workers, teenagers, and married women.

Work on the second major research goal, development of a model to analyze alternative unemployment insurance programs, will profit from information gained in research on the effects of unemployment insurance on the labor force. We would like to use this information to construct an analytic model that goes beyond that developed to evaluate the present Unemployment Insurance Commission proposals. Our tentative plan is to retain parts of the computer program specifying the model in its present form, modifying other parts to allow for the analysis of other changes in unemployment insurance structure and to incorporate relevant information generated by the disincentives study and other supplemental studies.

The details of such modifications remain unsettled. We would like to capture three effects, namely, anticyclical effects, effects of differential incidence of costs and benefits across individuals and industries, and disincentive effects. An integrated analysis of these effects seems necessary before one can specify compensation schemes which are equitable yet also promote the efficient allocation of labor.

A number of preliminary tasks must be completed before much of the above research can be undertaken. These tasks range from additional data validation to problems associated with the extension of the current simulation model. We expect to begin work on analyzing the 1965 and 1966 data in the summer of 1970. We expect that data for 1967 and 1968 will also become available at that time. In the meantime, we are concentrating on developing a model of labor force behavior under unemployment, assuming individuals to be maximizing utility subject to a full wealth constraint.

> John Bossons James Hosek

## Inter- and Intrastate Analyses of Grants-in-Aid and Local Fiscal Activity

These studies are currently undergoing revision and staff review preliminary to publication by the National Bureau. Struyk's study, outlined in the 1969 Annual Report, is an analysis of state grant-in-aid programs to local governments in New Jersey; Dresch's analysis, presented to Yale University as a doctoral dissertation, utilizes an interstate sample of local governments in metropolitan areas to examine the impact of varying state-local fiscal structures.

The basic model which is used to reconcile the two analyses can be indicated in brief outline. First, an adequate model of local fiscal behavior as it is influenced by grants-in-aid must reflect the structure of the grant-in-aid

<sup>&</sup>lt;sup>1</sup>For a review of previous research, see Charles Lininger, "The Effect of Weekly Unemployment Benefit Amounts on the Duration of Unemployment Benefits," unpublished Ph.D. dissertation, University of Chicago, 1962.

system. The conventional model implicitly emploved in much of the literature on local government finance assumes that variations in grants are independent of local characteristics and fiscal behavior. An alternative formulation would treat the aid level as dependent on local characteristics, such as income, or the level of local expenditure, as when grants are provided on a matching basis. In that case there is a simultaneous determination of grant and expenditure levels. Secondly, aid programs differ in terms of the intralocal incidence of aid financing, varying from the complete absence of local incidence to total local incidence. The impact of aid programs on local activity, in terms of both income and substitution effects, can be expected to depend on the degree of local incidence. Thus, it is necessary to consider the determinants of aid grants and the relationship between levels of aid and levels of local income net of aid-financing taxes.

In the interstate analysis of urban fiscal activity by Dresch, it is assumed that grants-in-aid have a complete local incidence and hence have no influence on the local budget constraint. This assumption is justified on the ground that, across states, gross differences in levels of aid reflect differences in the distribution of responsibility for the provision of local revenue between the state and local governments. In this context, several alternative influences of grants are considered, most importantly possible differences in the *intralocal* incidence of state relative to local taxes and the imposition of state governmental controls over local activity accompanying increases in relative state revenue responsibility. Thus, the effect of grants is not through the level of payments but through the relative dependence of the locality on state financing. To measure this relative reliance, an aid rate (aid relative to expenditure) is utilized in the expenditure equations.

The effect of aid is quantified in the analysis of undeflated expenditures and local revenues; an increase in grants of one dollar is associated with an increase of \$0.15 to \$0.25 in total expenditures or revenue, and most of the coefficients measuring this association are not statistically significant. Alternative specifications of the aid variable are compared and these aid effects are attributed to the use of the aid rate; it is argued that conventional aid level variables vastly overstate the impact of grants.

> Stephen P. Dresch Raymond J. Struyk

## 2. NATIONAL INCOME, CONSUMPTION, AND CAPITAL FORMATION

## Introduction

Two separate lines of research have been pursued during the past year. The household capital formation and savings project, under my direction, is concerned with the development of behavioral relations that underly the acquisition of both tangible and financial assets by households. These studies involve analysis of both time-series and cross-sectional relationships. The latter are based on a set of experimental survey data obtained by the U.S. Bureau of the Census, with which the National Bureau is collaborating on the over-all project. The survey data will be used mainly for analysis of financial asset changes. In addition, the survey is designed to facilitate investigation of the potential uses of anticipatory data relating to changes in both tangible and financial assets.

A second research area, and the major one, concerns analysis of economic and social accounts. Here, Richard and Nancy Ruggles are studying disaggregation problems. They have been concentrating on the construction of subsector estimates, using existing data, and on the development and exploitation of microdata sets that would permit types of disaggregation not otherwise possible. John Kendrick and

Robert Eisner are directing studies that involve expansion or elaboration of the present system of national accounts. Kendrick's work is focused on constructing estimates of imputed value for selected nonmarket activities-unpaid household work, the opportunity cost of students, and volunteer labor. In addition, Kendrick is estimating both stocks and flows of "intangible" assets. Eisner is directing a series of studies concerned partly with activities not ordinarily included in national accounts and partly with refinement and improvement of the present accounts. Projects now under way range from analysis of capital gains to the valuation and allocation of time spent in the household. These projects are discussed in more detail below.

;

ł

F. Thomas Juster

## Household Capital Formation and Savings

The time-series analysis of demand for consumer durable goods is now close to completion. Virtually all parts of the study, including the specification, estimation, and analysis of durable goods demand models, are in manuscript form. An objective (nonanticipatory) model has been estimated and compared with models incorporating both objective and anticipatory data and with one incorporating only the latter. A paper comparing the objective and anticipatory models was presented at the CIRET conference held in Madrid last October.

The objective model has a tripartite structure based on the partial adjustment of actual to desired stocks of durables, the formation of expectations via response to past forecast errors, and different response mechanisms for transitory and permanent changes in financial variables. Thus the model explains observed changes in the stock of consumer durables as the sum of planned changes (those due to expected movements in the underlying behavioral variables) and unplanned changes (those due to unforeseen movements in behavioral variables). The model can be used to explain purchases, as distinguished from net investment, on the usual assumption that purchases are equal to net investment plus depreciation measured as some fraction of initial stock.

The first part of the objective model, i.e., expected or planned investment, can be compared with an anticipatory model that includes only subjective purchase expectations and a variable measuring consumer financial expectations. The complete objective model—expected (planned) plus unexpected (unplanned) changes in stocks of durables—can be compared with an anticipatory model which includes purchase expectations, expectations about financial variables, and unanticipated changes in financial variables.

The empirical results are striking. Over the period 1949-67 the objective model explains about 88 per cent of the variance of net investment in automobiles, and a little over 93 per cent of the variance of net investment in nonauto durables and in total durables. For gross investment (purchases), the objective model explains over 93 per cent of the variance in automobiles and about 99 per cent of the variance in both nonauto durables and the total. All of the substantive economic variables in the model have significant t ratios and reasonable regression coefficients, and the implied lag structures are plausible. The objective model implies a mean lag of under one year, with the peak response in the second and third quarters. These results, and the implied elasticities, are comparable to and generally a little better than those obtained by other investigators.

The anticipatory model cannot be estimated for the same time period because the basic data are unavailable; strict comparability can be achieved only for the period beginning in 1960, and only for net and gross investment in automobiles. A comparison of the objective and anticipatory models for this shorter period indicates that the much simpler (two variable) anticipatory model does just as well as the much more complex (seven variables, including a lagged dependent variable) objective model for planned investment, and slightly outperforms the objective model for total investment. Despite the fact that the anticipatory model does not strictly relate to total durables purchases, it does about as well as the objective model even with total durables as the variable to be explained.

Moreover, when the anticipatory variables are simply added to the fully specified objective model, both expected purchases and consumer expectations add significantly to the variance explained by the objective model; all but one of the substantive economic variables in the objective model are reduced to virtually random numbers This conclusion holds for both automobile and total durable goods purchases. The only objective variables that continue to exert a net influence on purchases, holding anticipatory variables constant, are relative prices and the unemployment rate. In both models, the latter variable represents unexpected changes in financial circumstances, hence it is predicted to be significant holding plans and expectations constant. A possible interpretation of the finding that relative prices have a significant influence net of expectations is that price movements are generally unforeseen by consumers and are thus not adequately accounted for in subjectively expressed plans and expectations. It is interesting that among those variables included in the objective model, relative price is the only one for which the state of consumer information might be substantially altered by actual investigation of a potential transaction; the other variables in the model are clearly known to the consumer unit at the time purchase and other expectations are measured.

Recent empirical work has suggested a slight modification of the anticipatory model which seems to provide better structural properties. The basic idea is that the variable used to measure consumer expectations (actually, the Index of Consumer Sentiment developed by the Survey Research Center at Michigan) is best interpreted as a measure of the state of consumer uncertainty. It can be argued that consumer uncertainty makes a net contribution to the explanation of purchase decisions only when it is changing systematically; otherwise the purchase expectations variable will reflect the full influence of the state of uncertainty. The model implied by this interpretation is a nonlinear version of the anticipatory model described above: purchases are specified to be a function of purchase expectations, current unemployment, and changes in the SRC Index of Consumer Sentiment multiplied by a dummy (1, 0) interaction variable. The interaction variable has a value of 1 if, and only if, consumer sentiment is changing systematically; otherwise, it has a value of 0.

We plan to complete two manuscripts within the next few months. The first will cover the analysis and interpretation of the objective model of durable goods demand, and will incorporate comparisons of objective and anticipatory models. The second will concentrate on the anticipatory models, focusing on the interpretation and proper specification of the uncertainty variable. This paper will also incorporate an analysis of optimal forecasting methods for the anticipations model, analyzing questions of useful forecast span, single-quarter forecasts versus the average of multiquarter forecasts, and so forth. Both of these papers are being written in conjunction with Paul Wachtel.

The experimental survey work being carried out in conjunction with the U.S. Bureau of the Census is now sufficiently far along so that we have begun to obtain substantive empirical results. At present the initial survey and a sixmonths reinterview are on tape, and a number of preliminary regressions have been estimated. The focus is on analysis of alternative ex ante durable goods expenditure variables; analysis of the ex ante savings data is being deferred, since savings during the available six-month span are likely to be seriously affected by seasonal factors. For durables, the preliminary results suggest that expected expenditure variables have less forecasting value than variables reflecting the probability of acquiring specific items like automobiles, houses, or appliances. The results also suggest that the omission of probabilities for the purchase of multiple units within a given time span has a perceptible effect on forecast accuracy. That is, probabilities of buying "more than one," which were obtained in the experimental survey, appear to contribute to the explanation of total purchases.

S

-1

1

r 1

l

)

Since the results of the second reinterview (conducted in May 1969) are now on hand and can be incorporated into the basic analysis tape, we expect to begin substantive analysis of the savings data within a few months. A wide range of questions will be investigated here: the contribution of various types of family income to an explanation of savings behavior, the association between durables purchase expectations, savings expectations, and the corresponding actuals; the question of what explains savings and durable goods expectations, as well as observed savings and durable goods purchases; and so on. Michael Landsberger, formerly at the University of Pennsylvania, joined the project staff in July and will be working mainly on the cross-section analysis of the experimental survey data.

The fourth wave of interviews on the experimental survey was completed as scheduled in November 1969; these data are now being edited and coded at the Census Bureau. The fifth and final wave, originally scheduled for May-June 1970, has been postponed for a few months because of budgetary constraints. It is now expected that we will obtain fifth-wave interviews in the late summer or early fall of 1970. The data set for this experimental survey will eventually comprise two full years of information for roughly 4,000 households, and will permit simultaneous analysis of differences over time and several sets of differences among families for the same time span. It will also be possible to relate differences in both expectations and actual behavior for identical families, a procedure which simulates the behavior of expectational variables in time series much more closely than the usual cross-section analysis.

Processing and preparation of the basic survey data for analysis is under the supervision of Avrohn Eisenstein. Teresita Rodriguez has joined the project as a research assistant, working mainly with data processing on the timeseries analysis.

F. Thomas Juster

## The Design and Use of Economic Accounts

Our recently published study, *The Design of Economic Accounts*, provides a framework within which the accounts can be disaggregated. Our current work is concerned with this question in two ways. First, in the tradition of national accounts estimation, a variety of sources of information are being drawn on to disaggregate major sectors and subsectors and to provide systematic and consistent data. Second, microdata sets are being created for specific subsectors of the economy to permit the use of simulation techniques and to provide for estimates which could not otherwise be constructed.

At present, research on the development and use of national economic accounts is focused on three separate segments of the system: (1) investigation of techniques for providing price indexes related to the national economic accounts, (2) subsector disaggregation of income and balance sheets for the household and enterprise sectors, and (3) the development of microdata sets with the objective of developing social as well as economic accounts.

In present practice, the price information on which the deflation of the national accounts is based derives in large part from the Cost of Living and Wholesale Price Indexes. Neither was designed primarily to fit into the national accounts. Moreover, the samples underlying these price indexes do not take into account the intercorrelation which normally exists among prices, and as a result considerable sampling inefficiency exists. Given suitable computer processing techniques, it is now possible to improve the specification of the price observations required for the development of price indexes that would deflate both the enduse and income-originating measures of gross national product. Preliminary analysis suggests that it would be possible to provide more valid information with substantially fewer observations than are now used in the Wholesale and Consumer Price Indexes.

The disaggregation of the household and enterprise sector has as its object the development (for one point in time) of more detailed income statements and balance sheets for specific subsectors. For the household sector, an attempt will be made to examine specific socioeconomic groups, such as the aged and those belonging to certain poverty classes. For the enterprise sector, attention will be focused on certain unincorporated enterprise subsectors, such as farm and professional. Other work is being undertaken regarding the microeconomic behavior of establishments in the manufacturing sector and the manner in which such behavior is related to productivity, wages, and price determination.

Finally, related research is concerned with developing microdata sets for the household and enterprise sectors. This work involves the addition of imputed information from a variety of sources to the basic information obtained from samples of households and establishments. This research has the dual function of using microdata sets on households and enterprises to assist in subsector disaggregation, and of developing techniques of integrating supplementary data into already existing microdata sets.

> Nancy D. Ruggles Richard Ruggles

## Studies in the National Income Accounts

Most of my time in recent months has been devoted to writing the monograph on postwar productivity trends (reported on in Section 1), and the national income studies have moved slowly as a consequence. With regard to imputations for nonmarket economic activities, Elizabeth Wehle, Jennifer Rowley, and Harold Wolozin are planning early completion of monographs on unpaid household work, opportunity cost of students, and volunteer labor, respectively. When these monographs are finished, I plan to write a summary essay covering these and other imputations—chiefly rental values of nonbusiness capital goods and final goods and services charged to current expense by business.

With regard to the total investment and capital stock project, some preliminary findings about the intangibles are summarized in the report on productivity mentioned above. The estimates involved in this study are being revised and checked by my principal assistant, Jennifer Rowley. We then plan to design appendix tables and write up the sources and methods underlying the estimates. By 1971, I hope to start on the analysis and to make some headway in writing the text. This study has been supported by grants from the National Science Foundation and by the general funds of the National Bureau.

John W. Kendrick

## Measurement and Analysis of National Income (Nonincome Income)

Work is under way on the following major topics: capital gains, the value of services and investment in education, the value of services and net investment in automobiles owned by households, depreciation of business capital stock, executive compensation (with particular focus on stock options), the valuation and allocation of household time, and the depletion of natural resources. The broad plan of research and some of the initial undertakings were described in last year's *Annual Report* (pp. 58-59).

At the American Statistical Association meetings in Detroit, December 1970, reports will be presented by Michael McElroy on "Capital Gains and the Concept of Income," by Allan Mendelowitz on "Measurement of Economic Depreciation," by Wolfhard Ramm on "Services of Household Durables: The Case of Automobiles," and, possibly, by Robert Eisner and Arthur B. Treadway on the general concept and aims of the project. McElroy's work consists of a careful theoretical analysis of the origins of capital gains and their status as income, estimates of capital gains on corporate stock from 1946 through 1968, estimates of capital gains of unincorporated business from 1946 to 1966, and other estimates from a variety of sources. Mendelowitz is applying accepted capital value theory to the estimation of economic depreciation, relating depreciation to exhaustion of an originally anticipated net revenue stream. After exploring relations among expected revenue streams, discount rates, asset service lives, and depreciation, Mendelowitz is estimating revenue stream profiles by relating actual revenue to prior gross investment rates. Initial results, based on data from McGraw-Hill capital expenditure survevs, have been promising.

Ramm is using highly disaggregated market data on auto prices, qualities, and quantities to estimate hedonic price deflators and ex post depreciation patterns. This will allow the construction of more rigorous estimates of stocks, income (including capital gains), and net investment flows for automobiles. This work promises to be the first comprehensive study of its kind, and will result in empirical estimates, for most of the postwar period, that utilize the major methodological suggestions in recent literature. The theoretical work has been completed, the laborious process of collecting information and transferring it to computer-usable formats is largely completed, and initial econometric results for several years have been obtained.

Robert Wallace has been working with Project Talent<sup>1</sup> data, relating information on a number of schooling inputs (aptitude, achievement and personality tests scores for successive years) to post-high-school income, education, and occupation. The statistical work controls for a number of sociological factors and attempts to identify school outputs by reference to the subsequent incomes that various human capital components appear to command in the market. Wallace's tentative findings suggest that output variables representing "technical training," as opposed to "verbal training" or personality characteristics, are most relevant in determining future incomes.

Among further studies recently begun, that of Peter McCabe on the valuation and allocation of household time concerns services of human capital not traded in the market but either consumed directly by the household or applied to the production of more human capital. Stephen Zabor is undertaking an analysis of executive compensation, with particular attention to stock options and other items of deferred compensation. John Soladay is beginning work on natural resource depletion, focused on the theoretical basis for the accounting of exploration costs, on investment in the exploitation of natural resources, and on the capital gains and depreciation on these investments.

Renewal of financial support from the National Science Foundation is under consideration. If obtained, it will permit extension of the study to several other areas as well as completion of the econometric re-estimation of key economic relations on the basis of revised accounts.

Robert Eisner

## Capital Gains and the Theory and Measurement of Income

While considerable attention has been focused on the tax treatment of capital gains and losses and, in a predominantly theoretical way, their behavioral implications in individuals' consumption and portfolio decisions, there has

<sup>&</sup>lt;sup>1</sup> A survey of 100,000 high school students conducted by the American Research Institute (Palo Alto) in 1960, with follow-ups in subsequent years.

been no systematic appraisal of their relevance to the theory and measurement of income. This project is a conceptual and statistical attempt to explore the role of capital gains and losses as a form of income.

Present practice is to exclude capital gains and losses, whether realized or not, from estimates of personal income. This results in a measure which, for purposes of assessing both the magnitude and the distribution of individuals' purchasing power, is considerably narrower than the theoretically appropriate Haig-Hicks concepts of individual income as consumption plus the change in net worth. Accrued gains and losses are large and highly variable: for the years 1947-64, annual gains on major asset groups-corporate stocks, residential real estate, and the physical capital of the unincorporated business sector (including farms)range from minus \$50 billion to over \$100 billion, averaging \$26.3 billion after adjustment for price level changes. By comparison, over the same period personal saving averaged \$18.3 billion and in almost every year was exceeded in absolute amount by capital gains (or losses). These estimates are preliminary, and minor revisions will be undertaken in the near future.

At present I am attempting to distribute this expanded measure of income over income size

classes. Not only is this measure likely to show greater inequality than the distribution of income as measured by the Office of Business Economics, but its trend over time may well be toward more inequality. Inequality in the size distribution of OBE personal income has remained virtually constant during the past twenty-five years.

A second phase of the study is analysis of the relevance of capital gains and losses to the measurement of current economic activity or output. It can be argued that major portions of accrued gains reflect "output" in a broad sense, and that they do not cancel out when the basic Haig-Hicks concept of income is summed over individuals. The problem, it is maintained here, is strictly one of measurement, a conclusion that runs counter to the conventional notion of capital gains and losses as "unproductive" increments to wealth. It is argued that the net result of including these gains and losses in national income is a reallocation of income over time precisely analogous to the treatment of tangible investment by the OBE. A set of consistent stock/flow accounts has been developed as an expository framework for this expanded concept of national income.

Michael B. McElroy

## 3. URBAN AND REGIONAL STUDIES

## Introduction

The National Bureau's research program in urban economics has expanded dramatically during the past year. Studies started last year and the year before have begun to come to fruition, and a number of new staff members have joined the Bureau's urban studies group.

The major part of the ongoing research is related to the development of a large-scale, experimental computer simulation model for studying the processes of urban development. We are carrying out concurrently the over-all design and programming of the computer simulation model and the empirical investigation of the behavioral relationships needed for the model. Although all members of the urban studies group have made important contributions to the model design, Greg Ingram has assumed principal responsibility for its over-all design and implementation. Special recognition should also be given to Royce Ginn, particularly for his help in solving the complex programming problems encountered in developing the simulation model. His contributions are not limited, however, to the computer simulation. All of the individual empirical studies involve the processing of large and complex data files; none would have proceeded very far without his tireless efforts.

The individual econometric studies emphasize one or more areas pertinent to the computer simulation and are expected to provide either specific parameter estimates or the theoretical understanding needed for some components of the simulation model. An exhaustive description of these linkages is not appropriate here. However, a few general examples are useful in illustrating the relationship between the individual econometric investigations and the simulation. The Brown-Kain study is designed to evaluate moving behavior and to determine how and why households modify their pattern of housing consumption. Dresch's study investigates the hypothesis that workplace location of the primary wage earner is a major determinant of both the location of the household's residence and the type of housing it consumes. This hypothesis is fundamental to our current model design. If his findings do not confirm this key hypothesis, we will have to re-examine our views about the processes of urban development and possibly make major modifications of our model design. Mayo's study tests this underlying hypothesis in a somewhat different manner and may provide an alternative means of modeling the household's choice of residential location, if his and Dresch's studies fail to support our working hypothesis.

None of the previous studies will provide much direct evidence about how the housing stock adjusts to changes in the demand for housing services by housing-type submarket and location. This is a serious problem that cannot be evaluated fully because of the lack of satisfactory time-series data on changes in the housing stock. Even so, Silver's study of stock adjustment during the decade 1950-60 should provide some guidance for our modeling efforts.

None of these studies involves original data collection. All of them except Silver's use large

bodies of underanalyzed data on housing markets, residential choice, and urban travel collected from land-use transportation studies in a number of metropolitan areas. One of the advantages of our approach to the development of an experimental urban simulation model is that it permits us to use varied bodies of data from several cities. This creates a number of difficult problems in reconciling parameter estimates from different data sources. However, we believe that these difficulties can be overcome and that the model will be more general as a result of the diverse bodies of data employed.

A more practical reason for proceeding in this way is that several million dollars would be needed to reproduce the data sources in a more consistent way and for a single city. Our entire budget is but a small fraction of this. The distribution of money spent on research and data collection is already badly out of balance. Another expensive and large-scale data collection effort would make this balance still more unfavorable. Furthermore, we still lack the knowledge to design a comprehensive data collection scheme of the kind that would be needed to answer the interrelated set of questions incorporated in the simulation model. Such a data collection effort might be justified after we have analyzed more carefully the bodies of data presently available to us and after we have completed a prototype computer simulation, but not before. Without this experience, we will not know precisely what kinds of data are most needed.

The Kain-Quigley study of housing market discrimination, although somewhat peripheral to the central urban modeling effort, is giving us valuable information about the characteristics and operation of urban housing markets and the way in which these markets are affected by racial discrimination.

In a similar way, the Struyk-James study on changes in industry location will be of value in simulating changes in the distribution of employment. We expect that changes in the location of basic industry will be exogenous to the urban simulation model. This is unsatisfactory. We have been trying for some time to obtain funding that would permit us to begin a largescale analysis of the determinants of the intrametropolitan location of manufacturing establishments. We have acquired from Dun and Bradstreet a valuable and most unusual body of data from which we could learn a great deal about this process, and we hope that we will be able to expand our research in this area in the coming year.

In addition to these studies, there are several others that are not so closely linked to the objective of developing an urban simulation model. David Gordon's research on employment problems in the ghetto, Joseph Persky's analysis of the growth and change in racial composition of Southern metropolitan areas, and Masanori Hashimoto's study of regional employment rates across states and cities fall into this latter category.

John F. Kain

## Modeling the Urban Housing Market

This research effort seeks to represent two important components of urban change. It attempts, first, to model changes which occur in the housing stock through new construction, modification of existing structures, and quality change over time; and, second, to simulate the locational choice of new and moving households. Since these activities are fairly complex, they are being represented in a computer simulation model. While there are undoubtedly a myriad of approaches one could use to simulate changes in the housing stock and locational choice, I have decided to represent these activities in a market setting. Thus the model has three major components: a supply submodel, a demand allocation submodel, and a market or assignment submodel.

The supply submodel simulates stock adaptation, construction, and quality change in each of the several zones which comprise the metropolitan area. The level of each of the possible activities is a function of its expected profitability and several constraints. The profitability is derived from this period's expected prices and engineering cost estimates. The constraints reflect such limitations as zoning restrictions and input availability. The output of this submodel is the revised stock of housing available for occupancy subscripted by structure type and zone of location.

The demand allocation submodel assigns movers of various household classes and workplaces to housing types, by means of traditional demand functions whose arguments are relative prices and incomes. The relative prices incorporate location in a general way in that they include not only the expected housing price but also the expected work-trip cost. This part of the model accommodates the cross elasticities of substitution between house types, since members of more than one household class can select a given house type. The output of this submodel is the number of mover households selecting each house type, subscripted by household class and workplace zone.

The market or assignment submodel matches up the movers with the available units. This will be done with a linear programming algorithm which will produce shadow prices on the various types of units. These shadow prices will then be used to formulate the expected prices for the next period.

The supply submodel was programmed first and is an operating prototype that simulates stock alteration and new construction. This prototype is now being modified to better represent quality change, especially disinvestment. The demand allocation and assignment submodels have been designed and will be programmed next. It is expected that the over-all market model will soon be operational. I will then run sensitivity analyses to identify important model parameters and tentatively simulate the effects of various transport investment and housing policies.

This model uses synthetic data, but it should be fairly easy to adapt to an actual city when the model is perfected and real data are available. Meanwhile, by means of informal consultations with those doing econometric work in the area, I hope to keep the data requirements of the model realizable and the specified parameters realistic.

Gregory K. Ingram

## The Detroit Housing Consumption-Residential Location Study

This study is best described in terms of the broader framework of the National Bureau's urban modeling effort, as outlined by Kain and Ingram. The household sector is of primary importance for three components of the NBER model: (1) the mover identification model, (2) the housing submarket assignment model, and (3) the location model (assigning movers by housing submarket, to residence location). The immediate function of the Detroit study is to estimate the housing submarket demand equations and to identify and assign households to the alternative submarkets. Analyses of other issues of relevance to the NBER model are being pursued simultaneously; particularly important questions relate to the housing consumption choices of "non-normal" households, with normal defined as single-worker, maleheaded, white households. Information on the housing consumption and residential location patterns of most non-normal household types is singularly lacking. It is hoped that the present study, with its rich data source, will significantly improve the understanding of these choices.

Although not explicitly incorporated in most previous urban models, a key assumption of the Bureau model is that workplace location alters the relative prices of different types of housing and significantly influences the choice of housing submarket. In this context, housing prices must be defined to include structure supply price, location rent, the costs (if borne by the household) of public services, and transportation costs (direct and opportunity), specifically the cost of the journey to work. The initial objective of the study is to identify the effect of workplace location on housing consumption choices.

The basic data source for the study is the home interview survey of the Detroit Transportation and Land Use Study (TALUS). The first phase of the research has consisted of constructing a "household-workplace" file for the 41,243 sample households. This was accomplished by merging several TALUS files to produce a composite containing (1) summary household information (e.g., residence location by census tract and TALUS analysis zone, structure type, tenure type and duration, race, income, family composition, number of working family members), (2) additional detail for the household head (sex, age, marital status, education, occupation, and industry) and the wife of head (labor force status), and (3) details of the primary work trips of the head and wife (workplace location, mode of travel, and elapsed time). Construction and editing of this file is now complete. Of the 32,629 households with working heads, it was possible to identify workplace location for 27,244. The actual (1960 Census) and sample geographic employment and residential distributions seem to coincide quite closely. This correspondence between the population and the sample is also observed in the socioeconomic dimension.

Major effort is being devoted at this time to identifying bundles of residential services which define the housing submarkets. The first step in this process utilizes the TALUS structure types: (1) single-family, (2) duplex and row, (3) small multiple, and (4) large multiple. Housing types will be further identified by the physical characteristics of housing units within census tracts, by neighborhood prestige, and by public service quality. As indexes of the quality of public service, public school and crime statistics are being developed. Preliminary analysis utilizing only tract characteristics is now under way.

Having defined housing types, the objective is the econometric estimation of the submarket

demand equations of the form:

(1) 
$$H_{i}^{h'} = a^{h'}X_{i} + \sum_{\substack{h=1\\ h=1,\ldots,n}}^{n} b_{h}^{h'}p_{j(i)}^{h},$$

where  $H_i^{h'}$  = the probability that household *i* will choose submarket h';  $X_i$  = characteristics (e.g., income, family size) of household *i*;  $p_{i(i)}^{h} =$ the price of housing type h (h = 1, ..., n), relative to the price of housing type n+1, at workplace j (the workplace of the head of household i), where the prices include the structure supply price, location rent, public service cost, and the cost of the journey to work. Since the workplace-specific relative housing prices are not observed directly, they must be estimated from the mean within-workplace residuals. The test of the effect of workplace on housing consumption is whether these workplace-specific "incentive factors" differ significantly from zero.

Assuming that a significant workplace effect is observed, the analysis will then attempt to identify the sources of the price variations. This will involve examining the relationships between the incentive factors and such variables as travel time, transit availability, etc. Also, the changes in the incentive factors over time will be examined through information on length of residence. The observed changes in the geographic residential distribution over the various periods will be decomposed into changes resulting from (a) changing workplace locations, (b) changing prices at given workplaces, and (c) changing household characteristics.

It will also be possible at this stage to estimate quantitatively the effect of housing market discrimination on the housing consumption patterns of nonwhites. The estimation of the submarket demand equations will be restricted initially to whites. By predicting black housing consumption on the basis of the estimated white equations and comparing this with the observed black consumption patterns, the distortion in choice can be specified. An effort will also be made to estimate the reverse effect of housing market restrictions on employment opportunities. Other specific areas of investigation include the housing consumption patterns of the retired, blacks, female-headed households, and households with multiple workers. Since sample sizes in excess of 4,000 are available for each of these groups, detailed analysis will be possible.

The primary output of the Detroit study, in terms of the Bureau model, will be the submarket demand equations. From the estimated equations it will be possible to specify consistent sets of workplace-specific prices, which can then be used in initializing the simulation model.

Stephen P. Dresch

## **Residential Location Decisions**

This study is an econometric investigation of the determinants of the residential choices of households. Objectives of the study have been to ascertain those attributes of households which may be used to identify submarkets in the urban housing market and to determine the relative importance of each of a number of subsets of locational attributes within each submarket. At the heart of the theoretical model is a transportation cost-location-rent trade-off model which additionally considers the impact on residential choice of local public services, housing attributes, social amenities, property taxes, accessibility to shopping areas, and preexisting land use and topography. The theoretical development of the model stresses integration of both the demand and supply sides of the market for urban housing. Empirical testing of the model is conducted by considering each of twelve stratified groups within the population as comprising distinct submarkets who compete for housing. The groups which are considered are stratified according to race and sex of the household head, household income, family size, and the number of contributors to family income. Households are further stratified by workplace in order to isolate workplace and residence interactions.

The form of the model which was tested was:

$$P_{ijk} = F_{jk}(X_i, t_{ji})$$

where  $P_{ijk}$  = the proportion of workers who work at workplace *j*, and who are in the *k*th socioeconomic category, and who live at residential location *i*;  $X_i$  = a vector of variables which characterizes residential location *i* according to the sets of variables mentioned above;  $t_{ji}$  = travel time from workplace location *j* to residential location *i*. The subscripts of *F* indicate that there is a different function for each combination of workplace location and socioeconomic category. The equation thus describes the pattern of residential locations for each combination of *j* and *k* as a function of the characteristics of residential locations and the characteristics of the transportation system.

The model was estimated using ordinary least squares with census tracts as the unit of observation. Predicted and actual values of  $P_{ijk}$  were grouped according to broader geographical areas than census tracts to evaluate the ability of the model to predict population distributions over larger than tract-size areas.

Estimation of the model at the census tract level resulted in corrected  $R^2$  statistics which ranged from about 0.04 to 0.45. Grouping the predicted and actual observations resulted in proportions of explained variance almost uniformly on the order of 80 to 90 per cent. Major substantive conclusions are:

1. Increases in commuting costs appear to be traded for lower location rents in every socioeconomic group investigated. The relative importance of commuting time and location rent variables decreases with increasing income.

2. Workplace locations of secondary wage earners in households, as well as that of the primary wage earner, seem to have a significant effect on household locational choice.

3. Public services apparently have no significant unambiguous impact on residential choice.

4. School quality seems to affect the locations of only the higher-income groups.

5. Attributes of the housing stock greatly affect residential choices, though different at-

tributes are important for different groups.

6. Land use externalities do not appear to influence residential choices significantly.

7. Property taxes seem to be capitalized almost entirely into property values and therefore have no pervasive effect on location.

Some of these conclusions are subject to qualification because of problems of multicollinearity and sampling errors in the data. The predictive equations do appear to be relatively sound, however, based on the ability to forecast residential distributions about one workplace using behavioral equations estimated on the basis of other workplaces.

This analysis indicates that, while residential location models based upon location rent transport cost trade-offs are substantially realistic, there are other sets of variables which strongly influence locational decisions and which should be considered in further investigations of this sort. Stratification by socioeconomic categories appears to be absolutely necessary in models of residential choice; behavior is significantly different among practically all groups considered.

Stephen Mayo

## Metropolitan Moving Behavior

This research is concerned with household decisions to move, to purchase particular bundles of housing services, and to choose particular locations within an urban area. We are examining two questions: (1) Given the characteristics and changes in the characteristics of family units and the characteristics of the current residence, can we predict which households will move? (2) For households that move, can we explain how the demand for dwelling unit quality, size, and structure type, neighborhood quality, and the quality of local public services enters into their choice of a new residence?

The principal body of data used for the study was obtained from the Bay Area Transportation Study (BATS). In addition to the usual origin and destination survey, BATS conducted a more extensive home interview of an additional 3,000 households. This supplemental survey provided ten-year employment and residential histories for each household. From this data we have created a "movers file," which for each move made during the ten-year period describes: (1) the location, dwelling-unit and neighborhood characteristics, and value or rent of each residence; (2) the head of household's occupation, industry, and workplace location before and after each move; and (3) the relationship, sex, and age of all household members before and after the move.

In addition, we are now working on a second file which will give the characteristics of each household and residence in each year and indicate whether it moved in that year. We will use this file to analyze the determinants of moving.

The bundles of housing services included in the analysis are described in terms of tenure (own vs. rent), value or rent, structure type, age of structure, number of rooms, location, neighborhood quality and prestige, school quality (average achievement scores), and tax rates. Many previous studies have emphasized the importance of school quality and tax rates on the location decisions of urban households. Dwelling unit characteristics were obtained from the home interview survey; measures of neighborhood quality and prestige, from census tract statistics; and school quality and tax data, from local governments.

We assume that, at any moment in time, households demand a particular collection of attributes of the bundle of housing services and a particular location. Household demands for particular housing services depend on family structure, income, and where family members are employed. Therefore, changes in household characteristics may change the demand for either particular attributes or a particular location. When these changes in demand are large enough, the household will change its residence. For example, the birth of a child may cause the family to demand more space, or an increase in income may cause a family of the same size to demand a higher-quality unit.

Changes in bundles of housing services may or may not be associated with a move from one part of the metropolitan area to another. Similarly, a major change in workplace location from one part of the region to another may cause the household to move while it consumes otherwise identical bundles of housing services. On the other hand, changes in workplace location may change the price of certain attributes of housing bundles, thereby changing the characteristics of the bundle. The empirical testing of these several hypotheses has great significance in the validation of alternative theories of residential location.

A variety of statistical methods will be used in estimating these relationships. We have yet to determine the exact nature of the equations needed to estimate these demand relationships. The individual equations are obviously interrelated, but we still have to determine how this interrelationship should be specified.

Besides being of general theoretical interest, we expect the findings of this research to be helpful in determining the demand equations for the simulation model.

> John F. Kain H. James Brown

## Housing Consumption, Housing Demand Functions, and Market-Clearing Models

Analysis of variance tests reveal rather dramatic differences in housing consumption by family type, employment status, workplace, income, and race. These differences among households are attributable to differences in tastes, differences in prices in the housing market as determined by workplace location, and by racial segregation, which effectively creates a separate housing submarket for blacks in major urban areas. There may also be effects on the side of supply, such as market imperfections or long lags in changing the housing stock.

To date most empirical research on urban housing has been devoted to describing the housing market prices, quantities purchased, and the quality of the stock. Little attention has been given to specifying the underlying demand and supply functions or how the housing market operates (e.g., how the stock is utilized or altered). For example, regression analysis relating housing prices or rents to resident income, housing quality, neighborhood characteristics, and race is essentially a description of the current housing market as determined by both demand and supply considerations and market imperfections. That housing prices are closely related to resident income and stock quality is testimony to the workings of the housing market. However, the particulars of the causal structure remain obscure. Highincome residents, high-quality housing, and high house prices in a geographic area are all endogenous variables, reflecting the spatial configuration of jobs and the current housing stock throughout the city, which determines who will outbid whom at a given site.

To disentangle the sources of variation in housing consumption and housing prices requires in the first instance a specification of housing demand functions. Household interview data are required for this analysis. Previous analysis based on aggregated data, e.g., census tracts, unfortunately obscures the role of the workplace, a fundamental determinant of the relative prices of housing and work-trip costs confronting the household. Housing demand functions for the complex set of residential services which can be considered "housing" are being estimated from household interview data; these include income elasticities and price elasticities as derived from the effects of workplace location on relative prices.

These demand estimates permit a determination of the separate effects on housing consumption of supply imperfections, or lags in supply adjustments to demand, relative to differences in tastes. They also can be employed in simulation models of the "market clearing" process, a specification of how households relocate and what price they pay for different housing bundles. Recourse to either a mathematical programming formulation or more ad hoc iterative schemes in such a simulation depend for their success on using realistic housing demand functions as inputs.

The output of these simulations would therefore be the assignment of households to the existing housing stock and a set of derived prices. These, in turn, are important inputs to models representing housing stock additions and improvements as well as changes in such neighborhood characteristics as the tax base and the need for education.

Mahlon R. Straszheim

## The Demand for Housing

The objective of this research is to examine the demand for housing in the short run. The general model upon which the analysis is based is of the form:

$$E(Q_i) = f(x_{li}, \ldots, x_{ki}, x_m, \ldots, x_s)$$
$$g(Y_i, p, Q_i, t_{-1}, H_i)$$

f(\*) = 0 if no residential move = 1 if residential move

where  $E(Q_i) = \text{expected value of housing serv-}$ ices demanded by household *i* in a transaction during the period;  $x_{li}, \ldots, x_{ki} = \text{a}$  series of "status" or "change" variables specific to household *i*;  $x_m, \ldots, x_s = \text{a}$  series of variables specific to the neighborhood;  $Y_i = \text{income}$ ; p = price;  $Q_{i, t-1} = \text{level of housing services}$ consumed at the beginning of the period;  $H_i =$ household characteristics

This model emphasizes two important aspects of housing demand behavior. First, a portion of all households adjust their housing consumption by moving. Second, out of the total population, those households which do move are more likely to display a long-run level of demand, as measured by the amount of housing services purchased or rented in the market, than are "sitting" owners or renters, whose consumption of housing is measured by the potential market value or existing rental level of the dwellings which they occupy.

The empirical work employs data from several thousand individual household records collected by the Southeastern Wisconsin Regional Planning Commission. These data include information over a period of up to thirteen years (eight points in time) prior to the year of interview, on places of work and residence, and on income and value of housing for years in which place of work or residence was changed.

The analysis falls into two principal parts:

1. For that portion of the population which moved in the period prior to the interview date, the parameters of a variety of demand equations have been estimated.<sup>1</sup> The principal findings are: that a measure of income which includes the influences of wealth is superior to income measures which do not; that the level of housing services consumed prior to the residential move adds significantly to the explanatory power of all of the income measures employed; and that aggregation leads to a severe upward bias on the coefficient of the income variable, whether this be current income or some representation of the permanent component of income. Extensions of this portion will include further experiments with the income variable and attempts to account for quality differences among housing units.

2. The second principal portion of the analysis involves a sample of households present at the beginning of the period, regardless of whether they moved their residence during the period. The object is to discover the determinants of the residential move. Those variables which will be emphasized are: the divergence between long-run and actual housing consumption levels, differences in individual and average neighborhood household characteristics, changes in family size, and changes in travel time from home to work. In addition, hypotheses about the differences in causality between workplace change and residence change are to be tested. Differences in behavior between white and nonwhite households will also be examined. Nearly all the work on this portion has been concerned with preparing the data for analysis. Some preliminary examination of the processed data file is being conducted to familiarize the investigator with distributions within the data, primarily by means of cross tabulations and hierarchical decision trees where sequential decisions are hypothesized, e.g., workplace move, residential move, tenure type in new housing, type of area of new housing, location of new housing.

Irving R. Silver

## A Housing Market Model

While a series of studies concerning specific components of housing market behavior are being developed from an urban simulation model, a simpler model of the housing market has been formulated which can analyze actual changes in the housing stock of individual metropolitan areas. This model attempts to explain adjustments in the quality of the existing stock of housing units as a response to price. The model postulates a continuum of quality within the stock, which, for empirical simplification, is divided into a few discrete classes. It is hypothesized that, within each small and relatively homogeneous area of the metropolitan area, change in the quantity of housing services, by converting the housing unit for some level of demand, depends upon the vector of price changes in the various quality levels weighted by some a priori measure of interclass degree of substitutability, e.g., spatial separation. Conversion, by definition, includes deterioration and improvement in addition to actual alteration of dwellings.

The empirical work is based on census tract data for several metropolitan areas for 1950 and 1960. Data for the San Francisco-Oakland and the Washington, D.C., areas are being processed and are nearly ready for analysis.

<sup>&</sup>lt;sup>1</sup>Results of this analysis are summarized in the paper, "A Model of Housing Demand in Metropolitan Areas," to be published with other papers presented at a Conference on Urban Land Economics, by the John C. Lincoln Institute.

Additional data for St. Louis are also being acquired. Since the data include separate figures for the nonwhite portions of those census tracts having a large percentage of nonwhite households, additional hypotheses may be tested about racial discrimination. The predictive accuracy of the model will be tested against the results of the 1970 Census.

Irving R. Silver

## An Analysis of Ghetto Housing Markets

There is a growing recognition that housing market discrimination plays a central role in the nexus of problems facing urban areas. Yet, in spite of the far-reaching effects of housing market discrimination, there has been very little systematic investigation into its nature and consequences.

This study, an econometric analysis of the ghetto housing market in St. Louis, Missouri, should help fill this gap. The analysis is based on a sample of approximately 1,500 households in St. Louis in 1967. The sample contains detailed information on both the characteristics of households and their dwelling units. Particularly noteworthy are detailed data on the quality of each dwelling unit and the surrounding neighborhood. There have been many surveys of dwelling units and many surveys of households, but we know of no other largescale effort to collect and merge comprehensive housing and household information in this way.

Although the study emphasizes the impact of discrimination on urban housing markets and the resulting distortions of Negro housing consumption, it is cast in the more general framework of an analysis of urban housing markets. Therefore, we consider the actual patterns of housing consumption by both black and white households in St. Louis and attempt to evaluate the racial discrimination in determining these "patterns." The study deals explicitly with the multidimensional character of housing services. Thus, it considers the physical characteristics of individual dwelling units (e.g., number of rooms, total floor area, number of baths, condition, and over-all quality), the quality of surrounding properties and the neighborhood as a whole, and the quality of local public services.

For the most part, research into housing market discrimination has been concerned with measuring the extent of segregation, evaluating the causes of current and historical patterns of racial segregation, and determining whether Negroes pay more than whites for comparable housing. Although the last question has been the focus of a large number of empirical studies, there is no completely persuasive evidence either way on the matter. Most researchers would accept the view that blacks pay more than whites for housing of comparable size and quality, but this view is by no means unanimous. Our own findings for St. Louis in 1967 indicate that equivalent housing is roughly 8 per cent more expensive in the ghetto than outside.1

In any case, price markups for comparable housing may be relatively less important than other consequences of housing market discrimination. A far more serious result, for example, may be a limitation on or a distortion of Negro housing patterns. Many kinds of housing services may be completely unavailable to blacks or available only at prices or under circumstances that virtually prohibit blacks from consuming them. Indeed, our research indicates that a much smaller proportion of Negroes purchase housing than whites, even after differences in income, family size and structure, and other determinants of homeownership are taken into account. Thirty-two per cent of the Negro households in our sample were homeowners in 1967. Our analysis suggests that 45 per cent would have been homeowners had they been white. The differences for home purD

3

n

O

u

s r

5

Э

ge

эi

ıg v

S.

n

N.

h.

b

k

Ŋ

о

31

<sup>&</sup>lt;sup>1</sup> Some preliminary findings including those pertaining to housing market discrimination are contained in John F. Kain and John M. Quigley, "Measuring the Value of Housing Quality," *Journal* of the American Statistical Association, June 1970.

chasers were larger still.<sup>2</sup> If nonwhites are systematically excluded from homeownership, the consequences may extend beyond housing consumption. For example, homeownership is by far the most important form of saving for lowincome households. If nonwhite households are discouraged from owning their homes, they may be denied an important method of wealth accumulation.

> John F. Kain John M. Quigley

## Industrial Location within Metropolitan Areas

The main thrust of the study during the past year has been developing data and more clearly defining the process of metropolitan industrial location. With respect to the latter, the importance of the marginal components-new firms, firms relocating within the area, firms going out of business or moving out of the area, and firms expanding their employment at present locations-in producing the observed locational pattern of industry and industrial employment is being examined for four metropolitan areas. These areas are Boston, Cleveland, Minneapolis-St. Paul, and Phoenix. A report of the preliminary findings for the Boston area was presented at the Fall 1969 Research Conference of the Committee on Urban Economics, and a report on the findings of all four areas will soon be given.

A considerable part of last year's efforts was also devoted to investigating the limitations and usefulness of the establishment-level Dun and Bradstreet data, which are serving as our primary data source. As a result of this work, the cost of carrying out similar work for other cities will be substantially reduced, and the quality of the data will be generally improved.

The ultimate goal of the project since its initiation has been not only to understand the dimensions of the location process but also to determine which factors most strongly influence the intrametropolitan location decision of manufacturers and to quantify those influences using behavioral models. It is anticipated that one of the four metropolitan areas currently under study will be selected for this purpose and that modeling will begin in the second half of 1970. In addition, Robert Leone and Gordon Saussy of Yale University are using the data to study the influence of transportation facilities and other factors on the location decision of firms in the New York and New Orleans metropolitan areas.

> Franklin James Raymond J. Struyk

## **Ghetto Employment Problems**

I have spent the past year trying to complete some exploratory research on ghetto employment problems. The data needed became available much later in the year than I had expected, and in thinking about my work I have reconsidered many of the underlying analytic assumptions.

In my own area of interest, conventional marginal analysis has been applied quite directly to the analysis of ghetto employment problems and discussions of manpower policy. Typically, an individual's "disadvantage" is presumed to vary more or less as the sum of a collection of individual handicaps. A person earns low wages, for instance, because he has had relatively little education, or because he has had little specific training, or because he has had little information about job opportunities. Policy conclusions have derived directly from that framework. Since disadvantage is presumed to vary as a continuous function of a variety of relatively independent variables, analysts assume that marginal improvement

<sup>&</sup>lt;sup>2</sup> These preliminary findings were included in a paper presented at the December 1969 meetings of the AEA. They may be found in John F. Kain and John M. Quigley, "Housing Market Discrimination, Homeownership, and Savings Behavior," Harvard University, Program on Regional and Urban Economics, Discussion Paper No. 58.

of any relevant labor market characteristic will automatically bring about an incremental improvement in the worker's labor market situation. Thus, if he receives one additional year's equivalent of education, his earnings will be expected to increase automatically by a certain amount, regardless of his other characteristics and regardless of the social structure.

An alternative hypothesis might be to presume that, at any point in history, the prevailing and constantly evolving system of social and economic institutions defines and maintains class distinctions. It might be further assumed that these class distinctions change in such a way as to maximize the advantage of those in control of the institutions. At the most general level, it would envisage that individual labor market outcomes are determined primarily by those characteristics along which class distinctions are made, and only secondarily by those characteristics to which economists usually attribute productivity. With reference to ghetto employment problems, it would assume that those who are "disadvantaged" remain so more because it serves the interests of those in control of institutions that a class of people is considered "disadvantaged," than because they are relatively unproductive.

This kind of analytic framework suggests several illustrative observations about ghetto employment problems, observations which ought to be subject to empirical test. For example, it implies that those with easily determined and conventionally accepted secondclass characteristics (blacks and women, for instance) dominate those jobs at the bottom of the hierarchical ladder (lower-status clerical, laborer, and service jobs). It would also predict that training programs designed to increase a disadvantaged worker's productivity will not necessarily bring about improvements in his labor market status; institutions may continue to channel him into low-status jobs despite his apparent increase in skill.

To begin to test these alternative hypotheses, I have been working with what seemed to me the most useful available set of data about ghetto employment problems, the new Urban Employment Survey, sponsored by the Bureau of Labor Statistics and the Bureau of the Census. In its first year, fiscal 1969, it sampled large numbers from the ghetto populations of New York, Chicago, Los Angeles, Detroit, Houston, and Atlanta (and also, for control purposes, from the rest of Detroit and Atlanta). Its extensive questionnaires provide more detailed information about job histories and labor market problems than we have ever had before. Using these data, I am trying to test the differences between a "conventional" and "class" analysis of these labor markets in several ways.

First, I am trying to explore the explanatory power and interrelationships of different sets of variables that influence such labor market outcomes as wages and occupational statuson the one hand, variables like education and job experience, which we tend to assume are directly related to "productivity" and, on the other hand, variables like race and sex, which we assume are more distantly related to productivity. Second, I am trying to test for discontinuities in the structure of jobs in the labor market, looking for evidence that a certain subset of jobs (defined by both industry and occupation) comprise the secondary half of what some have called the "dual" labor market. Third, I am trying to use these empirically derived definitions of the secondary labor market to help explain the relative effectiveness of the first and second sets of explanatory variables in influencing labor market outcomes-to look for evidence, in short, that some people are channeled into certain jobs with little reference to their skills.

## David Gordon

## Migration and Employment in Southern Metropolitan Areas

Over the last year my research has focused on large southern metropolitan areas. This work is meant to complement the earlier work I did with John Kain on the nonmetropolitan South. The general purpose of the current research is to explore the relation of migration and growth of employment in determining the racial and skill composition of southern cities.

The heart of this effort is a migration model. This model includes four streams of migrants for the period 1955-60: white in-migrants from metropolitan areas, white in-migrants from nonmetropolitan areas, black in-migrants from metropolitan areas and black in-migrants from nonmetropolitan areas. Out-migration has been broken down into white and black streams. The most interesting (and still tentative) findings to date are: (1) the importance of the hinterland in determining white and black nonmetropolitan in-migration. Each SMSA in the sample has been assigned a hinterland as defined by Rand McNally trading areas. Thus two SMSA's close to one another have a smaller "supply pool" of nonmetropolitan migrants to draw upon. This effect comes up clearly in regression results. (2) The relative constancy of white and black out-migration rates once adjustments are made for military movement. Blacks, however, tend to out-migrate at a substantially lower rate than whites. Differences in employment growth have only minor effects on out-migration. This can be interpreted as a substitution effect of "cheaper" labor within each racial labor force or, alternatively, an indication that the city in question is a "stopping off" point for migration elsewhere (e.g., Memphis for migration to Chicago). (3) Other things being equal (in particular the rate of employment expansion), blacks tend to be more willing to move to and less willing to leave SMSA's with a low proportion of blacks. This may reflect a larger pool of "available" jobs in these cities.

My research effort is currently moving backward in time. The central question is whether a simple migration model as described above can be adapted to explain the changes in the racial and skill composition of southern cities since 1900. I am currently working on a "simulation model" which will attempt such an explanation.

Joseph J. Persky

## **Research on Regional Unemployment**

The purpose of this study is to analyze unemployment rates across states and cities. The study so far deals only with state differences, but the analytical procedure would be the same for cities.

Observed differences in state unemployment rates at any point in time reflect both short-run and long-run components. The unemployment,  $u_{jt}$ , for the  $j^{th}$  state at time t can be decomposed into the cyclical component,  $c_{jt}$ , the secular component,  $s_{jt}$ , and the residual,  $v_{jt}$ . Two alternative forms of the decomposition were attempted here. One assumes that the three components are additive and the other assumes a multiplicative relation:

$$(1) u_{jt} = c_{jt} + s_{jt} + v_{jt}$$

or

(2) 
$$u_{jt} = c_{jt} \cdot s_{jt} \cdot v_{jt}$$

To facilitate the empirical separation of these components, the following relationships for the cyclical and the secular components were assumed. For the cyclical component,

(1-a) 
$$c_{jt} = \beta_j u_{t+n_j}$$

or

(2-a) 
$$c_{jt} = u_{t+n_j}^{p_j},$$

where  $u_{t+n_j}$  is the U.S. unemployment rate at time  $t+n_j$  and  $\beta_j$  is a measure of cyclical sensitivity.

ο.

For the secular component,

(1-b) 
$$s_{jt} = \alpha_j + \gamma_j t + \delta_j t^2$$

or

(2-b) 
$$s_{jt} = \alpha_j e^{(\gamma_j t + \delta_j t)}$$

Thus the cyclical component of unemployment in a given state is related to the aggregate level of economic activity as represented by the aggregate unemployment rate, while the secular component is represented by a constant plus a trend. Substituting into (1) and (2), we get:

2

(3) 
$$u_{jt} = \alpha_j + \beta_j u_{t+nj} + \gamma_j t + \delta_j t^2 + v_{jt}$$
  
or

(4) 
$$\log u_{jt} = \alpha'_j + \beta_j \log u_{t+n_j} + \gamma_j t + \delta_j t^2 + \nu'_{jt}$$

The first task is to obtain meaningful measures of the parameters in the above relationships, while the second is to compare and analyze the differences in these measures among states. Finally, I hope to identify mechanisms by which labor markets adjust to changes in demand and supply conditions in both the short and the long run.

Using seasonally adjusted quarterly data on insured unemployment rates for states from 1950-I to 1968-IV, the parameters  $\alpha_i$ ,  $\beta_j$ ,  $\gamma_j$  and  $\delta_j$  were estimated for both linear and logarithmic equations. The best fit for both equations in every state was obtained when  $n_j = 0$ ; apparently there are no quarterly leads or lags in state unemployment responses to aggregate economic activity.

The following table summarizes the distribution of the parameters across states.

	linear equation			log equation				
	α	β	100γ	10008	α'	β	100γ	10008
mean	0.144	0.906	1.013	-0.189	-0.155	0.980	0.505	-0.062
standard deviation	1.476	0.315	4.917	-0.535	0.670	0.249	1.230	0.165
coefficient of variation	10.25	0.35	4.85	2.83	4.32	0.25	2.44	2.66

The dispersion of the parameters as measured by both the standard deviation and the coefficient of variation is smaller in the log than in the linear equation. In the short and long run, state unemployment rates behave more alike relatively than absolutely.

An examination of the results suggests that  $\beta$  is higher in high-unemployment states than in low-unemployment states when the linear equation is used; there is no comparable relationship with the log equation. For the linear equation, there is a positive correlation between  $\beta$  and average unemployment between 1950 and 1968 (r = 0.59), but for the log equation there is a weaker and negative correlation (r = -0.37). Evidently, a given fall in the aggregate unemployment rate is associated with a greater absolute decline in unemployment

rates in high-unemployment states than in lowunemployment states. But a given decline in aggregate unemployment tends to be associated with a proportionately smaller decline in unemployment rates in higher-unemployment states.

To explore the determinants of cyclical sensitivity, the following regressions were run across states:  $\log \overline{u}$  is the logarithm of the average state unemployment rate between 1950 and 1968, SW represents the proportion of secondary labor force in the population, i.e., teenagers, women over 20, and men over 65, CD/RS is the ratio of employment in construction and durable manufacturing industries to employment in wholesale, retail, and service industries, and S is median years of schooling.

 $\beta \text{ (from equation 3)} = \underbrace{0.579 + 0.494 (\log \tilde{u}) - 0.011 (SW) + 0.005 (CD/RS) - 0.012 (S)}_{(0.811) (4.800) (-0.821) (4.358) (-0.393)} \quad \overrightarrow{\mathbf{R}^2} = \underbrace{0.522}_{\mathbf{n} = 49}$ 

$\beta$ (from equation 4) =	= 2.309 - 0.333 (log	ū) -0.026 (SW	V) + 0.005 (CD/	(RS) = -0.005 (S)	₽ R²	= 0.396
	(3.647) (-3.653)	(-2.167)	(5.204)	(-0.199)		n = 49

t values are in the parentheses.

The negative coefficient of SW in these regressions suggests the predominance of the discouraged worker effect. The positive coefficients of the CD/RS variable suggest that unemployment in construction and durable manufacturing industries is more cyclically sensitive than in the retail and service industries. This result is to be expected since output and sales in the former groups of industries are cyclically more sensitive.

Human capital analysis predicts negative signs for the coefficients of the S variable, assuming that skill level is a positive function of schooling level and that the specificity of skills is also related positively to the total amount of skill. Short-run fluctuations in final demand cause immediate fluctuations in the demand for variable factors of production. The more specific the skill, the less variable a factor of production is the worker possessing the skill. The results are consistent with this analysis, although the S coefficients are quite weak.

A preliminary investigation of the secular component,  $s_{jt}$ , shows interesting patterns in change over time.

1. States whose secular component declined experienced a faster growth in per capita income and a faster growth in nonagricultural employment than states whose secular component tended to rise.

2. States with declining secular components experienced faster growth in population, a smaller decline in the male labor-force participation rate, and a smaller increase in the female labor-force participation rate than states with rising secular components.

3. States with declining secular components showed net in-migration, while those with rising secular components showed the reverse. This suggests that migration was largely joboriented, in that most migrants were formerly in the labor force and moved simply to obtain new employment.

At any given time, what proportion of the observed variation across states in unemployment rates is cyclical and what proportion is secular? To answer this question, I examined the composition of the variance in unemployment rates across states during different cyclical periods. While the calculations are not yet complete, the results indicate that the contribution of the cyclical component of variance to the total variance is larger during cyclical troughs than during peaks. If this is so, depressed areas would be more accurately identified by unemployment rates during periods other than recessions.

My current plans call for refinement and extension of the analysis. A few areas in immediate need of development are:

1. Refinement of the analysis of factors influencing  $\beta_{j}$ .

2. Identification and analysis of economic variables that explain differences in  $s_{jt}$  at a given time.

3. Exploration of interactions of changes in the demand for and supply of labor associated with particular trend patterns.

4. Use of these findings to synthesize relevant economic factors into a more complete model that explains cyclical and secular features of the regional unemployment distribution.

Finally, a parallel study of the effects of minimum wages on the labor market is being carried out. Preliminary results suggest that federal minimum wages had a depressing effect on both the employment rate and the labor-force participation rates of low-skilled groups in the labor force. Thus unemployment alone may not be a good indicator of minimum wage effects, since labor-force participation may also be affected. A more thorough study, with special attention paid to the lagged patterns of response to minimum wages, is planned in the future.

Masanori Hashimoto

## 4. HUMAN RESOURCES AND SOCIAL INSTITUTIONS

## Introduction

During the past year work has proceeded on three broad research programs: education, the economics of the legal system, and the economics of health.

Some ongoing programs in education are being directed by Gary S. Becker (personal income distribution, consumption-labor supply decisions), while others are under the direction of F. Thomas Juster (net returns to education, savings, obsolescence of educational capital, school production functions, and agricultural productivity). Becker is primarily responsible for the legal economics studies, and Victor R. Fuchs is directing studies in the health area, which are reported on in Section 7 of this report.

Education Studies. A volume with contributions by three authors on the effects of human capital on the personal distribution of income is almost ready for a staff reading committee. One essay, by Barry Chiswick, deals with the effects of differences in the distribution of schooling on differences between regions and countries in inequality and skewness in the distribution of income.1 Jacob Mincer has almost completed his study of the influence of schooling and postschooling investment on the structure and age profile of earnings. Becker's study of the theory underlying the observed distribution of schooling and other human capital was published as a Woytinsky Lecture at the University of Michigan.<sup>2</sup>

Gilbert Ghez, Robert Michael, and Becker are examining the influence of education on consumption and labor supply decisions. Michael's study, which concerns the influence of education on a household's "efficiency" in utilizing goods and time, has been through a reading committee and is being revised for publication as an Occasional Paper. Ghez's study, based on the household production function model, is designed to explain variations in consumption with age. It emphasizes the interdependence over the life cycle between consumption decisions and labor supply decisions. Becker's companion study uses the household production function model to examine lifecycle patterns in the amount of time spent by males in the labor force.

Both the income distribution and consumption-labor supply studies are being financed with the aid of a grant from the Carnegie Corporation.

Considerable progress has been made during the past year on a series of education studies being conducted with the aid of a grant from the Carnegie Commission on Higher Education. Paul Taubman and Terence Wales, who are studying net returns to education, have completed a paper on the historical relation between mental ability (as measured by the usual test scores) and educational attainment. Their results are surprising in some respects: the data show that the average ability of those entering college has increased steadily during the past several decades-a period when the proportion of high school seniors entering college has also increased. Thus the widely expressed fear that expansion of college enrollments to accommodate a rising fraction of the high school population would inevitably lead

<sup>&</sup>lt;sup>1</sup>See the 1969 Annual Report, pp. 69-70, where Chiswick's work is discussed.

<sup>&</sup>lt;sup>2</sup> See his *Human Capital and the Personal Distribution of Income*, Institute of Public Administration, University of Michigan, 1967.