PRODUCTIVITY: A SELECTED, ANNOTATED BIBLIOGRAPHY 1965–71

Bulletin 1776

U.S. Department of Labor
Bureau of Labor Statistics

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U.S. DEPARTMENT OF LABOR
Peter J. Brennan, Secretary

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Preface

Productivity—the relation between physical output and input—has for many years been a subject of study in the Bureau of Labor Statistics of the U.S. Department of Labor. Productivity studies and research are conducted in the Bureau's Office of Productivity and Technology. The interest in productivity derives from a number of concerns – the pace of technological change and its effects on employment and skills; the trend in prices and costs; and the rate at which additional goods and services become available. Thus, the study of productivity is essential in understanding the factors giving rise to variations in income and wealth and in determining economic policy.

This bibliography, the third in a series, is intended to facilitate such study. It covers a large selection of books and articles that were published between 1965 and 1971. It provides annotated references for nearly 800 publications dealing with concepts and methods, measurement of levels and trends, the sources of productivity change (such as technology and economic growth), and the relation of productivity to the economy as a whole and to economic variables such as wages and prices.

Most of the work on this bibliography was performed by Andrea Mooney Sweeny, under the supervision of Horst Brand, in the Division of Industry Productivity Studies. Others who contributed include Jack Ferris, Brian Friedman, and Barbara Donoghue. Martha Farnsworth Riche compiled the subject index.

Contents

		Page
Annotated listing		1
I.	Concepts and methods	1
II.	Measures	15
III.	Factors affecting productivity	27
	A. Labor and education	27
	B. Management and organization	34
	C. Technological change	38
	D. Research and development	53
IV.	Productivity, prices, and costs	59
V.	Productivity and employment	68
VI.	Productivity and economic growth	78
VII.	Theses and dissertations	85
VIII.	Bibliographies, annual reports, etc.	89
Author index		92
Subject index		99

Annotated Listing

I. Concepts and methods

1.001 Aigner, D. J. and Chu, S. F. "On Estimating the Industry Production Function." *American Economic Review,* Vol. 58, No. 4, September 1968, p. 826-839.

Presents an estimation technique which allows the economist to make a traditional interpretation of an empirically estimated microproduction function, where the underlying production process is assumed to be deterministic.

1.002 Alterman, Jack, and Kutscher, Ronald E. *Capital Flow Matrix, 1958,* BLS Bulletin 1601. U.S. Department of Labor, Bureau of Labor Statistics, 1968. 72 pp.

Shows in detail the transactions of capital goods among producing and using industries, and thus differs from conventional input-output tables, which distribute capital goods output directly to an overall category of "gross private domestic fixed capital formation."

1.003 American Machinist. *The Tenth American Machinist Inventory of Metalworking Equipment, 1968.* New York, McGraw-Hill, 1968. 320 pp.

Presents estimates of the number and age of metalworking machinery in the United States.

1.004 Anderson, W. H. L. "Production Scheduling, Intermediate Goods, and Labor Productivity." *American Economic Review,* Vol. 60, No. 1, March 1970, pp. 153-162.

Explores why short-run elasticity of man-hours in relation to output is empirically less than 1, and why hours of input seem to respond to changes in output with a distributed lag. Maintains that studies of variation in labor productivity based on final product, rather than taking intermediate products into account, result in output series which are highly suspect.

1.005 Beckmann, Martin J., and Sato, Ryuzo. "Aggregate Production Functions and Types of Technical Progress: A Statistical Analysis." *American Economic Review,* Vol. 59, No. 1, March 1969, pp. 88-101.

The authors specify several production functions to allow for types of neutral technological change other than the Hicks or Harrod models.

1.006 Berglas, Eitan. "Investment and Technological Change." *Journal of Political Economy,* Vol. 73, No. 2, April 1965, pp. 173-180.

Argues that studies by Solow, Kendrick, and Fabricant give insufficient weight to the effects of investment on economic growth. Tests empirically three hypotheses that suggest that observed technical change has a larger effect on the rate of investment than those studies imply.

1.007 Borch, Karl. "Theories and Principles of Productivity Measurement at Different Levels." *Productivity Measurement Review,* August 1965, pp. 5-15.

Examines conceptual and practical problems in productivity measurement.

1.008 Braae, G.P. "Indirect Measurement of Labor Productivity in House-Building in Britain, 1919-38." *Manchester School of Economic and Social Studies,* Vol. 35, No. 3, September 1968, pp. 275-84.

Suggests a method for estimating labor productivity where data for inputs are lacking or unreliable.

1.009 Briscoe, G.; O'Brien, P.; and Smyth, D. J. "The Measurement of Capacity Utilization in the

United Kingdom." *Manchester School of Economic and Social Studies,* Vol. 38, No. 2, June 1970, pp. 91-117.

The authors examine five methods of increasing capacity utilization in the United Kingdom for the period 1954-67.

1.010 Brown, Murray, ed. *The Theory and Empirical Analysis of Production.* Studies in Income and Wealth, Vol. 31. New York, National Bureau of Economic Research, 1967. 515 pp.

A collection of papers summing up present knowledge on the structure of the production function, pointing out areas where more research is needed, and suggesting some new approaches.

1.011 Brubaker, E. R. "Embodied Technology, the Asymptotic Behavior of Capital's Age, and Soviet Growth." The *Review of Economics and Statistics,* Vol. 50, No. 3, August 1968, pp. 304-311.

Explores the usefulness of the hypothesis of embodied technological change in studying the sources of growth of the Soviet economy. Interpreting the data within the framework of a Cobb-Douglas function, amended to reflect the effects of disembodied technical change and investment in education, fails to explain most of the "residual." It was assumed that design changes in physical capital, implicit in changes in the age of capital, accounted for the residual. As opportunities for reducing the average age of capital decline, so will the contribution to growth from this source.

1.012 Christensen, L. R., and Jorgenson, D. W. "The Measurement of U.S. Real Capital Input, 1929-1967," *Review of Income and Wealth,* Vol. 15, No. 4, December 1969, pp. 293-320.

The authors provide a conceptual basis for real capital input based on perpetual inventory estimates of capital stock and corresponding estimates of capital service prices.

1.013 Christensen, L. R., and Jorgenson, D. W. "U.S. Real Product and Real Factor Input, 1929-1967." *Review of Income and Wealth,* Vol. 16, No. 1, March 1970, pp. 19-50.

The authors provide a conceptual basis for separating social product and social factor input accounts into estimated price and quantity components.

1.014 Daniels, Mark R. "Differences in Efficiency among Industries in Developing Countries." *American Economic Review,* Vol. 59, No. 1, March 1969, pp. 159-171.

Defines differences in efficiency as any variation in output per worker unexplained by weighted differences in the capital-labor ratio. After discussing some data problems, author presents an array of estimates of efficiency for a group of manufacturing industries in a number of developing countries.

1.015 David, Paul A. "Labour Productivity in English Agriculture, 1850-1914: Some Quantitative Evidence on Regional Differences." *Economic History Review,* Vol. 23, No. 3, December 1970, pp. 504-514.

Derives estimates of labor productivity in different farming regions of England from data on daily wages paid to laborers and piece-rate quotations for well-defined tasks performed by hand methods. Patterns of labor efficiency closely correlate with geographical patterns of agricultural wage-rate differences. Argues that findings are consistent with the thesis that until recently many areas of England displayed features typical of economically under-developed agrarian societies.

1.016 Deakin, B.M. and Seward, T. *Productivity in Transport: A Study of Employment, Capital, Output, Productivity and Technical Change.* Occasional Papers, No. 17. Cambridge, England, Cambridge University Press, 1969. 248 pp.

The authors measure employment, capital, output, labor productivity, and technical change in major sectors of surface and air transportation, and develop a production function to interpret the data. They probe for more fundamental explanations by testing hypotheses relating to the links between output

and labor productivity; labor productivity and prices; output and technical change; and capital stock input and technical change.

1.017 de Leeuw, Frank. "A Revised Index of Manufacturing Capacity." *Federal Reserve Bulletin,* Vol. 52, No. 11, November 1966, pp. 1605-1615.

Describes the methods used to calculate capacity and capacity utilization in manufacturing. Compares the revised indexes to those previously published. Sees a need for more thorough understanding of basic concepts, better coverage of key manufacturing industries, and alternative approaches to collecting information on capacity.

1.018 Denison, E. F. "Some Major Issues in Productivity Analysis: An Examination of Estimates by Jorgenson and Griliches." *Survey of Current Business, Part II,* Vol. 49, No. 5, May 1969, pp. 1-28.

Discusses the methodology and conclusions of the article by Jorgenson and Griliches reprinted in the same issue of the *Survey.*

1.019 Diamond, Peter A. "Disembodied Technical Change in a Two-Sector Model." *Review of Economic Studies,* Vol. 33 , No. 90, April 1965, pp. 161-168.

Presents and explains the use of a two-sector model for the measurement of technical change in consumption goods and investment goods, taking into account differences in the growth of labor inputs.

1.020 Diamond, Peter A. "Technical Change and the Measurement of Capital and Output." *Review of Economic Studies*, Vol. 32(4), No. 92, October 1965, pp. 289-298.

Asserts that equations which describe the development over time of an economy with disembodied technical change can also be used to describe differences in production with capital of different vintages in a model with embodied technical change. The rate of embodied technical change is estimated from aggregate data for the post-war U.S. economy.

1.021 Diaz Alejandro, Carlos F. "Industrialization and Labor Productivity Differentials." *The Review of Economics and Statistics,* Vol. 47, No. 2, May 1965, pp. 207-214.

Examines a version of the hypothesis that highly capital-intensive pursuits are well suited for underdeveloped countries because they force management to perform much-needed but unfamiliar tasks.

1.022 Doll, John P.; Rhodes, James V.; and West, Jerry G. *Economies of Agricultural Production, Markets, and Policy.* The Irwin Series in Economics. Homewood, Ill., Richard D. Irwin, 1968. 557 pp.

The authors discuss the economics of production and the algebra of production functions, as well as multiple factor input and product output models.

1.023 Domar, Evsey D. "An Index Number Tournament." *Quarterly Journal of Economics,* Vol. 81, No. 2, May 1967, pp. 262-272.

Compares the Soviet-type index of industrial production using value-of-output or price weights and the Federal Reserve-type index of value-added weights. Finds that both indexes contain biases when compared to certain alternative indexes.

1.024 Du Boff, Richard B. "Electrification and Capital Productivity: A Suggested Approach." *The Review of Economics and Statistics,* Vol. 48, No. 4, November 1966, pp. 426-431.

Presents evidence that there was a strong causal connection between industrial electrification at the time of the first World War and the upward shift in the productivity trend at that time, as observed by Kendrick.

1.025 Fabricant, Solomon. *A Primer on Productivity.* New York, Random House, 1969. 206 pp.

Introduces basic ideas about productivity. Discusses the sources of productivity, and relates productivity to business cycles, inflation, and economic policy. Also discusses productivity abroad.

1.026 Federal Reserve Bank of Chicago. "Larger Farms– A Continuing Trend." *Business Conditions,* May 1969. pp. 7-13.

Sees a continued trend towards larger and fewer farms because of the inability of smaller farms to use machinery and labor efficiently or to provide operators with satisfactory incomes. Suggests a need for adjustment in methods of financing larger farms.

1.027 Feinstein, C. H. *Domestic Capital Formation in the United Kingdom, 1920-1938.* Studies in the National Income and Expenditure of the United Kingdom. Cambridge, England, Cambridge University Press, 1965. 270 pp.

Derives estimates of gross and net capital formation and the capital stock for the economy as a whole and for the major sectors. Compares his methods and estimates with those of other economists.

1.028 Fenske, Russell W. "An Analysis of the Meaning of Productivity." *Productivity Measurement Review,* August 1965, pp. 16-22.

Examines alternate definitions and interpretations of productivity.

1.029 Ferguson, C. E. "Time Series Production Functions and Technological Progress in American Manufacturing Industry." *Journal of Political Economy,* Vol. 73, No. 2, April 1965, pp. 135-147.

Fits time-series data for 1949-61 covering two-digit American manufacturing industries to the production function suggested by Arrow, Chenery, Minhas, and Solow, to discover whether technological change in these industries has been biased. Finds most change has been either neutral or capital-using.

1.030 Fogel, Robert W., and Engerman, Stanley L., eds. *The Reinterpretation of American Economic History.* New York, Harper and Row, 1971. 494 pp.

Presents a number of historical essays on capital formation, growth, innovation, and related subjects.

1.031 Fuchs, Victor R., ed. *Production and Productivity in the Service Industries.* Studies in Income and Wealth, Vol. 34. New York, National Bureau of Economic Research, 1969. 395 pp.

A collection of essays dealing with conceptual and measurement problems of output and productivity in service industries. Among industries discussed are medical care, commercial banks, and retail trade. Chapters also deal with service industries in Canada and with the development of service industries in the 19th century.

1.032 Fuchs, Victor R. "The First Service Economy." *The Public Interest,* Winter 1966, pp. 7-17.

Discusses the growth of services and of the labor force producing services rather than tangible goods. Explores reasons for this evolution, its benefits, and the difficulty of measuring productivity in services. States the need for appropriate measures of output.

1.033 Gaathon, A. L. *Economic Productivity in Israel.* Praeger Special Studies in International Economics and Development. New York, Praeger, in cooperation with the Bank of Israel, 1971. 280 pp.

Discusses alternative theories and measurements of productivity in estimating and explaining Israel's performance from 1950-65 (postscript 1965-69). Develops two models to appraise long-run productivity prospects.

1.034 Galatin, Malcolm. *Economies of Scale and Technological Change in Thermal Power Generation.* Amsterdam, North-Holland Publishing Co., 1968. 196 pp.

Presents econometric models of the production process in a multiplant unit in order to explore the effects of technological change and economies of scale on steam-electric power generation. Reviews past studies.

1.035 Geisel, John M. "A Method for Measurement and Analysis of Supervisory Work." *Journal of Industrial Engineering,* Vol. 19, April 1968, pp. 175-185.

Argues that fundamental changes in the functions of the foreman have given rise to problems of determining the effectiveness with which foremen are performing their tasks. Establishes a number of criteria which permit management to deal with these problems.

1.036 George, K. D. *Productivity and Capital Expenditure in Retailing.* Cambridge, England, Cambridge University Press, 1968. 86 pp.

Assesses the role of capital expenditures in increasing productivity in retailing in the United Kingdom, 1960-66. Also examines possible obstacles to growth and investment, such as shortages in management, high costs, inadequate financing, and difficulties in site acquisition.

1.037 Gold, Bela. *Explorations in Managerial Economics: Productivity, Costs, Technology and Growth.* New York, Basic Books, Inc., 1971. 297 pp.

Contains chapters on productivity and on the economic effects of technological innovations, providing brief, critical surveys of existing approaches to measurement. Suggests analytical and measurement techniques particularly suited to the analysis and evaluation of managerial (or operational) problems.

1.038 Golov, A. "Methodology of the Measurement and Planning of Labor Productivity in the U.S.S.R." *International Labour Review,* Vol. 97, No. 5, May 1968, pp. 447-464.

Describes methods of measuring production and labor productivity within the framework of the system of planning and incentives recently introduced in the Soviet Union. Explains the new approach employed in ascertaining for planning purposes the economic basis for gains in labor productivity in enterprises and industry.

1.039 Gordon, Robert J. "$45 Billion of U.S. Private Investment Has Been Mislaid." *American Economic Review,* Vol. 59, No. 3, June 1969, pp. 221-237.

Argues that the U.S. figures on the stock of capital available for private production have been drastically underestimated since 1940, thus seriously skewing most production and productivity studies. This underestimation is due to the omission of government-owned, privately operated plant and equipment from the capital accounts.

1.040 Gouverneur, J. "Hirshman on Labor Productivity Differentials: An Empirical Analysis." *Bulletin,* Oxford University Institute of Economics and Statistics, Vol. 32, No. 3, August 1970, pp. 259-265.

Disputes the Hirshman argument that process-centered industries and man-paced operations are particularly suited to raise labor productivity in less developed countries.

1.041 Gouverneur, J. *Productivity and Factor Proportions in Less Developed Countries: The Case of Industrial Firms in the Congo.* New York, Oxford University Press, 1971. 171 pp.

Analyzes the long-run changes in the labor coefficient, the capital coefficient, capital intensity, and the occupational composition of the labor force in relation to output changes.

1.042 Green, H. A. J. "Embodied Progress, Investment, and Growth." *American Economic Review,* Vol. 56, No. 1, March 1966, pp. 138-151.

Reinterprets the concept of "embodied technical progress," as developed by Solow and Phelps. Argues that certain aspects of this concept must be viewed in terms of contrasting rates of change of technical progress in the investment and consumption sectors.

1.043 Griliches, Zvi, and Jorgenson, Dale. "Sources of Measured Productivity Changes: Capital Input." *American Economic Review,* Vol. 56, No. 2, May 1966, pp. 50-61.

The authors investigate the relation of changes in the structure of capital to established estimates of changes in total factor productivity from 1929 to 1964. They conclude that errors in measuring capital inputs have resulted in significant overstatement of productivity gains.

1.044 Grossling, William, and Dovring, Folke. "Labor Productivity Measurement: The Use of Sub-Systems in the Interindustry Approach, and Some Approximating Alternatives." *Journal of Farm Economics,* Vol. 48, No. 2, May 1966, pp. 369-377.

The authors seek to measure the benefit to the community of technological change in agriculture by developing a productivity index including both direct and indirect man-hours as input.

1.045 Gupta, S., and Steedman, I. "An Input-Output Study of Labor Productivity in the British Economy." *Bulletin,* Oxford University Institute of Economics and Statistics, Vol. 33, No. 1, February 1971, pp. 21-34.

The authors argue that gains in labor productivity in a given industry may be due to the substitution of manufactured products from outside the industry, so that "system" productivity may actually change little, if at all. They provide alternative measures of system productivity by means of input-output calculations. They find that their derived rates of change in productivity of individual industries differ significantly from those found by the conventional approach.

1.046 Hall, R. E. "Technical Change and Capital From the Point of View of the Dual." *Review of Economic Studies,* Vol. 35 (1), No. 101, January 1968, pp. 35-46.

Develops certain basic notions of capital theory econometrically. Investigates the problem of the production function in terms of factor price functions, relating the wage to the price of machines' services over time.

1.047 Hamada, K. "Optimal Capital Accumulation by an Economy Facing an International Capital Market." *Journal of Political Economy,* Vol. 77, No. 4, July, August 1969, pp. 684-697.

Argues, on the basis of the neoclassical growth model, that capital borrowing (or lending) occurs when a country increases its capital more (or less) than its domestic savings. Defines optimal path of accumulation and examines its properties.

1.048 Heskett, J. L., ed. *Productivity in Marketing.* Papers of the Theodore N. Beckman Symposium on Marketing Productivity, April 1965. Columbus, Ohio, College of Commerce and Administration, The Ohio State University, 1965. 88 pp.

A compendium of papers dealing primarily with the measurement of productivity in the trade sector.

1.049 Hildebrand, George H., and Liu, Ta-Chung. *Manufacturing Production Functions in the United States, 1957: An Interindustry and Interstate Comparison of Productivity.* Ithaca, New York, New York State School of Industrial and Labor Relations, Cornell University, 1965. 224 pp.

The authors estimate production function coefficients for 15 2-digit manufacturing industries.

1.050 Hogg, H. C.; Rankine, L. B.; and Davidson, J. R. "Estimating the Productivity of Irrigation Water." *Agricultural Economic Research,* Vol. 22, No. 1, January 1970, pp. 12-17.

The authors use the example of sugar cane irrigation on two Hawaiian sugar plantations to show how to incorporate known economic relationships into a production function which can be optimized by economists and managers.

1.051 Hunt, E. H. "Quantitative and Other Evidence of Labour Productivity in Agriculture, 1850-1914." *Economic History Review,* Vol. 23, No. 3, December 1970, pp. 515-519.

Criticizes a paper in the same issue of the *Review* by Paul A. David (see entry 1.010).

1.052 International Labor Office, *Measuring Labor Productivity.* Geneva, ILO, 1969. 172 pp.

Provides a comprehensive survey of the methods and problems of measuring labor productivity. Reviews national productivity measures, explains difficulties in international comparisons, and suggests ways to improve international comparability of productivity statistics.

1.053 Intriligator, Michael D. "Embodied Technical Change and Productivity in the United States, 1929-1958." *The Review of Economics and Statistics,* Vol. 47, No. 1, February 1965, pp. 65-70.

Estimates embodied and disembodied technical change using a Cobb-Douglas production function.

1.054 Jack Faucett Associates, Inc. *Development of a Matrix of Interindustry Transactions in Capital Goods in 1963.* Prepared for the Bureau of Labor Statistics, U.S. Department of Labor. Silver Spring, Md., Jack Faucett Associates, December 1966. 117 pp.

Estimates the output and consumption of capital goods by industy. Presents matrix tables of capital expenditures for the producing and consuming industries.

1.055 Jorgenson, Dale W. "The Embodiment Hypothesis." *Journal of Political Economy,* Vol. 74, No. 1, February 1966, pp. 1-17.

Constructs a mathematical model of embodied technical change free of Solow's assumptions that technical change takes place at a constant exponential rate and that consumer and investment goods as conventionally measured are perfect substitutes in production.

1.056 Jorgenson, Dale W., and Griliches, Zvi. "The Explanation of Productivity Changes." *Review of Economic Studies,* Vol. 34, No. 99, July 1967, pp. 249-284.

The authors argue that if real product and real factor input are accurately accounted for, the observed growth in total factor productivity is negligible. They find that the rate of growth of input explains 96.7 percent of the rate of growth of output; change in total factor productivity explains the rest. The accumulation of knowledge is governed by the same economic laws as any other process of capital accumulation--costs must be incurred if benefits are to be achieved.

1.057 Kendrick, John W. "An Evaluation of Productivity Statistics." *Proceedings of the Twenty-First Annual Winter Meeting,* Industrial Relations Research Association (December 29-30, 1968, Chicago, Ill.), University of Wisconsin, Madison. pp. 129-135.

Argues for expanded analyses of productivity and discusses the conceptual aspects of such expansion.

1.058 Kendrick, John W., and Creamer, Daniel. *Measuring Company Productivity: Handbook with Case Studies.* Studies in Business Economics, Number 89. New York, The Conference Board, 1965. 120 pp.

The authors explain the meaning and uses of company productivity measures and describe procedures and problems involved in their construction. Includes case studies of how six companies measured their productivity.

1.059 Kennedy, R. V. "The Meaning and Measurement of Potential National Production in Australia." *Economic Record,* Vol. 32, No. 3, August 1970, pp. 219-229.

Derives quarterly nonfarm potential GNP for the period 1950-69. Links peaks in real output and extrapolates the trend rate of real GNP growth from a full employment peak. Also derives potential GNP from relationships between unemployment and changes in real output, and from an aggregate production function technique.

1.060 Kim, S. "Interregional Differences in Neutral Efficiency for Manufacturing Industries: An Empirical Study." *Journal of Regional Science,* Vol. 8, No. 1, Summer 1968, pp. 19-27.

Formulates an index of specialization as part of the Cobb-Douglas function. Finds that in six cases productivity is favorably influenced by diversification, while in three cases it is not.

1.061 Kleiman, E.; Halevi, N.; and Levhari, D. "The Relationship Between Two Measures of Total Productivity." *The Review of Economics and Statistics,* Vol. 48, No. 3, August 1966, pp. 345-347.

The authors show mathematically the biases in the productivity measures of Kendrick and

Solow. They show why the two measures may yield very different results in a rapidly developing economy.

1.062 Klotz, Benjamin P. *Industry Productivity Projections: A Methodological Study.* U.S. Department of Labor, Bureau of Labor Statistics, 1966. 5 pp.

Explores whether plants with high productivity levels can serve as a guide to projecting future productivity increases in an industry. Finds that data on "second-best" plants may be used to predict industry productivity 7 years later.

1.063 Klotz, Benjamin P. *Productivity Analysis in Manufacturing Plants.* BLS Staff Paper 3. U.S. Department of Labor, Bureau of Labor Statistics, 1970. 97 pp.

Uses both the Cobb-Douglas and the constant elasticity of substitution production functions to estimate the economies of scale and elasticities of substitution in 23 industries.

1.064 Klotz, Benjamin P. "Projecting Industry Productivity." *Monthly Labor Review,* Vol. 89, No. 5, May 1966, pp. 514-517.

Describes a method of projecting productivity 6 to 8 years ahead by comparing current productivity of second-best-practice establishments with the average for all establishments. Second-best-practice establishments are generally 6 to 8 years behind best-practice establishments in the level of productivity they have reached.

1.065 Knudsen, John W. "Productivity Changes." *Monthly Review,* Federal Reserve Bank of Kansas City, April 1971, pp. 3–9.

Discusses measurement problems as well as the sources of gains in productivity.

1.066 Kovalick, Peter N., and Moundalexis, John. *Feasibility of Measuring Federal Aviation Administration Productivity.* U.S. Department of Transportation, Federal Aviation Administration, June 1967.

The authors probe the feasibility of measuring productivity in the Federal Aviation Administration and examine measures applying to the agency as a whole, to its organizational components, and to its missions. Test results confirm the feasibility of measuring productivity of most of the components and missions as well as of the agency as a whole.

1.067 Kuh, Edwin. "Cyclical and Secular Labor Productivity in U.S. Manufacturing." *The Review of Economics and Statistics,* Vol. 47, No. 1, February 1965, pp. 1-12.

Shows that man-hour productivity data evidence a strong cyclical component in addition to the secular trend. Productivity falls when output falls, and then rapidly increases from the trough. This econometric study explains the theory and origins of this phenomenon.

1.068 La Tourette, J. E. "Aggregate Factors in the Trends of Capital-Output Ratios." *Canadian Journal of Economics,* Vol. 3, No. 2, May 1970, pp. 255-275.

Examines factors associated with the movement of capital coefficients in the United States and Canada. Finds that economic growth in Canada is secured only with a reduction in the rate of return and an accumulation of capital in excess of the increase in output.

1.069 La Tourette, J. E. "Sources of Variation in the Capital-Output Ratio in the United States Private Business Sector." *Kyklos,* Vol. 18, No. 4, 1965, pp. 635-651.

Examines the sources of variation in the capital coefficient for the U.S. private sector during the 1909-1959 period. They are the composition of capital, the age of capital, and the nature of technical progress. These sources are measured by the ratio of plant to equipment, the weighted age of the stock of capital, and a proxy time trend.

1.070 Lessowski, Witold. *Capital-Output-Employment Ratios in Industrial Programming.* Translated from the Polish by J. Syskind. New York, Pergamon Press, 1965. 225 pp.

Carries out a detailed theoretical and statistical analysis of productivity and capital/labor ratios, with a view to their use in industrial planning and the evaluation of economic policy in Poland.

1.071 Levhari, D., and Samuelson, P. "The Non-switching Theorem is False." *Quarterly Journal of Economics,* Vol. 80, No. 4, November 1966, pp. 518-519.

The authors discuss aspects of the "switching theorem," according to which one set of techniques may be replaced by another when the rate of interest declines, to be reinstituted as the rate declines still further. The authors retract a theory they had advanced earlier, according to which no switching would occur under certain assumptions of the composition of production techniques.

1.072 Lou, L. J., and Yotopoulos, P. A. "A Test for Relative Efficiency and an Application for Indian Agriculture." *American Economic Review,* Vol. 61, No. 1, March 1971, pp. 94-109.

The authors introduce a new method for measurement of relative economic efficiency between two or more firms. They take into account differences in technical and pricing efficiency. They apply the method to Indian agriculture.

1.073 Lucas, R.E., Jr. "Tests of a Capital-Theoretic Model of Technological Change." *Review of Economic Studies,* Vol. 34, No. 2 (98), April 1967, pp. 175-189.

Treats the problem of "residual growth" – i.e., that part of growth unaccounted for by increases in labor and capital inputs – in terms of technological change resulting from the allocation of inputs away from current production into what may be called "technological investment."

1.074 Masters, Stanley H. "The Behavior of Output Per Man During Recessions: An Empirical Study of Underemployment." *Southern Economic Journal,* Vol. 33, No. 3, January 1967, pp. 388-394.

Discusses changes in underemployment, which are defined as changes in output per man that accompany fluctuations in aggregate demand and output. Suggests that when the government adjusts the level of aggregate demand, it should aim to balance the cost of inflation against the cost of underutilization, including the cost of underemployment.

1.075 McCarthy, M.D. "Quantity-Augmenting Technical Progress and Two-Factor Production Functions: A Skeptical Note." *Southern Economic Journal,* Vol. 33, No. 1, July 1966, pp. 71-80.

Argues that the factors of production are "quantity augmenting": that is, any improvement in the quality of a factor of production may be treated as an increase in the quantity of that factor, holding quality constant.

1.076 "Measuring how Office Workers Work." *Business Week,* November 14, 1970, pp. 54-60.

Discusses the methods and the increasing importance of measuring clerical work.

1.077 Moss, Bennett R. "Industry and Sector Price Indexes." *Monthly Labor Review,* Vol. 88, No. 8, August 1965, pp. 974-982.

Discusses new BLS price indexes which reflect price trends in 4-digit industries, in contrast to wholesale price indexes, which reflect trends in commodity markets.

1.078 Moss, M. "Needs for Consistency and Flexibility in Measures of Real Product by Industry." *Review of Income and Wealth,* Vol. 14, No. 1, March 1968, pp. 1-17.

Discusses the impact of disparities between industrial production and gross product in manufacturing on the analysis of relations between prices and output and prices and productivity. Recommends improvements in data and concepts.

1,079 Muller, Charlotte, and Worthington, Paula. "The Time Structure of Capital Formation: Design and Construction of Municipal Hospital Projects." *Inquiry,* Vol. 6, No. 2, June 1969, pp. 42-52.

The authors examine the problem of translating capital funding into plant and equipment within the municipal hospital system of New York City. They deal with the question of why only one-half of funds budgeted for hospital construction are actually spent.

1.080 Nadiri, M. Ishaq. "Some Approaches to the Theory and Measurement of Total Factor Productivity." *Journal of Economic Literature*, Vol. 8, No. 4, December 1970, pp. 1137-1177.

Discusses the major contributions to the literature in recent years, and presents an authoritative list of source materials.

1.081 Nance, Harold W. "Five Techniques for Measuring Clerical Work." *The Office*, Vol. 66, No. 5, May 1967, pp. 12-14.

Examines the pros and cons of five approaches to the measurement of clerical output.

1.082 Nesvera, Vaclav. "Capital Stock Requirements." *Czechoslovak Economic Papers*, No. 5. Prague, Czechoslovak Academy of Sciences, 1965, pp. 57-69.

Analyzes the factors which determine the level and dynamics of capital stock requirements, with special attention to the causes of differences in capital requirements between different industries.

1.083 Nevile, J. W. "How Productive is Australian Capital?" *Economic Record*, Vol. 43, No. 103, September 1967, pp. 405-411.

Calculates the output-capital ratio for five countries and uses the findings as a yardstick to appraise the productivity of Australian capital. Concludes that the output-capital ratio is lower in Australia than it is in the five countries reviewed.

1.084 Nicholson, R. J. "Capital Stock, Employment and Output in British Industry 1948-64." *Yorkshire Bulletin of Economics and Political Science*, Vol. 18, No. 2, November 1966, pp. 1-21.

Examines the relation between output, employment, and capital stock in 14 industry groups in Great Britain, 1948-64. Finds that production has become more capital intensive in all groups despite their differing characteristics. In all manufacturing (except textiles) and construction, labor productivity has increased, owing to a balance of factors involving faster growth in capital stock than in output, and substantially faster growth in stock than in the labor force.

1.085 Nishikawa, Shunsaku, and Yamada, Saburo. *Productivity Measurement Manual.* Tokyo, Asian Productivity Organization, 1969. 165 pp.

A detailed introduction to the interpretation of productivity concepts, measurement of productivity in industry and agriculture, and the problems of international productivity comparisons.

1.086 North, Douglas C. "Capital Formation in the United States during the Early Period of Industrialization: A Re-examination of the Issues." *The Reinterpretation of American Economic History*, Robert W. Fogel and Stanley T. Engerman, eds. New York, Harper and Row, 1971, pp. 274-281.

Argues for a broadening of the definition of capital formation beyond the savings-investment nexus to cover all expenditures which raise productivity, including those for health and education.

1.087 Okishio, N. "Technical Choice Under Full Employment in a Socialistic Economy." *The Economic Journal*, Vol. 76, No. 303, September 1966, pp. 585-592.

Based on work by Joan Robinson, this article corrects some errors in her argument and develops a criterion for the choice of techniques under full employment of labor. Evaluates the nature of obsolescence in a socialist economy.

1.088 Organization for Economic Cooperation and Development, *Productivity Measurement, Volume III.* Paris, OECD, 1966. 434 pp.

A compendium of monographs from 15 member countries describing methods of measuring industry productivity.

1.089 Paelinck, Jean. "Programming – Projection – Productivity." *Productivity Measurement Review,* February 1965, pp. 23-32.

Discusses the principal factors determining the productivity of different industries. Points out that high productivity-production ratios are associated with high levels of capital investment.

1.090 Parker, William N. "Productivity Growth in American Grain Farming: An Analysis of Its 19th Century Sources," in *The Reinterpretation of American Economic History,* Robert W. Fogel and Stanley T. Engerman, eds. New York, Harper and Row, 1971, pp. 175-186.

Argues that productivity growth is due to the response of entrepreneurs, workers, and investors to certain opportunities, in particular the opportunities to employ growing supplies of productive factors, and to utilize improvements in knowledge about how to combine these factors. Assesses these opportunities in the light of statistical data.

1.091 Philpot, G. "Labor Quality, Returns to Scale, and the Elasticity of Factor Substitution." *The Review of Economics and Statistics,* Vol. 52, No. 2, May 1970, pp. 194-199.

Presents a test of the elasticity of substitution between capital and labor in 16 industries. Even allowing for differences in the quality of labor, 15 of the 16 industries had the same elasticity of factor substitution, and 12 showed constant returns to scale.

1.092 "Productivity: Big Challenge for '71." *Modern Manufacturing,* January 1971, pp. 48-61.

Provides a number of yardsticks for measuring productivity at the company level.

1.093 Rader, T. "Normally, Factor Inputs Are Never Gross Substitutes." *Journal of Political Economy,* Vol. 76, No. 1, January-February 1968, pp. 38-43.

Asserts that if increases in one factor raise the marginal productivity of other factors, the demand for factors by competitive firms always displays complementarity between the factors.

1.094 Robinson, Joan, and Naqui, K.A. "The Badly Behaved Production Function." *Quarterly Journal of Economics,* Vol. 81, No. 4, pp. 580-591.

The authors discuss certain aspects of the "switching theorem", according to which a set of techniques may be replaced by another set when the rate of interest declines, to be reinstituted when it declines still further.

1.095 Roman, Zoltan. "Alternative Measures of Productivity: Examples from Hungarian Industry." *Productivity Measurement Review,* No. 43, November 1965. Budapest, Central Bureau of Statistics. pp. 12-16.

Discusses alternative measures of labor productivity in mining and manufacturing industries for the period 1958-1963.

1.096 Rymes, Thomas K. *On Concepts of Capital and Technical Change.* Cambridge, England, Cambridge University Press, 1971. 191 pp.

Examines the problems of defining and measuring capital. Argues in support of the Harrod-Robinson concept of capital, rejecting as invalid the "neo-Walrasian" theories advanced by American economists.

1.097 Rymes, Thomas K. "Professor Read and the Measurement of Total Factor Productivity." *Canadian Journal of Economics,* May 1968.

Argues that by developing measures of technological change, prediction of the course of relative prices, real wage rates, and the price of capital goods is possible. Total factor productivity measures can also be developed.

1.098 Sahota, G. S. "Efficiency of Resource Allocation in Indian Agriculture." *American Journal of Agricultural Economics,* Vol. 50, No. 3, August 1968, pp. 584-605.

Presents an analysis of resource allocation in Indian agriculture. Average and marginal

productivity differences are derived for a number of inputs in the production of different crops. Concludes that there are relatively few inefficiencies in resource allocation in Indian agriculture.

1.099 Sahota, G. S. "The Sources of Measured Productivity Growth: U.S. Fertilizer-Mineral Industries, 1936-1960." *The Review of Economics and Statistics,* Vol. 48, No. 2, May 1966, pp. 193-204.

Shows that in the industries under study a little less than one-third of the change in the overall index of output per unit of input is explained by scale economies and the remainder by intrafirm technical progress. Of the intrafirm technical change, about half is accounted for by improvements in the quality of labor and about a quarter by improvements in the quality of capital.

1.100 Salkin, Jay S. "Land Size and Patterns of Resource Use and Productivity in South Vietnamese Rice Production." *Asian Economic Review,* Vol. 12, No. 2, August 1970, pp. 196-216.

Investigates production functions and patterns of resource use on rice farms of different sizes in South Vietnam. Argues that there is overutilization of labor on small farms and underutilization on larger farms.

1.101 Samuelson, Paul A. "A Summing Up." *Quarterly Journal of Economics,* Vol. 80, No. 4, November 1966, pp. 568-583.

Summarizes and interprets results of a symposium on "reswitching", papers from which were reprinted in this issue of the *Jounal.* "Reswitching" refers to the possibility that declining interest rates may cause consumption to rise relative to saving on a transient basis.

1.102 Sawney, P. K. "Productivity Trends in Indian Cement Industry." *Asian Economic Review,* Vol. 9, No. 3, May 1967, pp. 255-271.

Examines total factor productivity, with an explanation of methodology. Emphasizes the sharing of productivity gains by input factors. Also investigates productivity trends at regional levels.

1.103 Schwartzman, David. *The Decline of Service in Retail Trade: An Analysis of the Growth of Sales per Man-Hour, 1929-1963.* Study No. 48. Pullman, Wash., College of Economics and Business, Washington State University, June 1971. 261 pp.

Examines productivity and the factors affecting it. Holds that measuring output by constant dollar sales causes overestimation of productivity growth. Constructs an income-price model to obtain more accurate results.

1.104 Shaw, L. H. "Alternative Measures of Aggregate Inputs and Productivity in Agriculture." *Journal of Farm Economics,* Vol. 49, No. 3, August 1967, pp. 670-683.

Asserts that certain inconsistencies exist in the current measurement of aggregate inputs and productivity in agriculture. Offers an alternative way of measuring the components of aggregate agricultural production which affords consistent treatment.

1.105 Sherrard, William R. "Labor Productivity for the Firm: A Case Study." *Quarterly Review of Economics and Business,* Vol. 7, No. 1, Spring 1967, pp. 49-61.

Presents a case history of labor productivity in a lumber firm, with the following objectives: (1) to identify the factors which caused labor productivity to change; (2) to make inferences concerning the development of the lumber industry in the Pacific Northwest; and (3) to determine the importance of company-level labor productivity studies to management and to economic historians.

1.106 Solo, Robert A. "The Meaning and Measure of Economic Progress." *Technology and Culture,* Vol. 9, No. 3, July 1968. pp. 389-414.

Evaluates problems, techniques, and limitations implicit in the measurement of economic progress as an indicator of human welfare and the quality of culture.

1.107 Stephenson, Samuel S. "A Four-Level Quantitative Measurement of Company Produc-

tivity." *Productivity Measurement Review,* No. 42, August 1965, pp. 61-69.

Outlines methods for constructing partial and total factor productivity indexes for companies and their departments.

1.108 Temin, Peter. "Steam and Waterpower in the Early 19th Century," in *The Reinterpretation of American Economic History,* Robert W. Fogel and Stanley T. Engerman, eds. New York, Harper and Row, 1971. pp. 228-237.

Examines the use of stationary steam engines in America around 1840. Explores characteristics of their supply and draws comparisons with England. Discusses the factors underlying the choice between steam and water power in various industries.

1.109 Thornton, J. "Value-Added and Factor Productivity in Soviet Industry." *American Economic Review,* Vol. 60, No. 5, December 1970, pp. 863-871.

Develops new estimates of value added in Soviet industry for the period 1955-67. Estimates shares of labor and capital. Explains growth in output from growth in inputs, and presents estimates of Soviet productivity.

1.110 Thurow, Lester C. "Disequilibrium and the Marginal Productivities of Capital and Labor." *The Review of Economics and Statistics,* Vol. 50, No. 1, February 1968, pp. 23-31.

Argues that estimates of the marginal productivity of both capital and labor in the United States suggest a disequilibrium. The marginal product of capital is smaller than the actual returns to capital, while the marginal product of labor is larger than the actual returns to labor.

1.111 Tlusty, Zdenek. "Measuring the Productivity of Labor from the Standpoint of the Reproduction Process." *Czechoslovak Economic Papers*, No. 5. Prague, Czechoslovak Academy of Sciences, 1965. pp. 71-89.

Argues that indexes of productivity based on the ratio of goods produced to labor inputs cannot be considered as measures of social productivity. Such measures would include changes in the use of past labor, and would reflect the share of the production sector under study in the total. Uses input-output methods to develop what may be interpreted as a measure of total factor productivity.

1.112 U.S. Congress, Joint Economic Committee. *The Analysis and Evaluation of Public Expenditures: The PPB System.* A compendium of papers submitted to the Subcommittee on Economy in Government. Washington, U.S. Government Printing Office, 1969. Three volumes, 1,241 pp.

Presents views on the functions of Government in an enterprise system; institutional factors affecting efficient public expenditure policy; problems of analysis in evaluating public expenditure alternatives; the current status of the planning-programming-budgeting system; the performance of program budgeting and analysis in the Federal Government; and a discussion of unresolved issues in major policy areas.

1.113 U.S. Congress, Joint Economic Committee. *The Planning-Programming-Budgeting System: Progress and Potentials.* Hearings before the Subcommittee on Economy in Government, September 14, 19-21, 1967. Washington, U.S. Government Printing Office, 1967. 412 pp.

Presents views of government officials and academic experts on efficiency in government, together with budgetary and other pertinent data.

1.114 U.S. Department of Labor, Bureau of Labor Statistics. *BLS Handbook of Methods for Surveys and Studies,* BLS Bulletin 1711, 1971, pp. 213-235.

These four chapters give background and explain derivation of data on output per man-hour for the private sector as a whole and for a variety of industries, discuss the Bureau's program of studies of technological change, and describe the series on labor and material requirements in construction.

1.115 U.S. Department of Labor, Bureau of Labor Statistics. *Industrial Productivity Measurement in the United States.* Mimeographed. Office of Productivity, Technology, and Growth, January 1970. 15 pp.

Describes the industrial productivity program of the U.S. Government. Outlines the methodology used to develop output per man-hour measures.

1.116 U.S. Department of Labor, Bureau of Labor Statistics. *Meaning and Measurement of Productivity,* BLS Bulletin 1714, 1971. 15 pp. Contains articles by Jerome A. Mark and Herbert Stein. Prepared for the National Commission on Productivity.

Explains why productivity increase is important to the economy, how it is measured, and why it is difficult to measure.

1.117 Usher, Dan. "Income as a Measure of Productivity: Alternative Comparisons of Agricultural and Nonagricultural Productivity in Thailand." *Economica,* Vol. 33, No. 132, November 1966, pp. 430-441.

Discusses possible biases in agricultural statistics tending to understate productivity in agriculture. Implicitly criticizes policies promoting the transfer of labor out of agriculture when such policies are based on inadequate or fallacious statistics.

1.118 Van Dussen, P. E. "Aggregate Production Relationships in Ten Manufacturing Industries in South Africa." *Finance and Trade Review,* Vol. 9, No. 1, June 1970, pp. 21-42.

Fits industry data to a Cobb-Douglas production function. Uses results to estimate returns to scale, elasticity of substitution, and the rate and nature of technological change.

1.119 Watanabe, Tsunehiko. "A Note on Measuring Sectoral Input Productivity." *Review of Income and Wealth,* Vol. 17, No. 4, December 1971, pp. 335-340.

Explores the relation between total factor productivity derived from national income accounts and total factor productivity based on input-output tables, especially at the sector level.

1.120 Wein, Harold H., and Sreedharan, V. P. *The Optimal Staging and Phasing of Multi-product Capacity.* MSU Studies in Comparative and Technological Planning. East Lansing, Mich., Institute for International Business and Economic Development Studies, Division of Research, Graduate School of Business Administration, Michigan State University, 1968. 131 pp.

The authors demonstrate an optimal solution under conditions of imperfect knowledge for problems of technological choice in multi-product capacity situations.

1.121 Wohlmuth, Karl. "The Growth of the Capital Stock in the Soviet Union." *Kyklos,* Vol. 23, No. 1, pp. 122-132.

Presents a review of *Soviet Capital Stock, 1928-1962,* by Richard Moorsteen and Raymond P. Powell, in which theories of Soviet economic growth in general and the lack of adequate data are critically discussed.

1.122 Worton, David A. "New Productivity Measures in Canada," in American Statistical Association, *Proceedings of the Business and Economic Statistics Section,* 1965, pp. 158-161.

Describes the Canadian government's program for measuring productivity.

1.123 Yoshihara, K.; Furuya, K.; and Suzuki, T. "The Problem of Accounting for Productivity Change in the Construction Price Index." *Journal of the American Statistical Association,* Vol. 66, No. 333, March 1971, pp. 33-41.

The authors examine the problem of estimating a price index for an industry whose output is not standardized, such as construction. They formulate an input cost and input productivity index for the Japanese construction industry, and find that the input cost index increases twice as fast as the input productivity index. Also find that the input productivity index approximates a hedonic

output index for a specified type of construction much more closely than an input cost index.

1.124 Yotopoulos, P. A.; Lau, J. J.; and Somel, K. "Labor Intensity and Relative Efficiency in Indian Agriculture." *Food Research Institute Studies in Agricultural Economics, Trade and Development,* Vol. 9, No. 1, 1970, pp. 43-55.

The authors argue that conventional averages of output per unit of input do not reveal the relative degree of economic efficiency of large as against small farms. Production functions may vary between the two categories or they may be nonhomothetic. Technical and price efficiency may differ, and market conditions faced by these farms may also differ. They use Indian data to test these arguments. They propose that efficiency be measured by means of a decision rule, such as profit maximization.

II. Measures

2.001 Adelman, Edwin, and Ardolini, Charles. "Productivity in the Soft Drinks Industry." *Monthly Labor Review,* Vol. 93, No. 12, December 1970, pp. 28-30.

The authors explain that the rapid rise in productivity in the soft drinks industry between 1958 and 1968 was a result of large output increases, technological improvements, larger establishments, new products, and increases in capital expenditures.

2.002 Alburo, Florian, A. "Philippine-United States Industrial Productivity Differences." *The Philippine Economic Journal,* Vol. 9, No. 1, First Semester, 1970, pp. 1-16.

Finds that differences in productivity between countries arise from differences in the rates at which technological change is absorbed. Presents evidence from the United States and the Philippines. Disputes the conventional theory that the ratio of capital to labor determines productivity.

2.003 Ardolini, Charles W. "Output Per Man-Hour in Selected Industries." *Monthly Labor Review,* Vol. 93, No. 3, March 1970, pp. 54-55.

Discusses the short-run decline in productivity in a number of selected industries between 1966 and 1967. Attributes part of the decline to lower utilization of capacity.

2.004 Auer, L. *Canadian Agricultural Productivity.* Staff Study No. 24. Ottawa, Economic Council of Canada, December 1969. 101 pp.

Compares the productivity performance of Canadian and U.S. agriculture, identifies sources of growth, and explores the potential for future productivity gains.

2.005 Auer, L. "Labor Productivity in Agriculture, A Canada-U.S. Comparison." *Canadian Journal of Agricultural Economics,* Vol. 18, No. 3, November 1970, pp. 43-55.

Contrasts postwar trends in labor productivity in Canada and the United States, finding Canadian productivity to be 25-35 percent lower. Urges more concentrated research in all aspects of Canadian agricultural economics.

2.006 Ball, Claiborne M. "Employment Effects of Construction Expenditures." *Monthly Labor Review,* Vol. 88, No. 2, February 1965, pp. 154-158.

Compares the labor requirements, both on-site and off-site, of single-family housing, hospital, highway, and various other types of construction.

2.007 Ball, Claiborne M. *Labor and Material Requirements for Construction of Federally Aided Highways, 1958, 1961, and 1964,* BLS Bulletin 299. U.S. Department of Labor, Bureau of Labor Statistics, 1966. 17 pp.

Estimates the man-hours required, both on and off the building site, to produce, sell, and deliver materials for each $1,000 of construction in 1964.

2.008 Ball, Claiborne M., and Murray, Roland V. *Labor and Material Requirements for Sewer Works Construction,* BLS Bulletin 1490. U.S. Department of Labor, Bureau of Labor Statistics, 1966. 31 pp.

The authors present estimates of man-hours required both on and off the building site to produce, sell, and distribute materials for each $1,000 of construction in 1962 and 1963.

2.009 Ball, Robert; Finn, Joseph T.; and Riche, Martha F. *Labor and Material Requirements for Hospital and Nursing Home Construction,* BLS Bulletin 1691. U.S. Department of Labor, Bureau of Labor Statistics, 1971. 50 pp.

The authors estimate the man-hours required both on and off the building site to produce, sell, and deliver materials for each $1,000 of construction in the 1960's.

2.010 Bateman, Fred. "Labor Inputs and Productivity in American Dairy Agriculture, 1850-1910." *The Journal of Economic History,* Vol. 29, No. 1, June 1969, pp. 206-229.

Examines the place of dairy farming in American agriculture. Determines man-hours used in dairy farming, and derives unit labor requirements and productivity estimates for 1850-1910, by region.

2.011 Behman, Sara. *Productivity Change for Carpenters and Other Occupations in the Building of Single-family Dwellings, and Related Policy Issues.* Berkeley, Berkeley Center for Labor Research and Education, Institute of Industrial Relations, University of California, April 1971. 199 pp.

Develops average physical labor productivity estimates for carpenters and a group of related occupations involved in the on-site building of single-family dwellings in 1930 and 1965 in Alameda County, California. Author believes that the findings are applicable in many other areas as well. Finds that average physical labor productivity rose 3.2 percent per year over the period studied. Discusses implications for manpower policy.

2.012 Bell, F.W., and Murphy, N.B. "Economies of Scale and Division of Labor in Commercial Banking." *Southern Economic Journal,* Vol. 35, No. 2, October 1968, pp. 131-139.

An empirical analysis of the commercial banking industry to determine whether any observed scale economies are related to specialization of labor.

2.013 Bergson, Abram. *Planning and Productivity Under Soviet Socialism.* New York, Columbia University Press, 1968. 95 pp.

Discusses Soviet productivity levels and trends as compared to the United States and other countries, and explains the differences in terms of education, sex, and attitude differentials.

2.014 Bossler, W. "An International Interfirm Comparison: Productivity Methodology for Foundries." *Productivity Measurement Review,* No. 41, May 1965.

Reports on various types of ratios found to be useful in international comparisons.

2.015 Brady, Dorothy, ed. *Output, Employment, and Productivity in the United States After 1800.* Studies in Income and Wealth, Vol. 30. New York, National Bureau of Economic Research, 1966. 660 pp.

A collection of essays dealing with long-term trends and the data from which they are derived. Also presents essays on regional developments and historical aspects of specific industries, including the New England textile industry, petroleum, and metal mining, as well as on power and the sources of productivity change.

2.016 Burck, Gilbert. "The Still-Bright Promise of Productivity." *Fortune,* Vol. 78, October 1968, p. 134+.

Discusses productivity in the service industries and the associated measurement problems, especially of output per man-hour in government. Also discusses effects of the increasing

service component of GNP on the total economy's productivity.

2.017 Bynum, Alice L. *Indexes of Output Per Man-Hour – Hosiery Industry, 1947-64,* BLS Report 307. U.S. Department of Labor, Bureau of Labor Statistics, June 1966. 24 pp.

Presents data on productivity and analyzes the factors affecting it.

2.018 Canada, Dominion Bureau of Statistics. *Aggregate Productivity Trends, 1946 to 1966.* Ottawa, Canada, 1967.

This bulletin presents sector measures of productivity for Canada, as well as comparisons with U.S. data.

2.019 Carey, John L. "Output Per Man-Hour in Gray Iron Foundries." *Monthly Labor Review,* Vol. 92, No. 10, October 1969, pp. 51-52.

Discusses output, employment, output per man-hour, and general characteristics of the gray iron foundries industry for the period 1954-1966.

2.020 Carey, John L., and Kelly, Terence F. *Indexes of Output Per Man-Hour, Steel Industry, 1947-65,* BLS Report 306. U.S. Department of Labor, Bureau of Labor Statistics, June 1966. 25 pp.

The authors present data on productivity and analyze the factors affecting it.

2.021 Carey, John L., and Kelly, Terence F. *Labor Productivity of the Steel Industry in the United States,* BLS Report 310. U.S. Department of Labor, Bureau of Labor Statistics, July 1966. 36 pp.

The authors analyze changes in output, employment, and technology to explain labor productivity between 1947 and 1965.

2.022 Carey, John L. and Lyon, Richard W. *Gray Iron Foundries Industry, 1954-66: Indexes of Output Per Man-Hour,* BLS Bulletin 1636. U.S. Department of Labor, Bureau of Labor Statistics, November 1969. 24 pp.

The authors present data relating to output per man-hour, as well as a study of technological developments.

2.023 Childs, Rex E. *Efficiency in Poultry Evisceration and Inspection Operations,* Marketing Research Report No. 813. U.S. Department of Agriculture, Agricultural Research Service, June 1968. 20 pp.

Measures the time required to prepare and inspect poultry using various types of equipment and production systems, in order to determine the optimal characteristics of a commercial processing plant.

2.024 Cleaver, Joe M. "Productivity in an Expanding Industry." *Monthly Labor Review,* Vol. 88, No. 4, April 1965, pp. 373-377.

Analyzes the major factors affecting productivity in the primary aluminum industry and presents pertinent indexes.

2.025 Cohn, Edward A., and Waldorf, William H. "Output Per Man-Hour in Food Manufacturing." *Marketing and Transportation Situation,* MTS-156. U.S. Department of Agriculture, Economic Research Service, February 1965, pp. 30-34.

The authors present and discuss productivity measures for the food processing industry and several of its component sectors.

2.026 Cordtz, Dan. "City Hall Discovers Productivity." *Fortune,* Vol. 84, No. 10, October 1971, p. 93 +.

Discusses the rising costs and declining quantity and quality of municipal services, and the managerial and technological methods being adopted to raise productivity of municipal employees.

2.027 Dacy, Douglas C. "Productivity and Price Trends in Construction Since 1947." *The Review of Economics and Statistics,* Vol. 47, No. 4, November 1965.

Discusses the lack of direct data to measure productivity in the construction industry and presents estimates derived indirectly. Direct measures fail because the output of the construction industry is extremely heterogeneous. Changes in wage rates, man-hours, pecuniary value of construction, and in materials, prices serve as the data bases from which estimates of prices and productivity are imputed.

2.028 Daly, D.J.; Keys, B.A.; and Spence, E.J. *Scale and Specialization in Canadian Manufacturing.* Staff Study No. 21. Ottawa, Economic Council of Canada, 1968. 102 pp.

Examines the disparity in productivity levels between the United States and Canada for nine broad industry groups.

2.029 Daly, D. J., and Walter, D. "Factors in Canada-United States Real Income and Wealth." *Review of Income and Wealth,* Series 13, No. 4, December 1967, pp. 285-310.

The authors discuss the differences in real output per employed person between Canada and the United States for 1960. The results indicate that the level of labor productivity in Canada was about 20 percent lower than in the United States.

2.030 Dawson, John. *Productivity Change in Canadian Mining Industries.* Staff Study No. 30. Ottawa, Economic Council of Canada, 1971. 63 pp.

Measures total factor productivity and identifies sources of growth since World War II.

2.031 Denison, Edward F. "As I See It: American Workers are More Productive than Europeans." Interview in *Forbes,* Vol. 104, No. 1, July 1, 1969, pp. 48-50.

Maintains that since the American worker has more education and has more capital to work with, he is more productive, and therefore is justified in asking for significantly higher wages than his European counterpart.

2.032 Denison, Edward F. "Sources of Postwar Growth in Nine Western Countries." *American Economic Review,* Vol. 57, No. 2, May 1967, pp. 325-332.

Examines growth patterns in Western Europe and the United States between 1958 and 1962. Shows that growth rates were lower in the United States and the United Kingdom because they had already absorbed the productivity gains due to employment shifts from small-scale agriculture to manufacturing that most of the other countries were still experiencing during this period.

2.033 Denison, E. F. *Why Growth Rates Differ: Postwar Experience in Nine Western Countries.* Washington, The Brookings Institution, 1967. 494 pp.

Estimates the contributions of key growth variables. Examines and compares the sources and rates of growth in Europe and the United States.

2.034 Dovring, Folke. *Productivity of Labor in Agricultural Production.* University of Illinois College of Agriculture. Agriculture Experiment Station Bulletin 726. Urbana, Ill., 1967. 73 pp.

Examines the behavior of the ratio of farm output for final use to the sum of direct and indirect labor used in production since 1919. Finds an accelerating rate of productivity change over time.

2.035 Dowie, J. A. "Productivity Growth in Goods and Services: Australia, U.S.A., U.K." *Economic Record,* Vol. 42, No. 100, December 1966, pp. 536-554.

Discusses the relative productivity performance of the goods and services sectors in Australia during the 1950's. Draws comparisons with the United States and the United Kingdom.

2.036 Dragonette, Joseph E. *Indexes of Output Per Employee - Air Transportation Industry, 1947-64,* BLS Report 308. U.S. Department of Labor, Bureau of Labor Statistics, August 1966. 13 pp.

Presents data on productivity and analyzes factors affecting it.

2.037 Dragonette, Joseph E., and Jaynes, Philip W. "Output Per Man-Hour, Gas and Electric Utilities." *Monthly Labor Review,* Vol. 88, No. 1, January 1965, pp. 34-39.

The authors analyze factors affecting productivity and present pertinent indexes.

2.038 Dragonette, Joseph E., and Myslicki, Chester. "Air Transport: Trends in Output Per Employee." *Monthly Labor Review,* Vol. 91, No. 2, Feb. 1968, pp. 13-16.

The authors discuss output and employment in the air transport industry. They analyze output per employee for the period 1947-66, as well as productivity by size of airline and type of service.

2.039 Duncan, James H. "Old and New Productivity Techniques Start Closing Gaps." *Columbia Journal of World Business,* Vol. 4, No. 1, January-February 1969, pp. 69-76.

Discusses reasons for Europe's productivity lag behind the United States. Among the factors responsible are education, social structure, and management's resistance to change.

2.040 Fehd, Carolyn S. *Indexes of Output Per Man-Hour – Corrugated and Solid Fiber Boxes Industry, 1958-1966,* BLS Bulletin 1641. U.S. Department of Labor, Bureau of Labor Statistics, December 1969. 19 pp.

Presents productivity and related indexes. Discusses changes which have affected productivity.

2.041 Fehd, Carolyn S. "Output Per Man-Hour in Selected Industries." *Monthly Labor Review,* Vol. 93, No. 12, December 1970, pp. 39-40.

Reports a general lag in productivity among 30 industries studied by BLS. Discusses the productivity performance of these industries between 1947 and 1969.

2.042 Fehd, Carolyn S. "Productivity in Corrugated and Solid Fiber Boxes." *Monthly Labor Review,* Vol. 93, No. 2, February 1970, pp. 64-65.

Briefly discusses productivity, output, product uses, changes in manufacturing, technology, capital expenditures, and general characteristics for the period 1958-66.

2.043 Fehd, Carolyn S. "Productivity in the Petroleum Pipelines Industry." *Monthly Labor Review,* Vol. 94, No. 4, April 1971, pp. 46-48.

Discusses the major factors affecting productivity, including trends in output and demand and capital investment.

2.044 Ferris, John W., and Gale, Hazen. "Trends in Output Per Man-Hour in the Sugar Industry." *Monthly Labor Review,* Vol. 93, No. 7, July 1970, pp. 32-34.

The authors discuss productivity, output, employment, technological change, and capital expenditures.

2.045 Fleming, M. C. "Conventional Housebuilding and the Scale of Operations: A Study of Prices." *Bulletin.* Oxford University Institute of Economics and Statistics, Vol. 29, No. 2, May 1967, pp. 109-137.

Presents the results of a study of conventional housebuilding in Ireland, assessing the influence of scale of operations on prices and labor productivity. Examines the relationship between prices and size of firm, as well as of prices and size of contract.

2.046 Fleming, M. C. "Cost and Prices in the Northern Ireland Construction Industry 1954-64." *Journal of Industrial Economics,* Vol. 14, No. 1, November 1965, pp. 42-54.

Describes the derivation of an index of construction output prices by developing annual estimates of the value of gross output at constant prices, based on labor, material, overhead and profits, and changes in the cost of these components.

2.047 Fuchs, Victor R. "Statistical Analysis of Productivity in Selected Service Industries in the United States, 1939-1963." *Review of Income and Wealth,* Vol. 12, No. 3, September 1966, pp. 211-344.

Examines differentials in output, employment, and productivity across 17 service industries in the United States from 1939 to 1963. Sixteen of these industries show positive rates of change in real output per man. Thus, author finds no basis for assuming that productivity cannot or does not increase in industries providing services.

2.048 Fuchs, Victor R., and Wilburn, Jean Alexander. *Productivity Differences within the Service Sector.* Occasional Paper 102. New York, National Bureau of Economic Research, 1967. 109 pp.

The authors present and analyze data on a detailed industry basis. They also present a study of contrasting productivity trends in the barber and beauty shop industries.

2.049 Gale, Hazen F. "Industry Output, Labor Input, Value Added, and Productivity Associated with Food Expenditures." *Agricultural Economics Research,* Vol. 20, No. 4, October 1968, pp. 113-133.

Relates the output represented by expenditures for farm food in 1947 and 1958 to the total output, labor, and value-added requirements of all supplier industries (including trade) within an input-output framework. Determines contributions of the various industries to changes in farm food output and related variables between 1947 and 1958.

2.050 Gale, Hazen F. "Output Per Man-Hour in Selected Industries." *Monthly Labor Review,* Vol. 92, No. 4, April 1969, pp. 66–68.

Discusses output, employment, output per man-hour, and growth in productivity for the years 1957-67. Presents a table of average annual rates of growth for selected industries.

2.051 Gale, Hazen F., and Van Horn, Thomas R. "Labor Productivity in Food Distribution." *Marketing and Transportation Situation,* MTS-168. U.S. Department of Agriculture, Economic Research Service, February 1968, pp. 12-20.

The authors present and analyze data on output, output per person, and output per man-hour.

2.052 Gale, Hazen F., and Waldorf, William H. *Output Per Man-Hour in Distributing Foods of Farm Origin,* Bulletin No. 1335. U.S. Department of Agriculture, Economic Research Service, April 1965. 24 pp.

The authors describe factors affecting productivity, and compare food distribution with other sectors of the economy.

2.053 George, K. D. *Productivity in Distribution.* Occasional Papers, No. 8. Cambridge, England, Cambridge University Press, 1966. 107 pp.

Analyzes the composition of sales, characteristics of the labor force, and labor productivity in retailing, with emphasis on comparisons between towns of different size and towns having similar market size.

2.054 George, K. D. "Productivity in the Distributive Trades." *Bulletin,* Oxford University Institute of Economics and Statistics, Vol. 31, No. 2, May 1969, pp. 61-75.

Examines recent trends in productivity in the British distributive trades sector, as well as the relation of output, employment, and productivity; productivity and growth; and productivity trends and unemployment.

2.055 Haldi, John. "The Value of Output of The Post Office Department," in *The Analysis of Public Output,* by Julius Margolis, ed. New York, National Bureau of Economic Research, 1970, pp. 338-387.

Discusses the valuation and pricing of postal services under existing technology. Outlines rate structure, nature of demand, costs, pricing policies, and externalities. A comment by William M. Capron follows.

2.056 Hayami, Y., and Ruttan, V.W. "Agricultural Productivity Differences Among Countries." *American Economic Review,* Vol. 60, No. 5, December 1970, pp. 895-911.

The authors discuss the contribution of resource endowments, technical inputs, and human capital to differences in agricultural output per worker in terms of an intercountry, cross-section production function analysis.

2.057 Headley, J. C. "Estimating the Productivity of Agricultural Pesticides." *American Journal of Agricultural Economics,* Vol. 50, No. 5, February 1968, pp. 13-23.

Estimates the productivity of expenditures for agricultural pesticides for 1963. The results indicate that chemical pesticides are highly productive inputs.

2.058 Henneberger, John E., and Ketterling, Virgil H. *Indexes of Output Per Man-Hour: Radio and Television Receiving Sets, 1958-66.* U.S: Department of Labor, Bureau of Labor Statistics, 1966. 27 pp.

The authors present data bearing upon productivity together with a discussion of industry characteristics.

2.059 Henneberger, John E., and Gale, Hazen F. "Productivity in the Major Household Appliance Industry." *Monthly Labor Review,* Vol. 93, No. 9, September 1970, pp. 39-42.

The authors discuss the factors affecting productivity in the major household appliance industry, 1958-69, individual output, population growth, replacement demand, responses to the business cycle, capital expenditures, and changes in technology.

2.060 Henneberger, John E. "Productivity Rises as Radio–T.V. Output Triples in 8 Years." *Monthly Labor Review,* Vol. 92, No. 3, March 1969, pp. 40-42.

Discusses production, employment and technological changes during the 1958-1966 period, and the rapid gains in output per man-hour over this period.

2.061 Herman, Arthur S. "Output Per Man-Hour in Selected Industries." *Monthly Labor Review,* Vol. 94, No. 10, October 1971, pp. 59-60.

Discusses the performance of selected industries in 1970. Presents statistics of average annual rates of change in output per man-hour for the 35 industries between 1957 and 1970.

2.062 Herman, Shelby W. "Productivity in the Railroad Industry," *Monthly Labor Review,* Vol. 93, No. 10, October 1970, pp. 42-43.

Summarizes a BLS study on productivity in the railroad industry (BLS Report 377). Econometric techniques based on the Cobb-Douglas production function were used to estimate returns to scale and elasticity of substitution.

2.063 Herman, Shelby W., and Fulco, Lawrence J. "Changes in Productivity and Unit Labor Costs – A Yearly Review." *Monthly Labor Review,* Vol. 94, No. 5, May 1971, pp. 3-8.

The authors review and analyze developments in 1970, and relate them to changes in employment.

2.064 Herman, Shelby W., and Fulco, Lawrence J. "Productivity and Unit Labor Costs in 1968." *Monthly Labor Review,* Vol. 92, No. 6, June 1969, pp. 11-15.

The authors review and analyze trends in productivity and unit labor costs in the private economy, and discuss the relationships between these and other economic factors such as employment, nonlabor payments, and prices.

2.065 Hilgert, Ronald J. *Indexes of Output Per Man-Hour – Concrete Products Industry, 1947-63,* BLS Report 300. U.S. Department of Labor, Bureau of Labor Statistics, November 1965. 19 pp.

Presents data on productivity, and analyzes the factors affecting it.

2.067 Huffstutler, Clyde; Hohenstein, Jeffrey; and Adelman, Edwin. *Indexes of Output Per Man-Hour, Motor Vehicles and Equipment,*

1957-66, BLS Bulletin 1613. U.S. Department of Labor, Bureau of Labor Statistics, December 1968. 31 pp.

The authors present data bearing upon productivity in the industry, together with a discussion of the factors affecting it.

2.068 Jackman, Patrick C. "Unit Labor Costs in Five Iron and Steel Industries." *Monthly Labor Review,* Vol. 92, No. 8, August 1969, pp. 15-22.

Compares trends in unit labor costs, output per man-hour, and hourly compensation in the United States and four other major steel-producing countries.

2.069 Jacks, Frederick G. "Productivity, the Name of the Game." *The Journal of Industrial Engineering,* Vol. 19, No. 6, June 1968, pp. 11-13.

Cites the large gains made in productivity in the steel industry in the previous 30 years, but maintains that further advances are necessary to meet foreign competition.

2.070 Jehring, John J. *Increasing Productivity in Hospitals, A Case Study of the Incentive Program at Memorial Hospital of Long Beach.* Madison School of Business, Center for the Study of Productivity Motivation, The University of Wisconsin, 1966. 74 + pp.

Describes the installation and operation of a savings sharing program, and discusses its impact on hospital performance.

2.071 Kendrick, John W. *Postwar Productivity Trends in the United States.* Mimeographed. New York, National Bureau of Economic Research, 1971 (to be published in 1973).

Updates the author's earlier work, published in 1961, which traced trends in U.S. productivity from 1889 to 1957. Focuses on developments in aggregate and industry productivity during the post-World War II period.

2.072 Kendrick, John W. *Summary and Evaluation of Recent Work in Measuring the Productivity of Federal Agencies.* U.S. Department of Commerce, National Bureau of Standards, Clearinghouse for Federal Scientific and Technical Information, 1965. 23 pp.

Summarizes and criticizes the Bureau of the Budget report *Measuring Productivity of Federal Government Organizations.* Concludes that the report could be extended from five to most other civilian agencies as well as to some functions of the Department of Defense.

2.073 Ketterling, Virgil H. *Indexes of Output Per Man-Hour – Aluminum Rolling and Drawing Industry, 1958-65,* BLS Report 314. U.S. Department of Labor, Bureau of Labor Statistics, December 1966. 20 pp.

Presents data on productivity and analyzes the factors affecting it.

2.074 Klotz, Benjamin P., and Herman, Shelby W. *Productivity in the Railroad Industry,* BLS Report 377. U.S. Department of Labor, Bureau of Labor Statistics, March 1970. 32 pp.

The authors develop production functions, analyze the production structure of the industry, and discuss key factors which underlie productivity differences.

2.075 Konopa, Leonard J. "An Analysis of Some Changes in Retailing Productivity Between 1948 and 1963." *Journal of Retailing,* Vol. 44, No. 3, Fall 1968, pp. 57-67.

Offers some rough productivity estimates for various forms of retailing. Discusses problems in defining and measuring productivity in this sector.

2.076 Koo, Anthony Y. C. "British and American Productivity and Regional Patterns of Exports." *Oxford Economic Papers,* Vol. 17, No. 1, March 1965, pp. 158-163.

Using regression equations, the author calculates the relative share of British and American exports to various regions of the world as a function of their productivity ratios. Substantial differences in regression coefficients were found between the regional and the aggregate equations employed hitherto in such studies.

2.077 Lomax, K. S. "The Measurement and Comparison of Productivity at Industry Level in O.E.C.D. Member Countries." *Productivity Measurement Review,* No. 43, November 1965, pp. 7-11.

Explores international comparisons of productivity at the industry level, using the International Standard Industrial Classification for 14 member countries of the OECD.

2.078 Maddala, G. S. "Productivity and Technological Change in the Bituminous Coal Industry, 1919-54." *Journal of Political Economy,* Vol. 73, No. 4, August 1965, pp 352-365.

Analyzes productivity and technological change in the bituminous coal industry in the United States by using the technique of aggregate production functions. Capital input is measured in terms of horsepower. The rise in labor productivity is explained almost entirely by the rise in horsepower per worker.

2.079 Maddison, Angus. "Comparative Productivity Levels in the Developed Countries." *Banca Nazionale Del Lavoro Quarterly Review,* Rome, December 1967.

Discusses levels of output, purchasing power, U.S. exchange rates, output per person, GNP, and consumption per person in ten developed nations.

2.080 Mark, Jerome A. "Productivity Trends and Their Implications." *Speech,* presented at the Conference on Productivity and Progress, American Institute of Industrial Engineers, at Florida Technological University, Orlando, Florida, March 13, 1971. 16 pp.

Holds that productivity provides a means for all groups to have a larger share of the Nation's product without taking from one group to give to another.

2.081 Mark, Jerome A., and Herman, Shelby W. "Recent Changes in Productivity and Unit Labor Costs." *Monthly Labor Review,* Vol. 93, No. 5, May 1970, pp. 28-32.

The authors examine the interaction of compensation, output, and output per man-hour in 1969, when unit labor costs rose by 6.3 percent.

2.082 Mark, Jerome A., and Ziegler, Martin. "Recent Developments in Productivity and Unit Labor Costs." *Monthly Labor Review,* Vol. 90, No. 10, May 1967, pp. 26-29.

The authors discuss the slowed growth in productivity in 1965 and 1966, viewing it as a result of pressures of sustained demand, contraction in reserve resources, and the need to hire less skilled labor. They examine the movement of productivity and unit labor costs in the major sectors of the economy.

2.083 McCloskey, S. N. "Productivity Change in British Pig Iron, 1870-1939." *Quarterly Journal of Economics,* Vol. 82, No. 2, May 1968, pp. 281-296.

Assesses the causes of productivity lags in a comparison of British and U.S. productivity.

2.084 Miller, Stanley F. "Labor and Material Required for College Housing." *Monthly Labor Review,* Vol. 88, No. 9, September 1965, pp. 1100-1104.

Presents estimates of on-site and off-site labor requirements, cost of materials and direct wages, and construction time required for college housing projects.

2.085 Miller, Stanley F., and Rothberg, Herman J. *Labor and Material Requirements for College Housing Construction,* BLS Bulletin 1441. U.S. Department of Labor, Bureau of Labor Statistics, May 1965. 34 pp.,

The authors estimate the man-hours required, both on and off the building site, to produce, sell, and distribute materials for each $1,000 of construction in 1961.

2.086 Moss, Fred T. *Indexes of Output Per Man-Hour – Footwear Industry, 1947-63.* U.S. Department of Labor, Bureau of Labor Statistics, July 1965. 17 pp.

Presents data on productivity and analyzes the factors affecting it.

2.087 Moss, Fred T. "Output Per Man-Hour in the Footwear Industry." *Monthly Labor Review,* Vol. 89, No. 4, April 1966, pp. 401-404.

Finds that productivity increased relatively slowly between 1947 and 1964. Growth was hampered by competition from increasing imports and the necessity of short production runs.

2.088 Myslicki, Chester. "Report on Productivity Increases in the Auto Industry." *Monthly Labor Review,* Vol. 92, No. 3, March 1969, pp. 37-39.

Reviews changes in production and employment over the 1957-1966 period and their relation to output per man-hour measures for the industry. Also discusses changes in technology.

2.089 National Commission on Food Marketing. *Organization and Competition in the Dairy Industry.* Technical Study No. 3. Washington, U.S. Government Printing Office, June 1962. 409 pp.

Contains indexes of output, man-hours worked and output per man-hour in the fluid milk industry from 1958 to 1964.

2.090 Nelson, Richard R. "A Diffusion Model of International Productivity Differences in Manufacturing Industries." *American Economic Review,* Vol. 58, No. 5, December 1968, pp. 1219-1248.

Examines certain difficulties with existing formal theory purporting to explain international differences in manufacturing productivity. Presents an empirical analysis of Colombian–U.S. productivity differences, which tends to modify current theories.

2.091 Organization for Economic Cooperation and Development. *The Comparative Measurement of Productivity in the European Paper-Making Industry.* Paris, OECD, 1965. 69 pp.

Presents productivity measures for a sample of European factories.

2.092 Perlo, Victor. "Capital-Output Ratios in Manufacturing." *Quarterly Review of Economics and Business,* Vol. 8, No. 3, Autumn 1968, pp. 29-42.

Discusses and takes issue with data showing a declining tendency in the capital-output ratio. Develops data showing that the ratio has continued to rise.

2.093 Piakash, Piem. "Relationship Between Size and Productivity in Selected Indian Industries." *Asian Economic Journal,* Vol. 11, No. 3, May 1969, pp. 237-248.

Using output-capital ratios and profitability ratios derived from Indian census data, the author investigates the relation between productivity and firm size. Finds that in the nine industries studied, productivity increases with firm size.

2.094 Pratten, C., and Silbertson, A. "International Comparisons of Labour Productivity in the Automobile Industry, 1950-1965." *Bulletin,* Oxford University Institute of Economics and Statistics, Vol. 29, No. 4, November 1967, pp. 373-394.

The authors discuss problems of productivity measurement in the automobile and component industries.

2.095 Remery, R. "International Inter-Firm Comparison in the Domestic Heating and Cooking Appliance Industry." *Productivity Measurement Review,* No. 43, November 1965, pp. 17-98.

Reports on a survey conducted by the OECD of domestic heating and cooking appliance industries in five countries (Federal Republic of Germany, Austria, Belgium, France, and Italy). Comparability ratios were obtained based on taxes, social charges, labor conditions, depreciation, and overtime charges. The use of these ratios made management more familiar with the industry and with related industries, as well as with new methods of interfirm comparisons.

2.096 Renten, Henry, and Walker, James F. *Labor and Material Requirements for School Construction,* BLS Bulletin 1586. U.S.

Department of Labor, Bureau of Labor Statistics, June 1968. 23 pp.

The authors estimate the man-hours required, both on and off the building site, to produce, sell, and deliver materials for each $1,000 of construction in 1964-65.

2.097 Riche, Martha Farnsworth. "Man-Hour Requirements Decline in Hospital Construction." *Monthly Labor Review,* Vol. 93, No. 11, November 1970, p. 48.

Discusses direct and indirect labor requirements for hospital construction for 1960 and 1966. Compares labor requirements for hospital construction with other construction industries.

2.098 Southard, Leland. "Labor Productivity in Food Manufacturing." *Marketing and Transportation Situation* MTS-171. U.S. Department of Agriculture, Economic Research Service, November 1968, pp. 16-20.

Presents and briefly discusses productivity measures for the food processing industry and several of its sectors.

2.099 Spatz, Laura H. *Indexes of Output Per Man-Hour -- Man-Made Fibers Industry, 1957-63.* U.S. Department of Labor, Bureau of Labor Statistics, October 1965. 20 pp.

Presents data on productivity and analyzes the factors affecting it.

2.100 Strassman, W. P. "Construction Productivity and Employment in Developing Countries." *International Labour Review,* Vol. 101, No. 5, May 1970, pp. 503-518.

Examines reasons for the changing intensity of interest in construction in the 1950's and 1960's. Discusses recent behavior of the sector with respect to productivity, innovation, and employment in developing countries.

2.101 Straszheim, Mahlon R. *The International Airline Industry.* Brookings Institution Transport Research Program. Washington, The Brookings Institution, 1969. 297 pp.

Examines the economic efficiency of the airline transportation industry since World War II. Discusses production functions and productivity.

2.102 "The New Inefficiency." *Business Week,* September 20, 1969, p. 45.

Discusses the decline in U.S. productivity in 1969, stressing the uncharacteristic economic growth accompanying it. Blames the situation on hoarding of labor and lack of incentive in a market where jobs are easy to obtain. Predicts rising unemployment for 1970.

2.103 United Nations Economic Commission for Europe. *International Comparisons of Labor Productivity in the Iron and Steel Industry.* New York, United Nations, 1967. 29 pp.

Briefly analyzes productivity and related data for five European countries and the United States. Discusses measurement problems.

2.104 United Nations Statistical Commission and Economic Commission for Europe. *Methodological Problems of International Comparison of Levels of Labor Productivity in Industry.* Conference of European Statisticians. Statistical Standards and Studies, No. 21. New York, United Nations, 1971. 102 pp.

Deals with the general methodological problems arising in comparisons of labor productivity in industry. Details the specific problems encountered in comparisons relating to individual branches of industry.

2.105 United Nations Economic Commission for Europe. *Principal Factors Affecting Labor Productivity Trends in the Iron and Steel Industry.* New York, United Nations, 1969. 200 pp.

Seeks to explain international differences in productivity and related data revealed in a 1967 study by presenting additional statistics and by analyzing productivity in terms of a larger variety of underlying factors.

2.106 United Nations Economic Commission for Europe. *Productivity of Underground Coal*

Workings. New York, United Nations, 1965. 189 pp.

Presents productivity indexes and related data. Describes the coal mining industries of the countries participating in the study and the technological changes that have taken place in the industry.

2.107 U.S. Department of Agriculture, Economic Research Service. *Changes in Farm Production and Efficiency, A Summary Report.* Statistical Bulletin 233. Annual. Washington, U.S. Government Printing Office.

An annual report presenting major statistical series on farm production, production inputs, and efficiency. Also provides the latest information for appraising changes in farm inputs and practices, improvement in labor productivity, and progress of farm mechanization.

2.108 U.S. Department of Labor, Bureau of Labor Statistics. "Comparative International Labor Cost and Productivity," in *United States International Economic Policy in an Interdependent World.* Papers submitted to the Commission on International Trade and Investment Policy, Vol. 1. Washington, U.S. Government Printing Office, July 1971. pp. 535-546.

Reports that the United States as a whole maintained a favorable unit labor cost position during the 1960's even though raises in hourly compensation were not offset by productivity gains as much as in other countries. Provides a special comparison of iron and steel industries.

2.109 U.S. Department of Labor, Bureau of Labor Statistics. *Indexes of Output Per Man-Hour, Selected Industries, 1939 and 1947-* (annually since 1953).

Presents indexes of productivity, output, employment, man-hours, and unit labor requirements in manufacturing and nonmanufacturing industries, together with a description of methods used in arriving at the figures and an analysis of current trends.

2.110 U.S. Department of Labor, Bureau of Labor Statistics. *Productivity and the Economy,* BLS Bulletin 1710. 1971. 35 pp.

A chartbook covering trends in productivity, and their relation to other economic trends.

2.111 U.S. Department of Labor, Bureau of Labor Statistics. "Productivity and Unit Labor Costs in Export and Import-Competing Industries, 1958-68," in *United States International Economic Policy in an Interdependent World.* Papers submitted to the Commission on International Trade and Investment Policy and published in conjunction with the Commission's Report to the President. Washington, U.S. Government Printing Office, July 1971. Vol. 1, pp. 507-533.

Examines trends in output per man-hour and unit labor costs in two groups of manufacturing industries: those in which exports are an important part of domestic output, and those in which imports are an important part of new supply (domestic output plus imports).

2.112 Waldorf, William H. "Labor Productivity in Food Wholesaling and Retailing, 1929-1958." *The Review of Economics and Statistics,* Vol. 48, No. 1, February 1966, pp. 88-110.

Presents estimates of the rate of growth of output and labor productivity in food wholesaling and retailing based on various measures of output. These include an index of gross output and two indexes of net output, a double-deflated value-added series, and a margin-weighted series.

2.113 "Why It's So Tough to Boost Productivity." *Business Week,* July 25, 1970, p. 64 +.

Discusses the decline in U.S. productivity in 1970. Shows that traditional ways of boosting productivity, such as raising capital investment, are not justified when sales are off and the outlook for the economy is bleak.

2.114 Woodhall, Maureen, and Blaug, Mark. "Productivity Trends in British Secondary Educa-

tion, 1950-63." *Sociology of Education,* Vol. 41, No. 1, Winter, 1968. pp. 1-35.

The authors develop a number of alternative output measures for education and construct productivity indexes. They conclude that regardless of the output measure used, productivity in British secondary education declined between 1950 and 1963.

2.115 Ziegler, Martin. "Productivity in Manufacturing." *Monthly Labor Review,* Vol. 90, No. 10, October 1967, pp. 1-5.

Discusses productivity for the period 1947-66. Explains the rise in productivity as reflecting the cumulative influence of investment in human resources and capital equipment, advances in technology, managerial skills, and interindustry shifts within the manufacturing sector. Also discusses long-term trends, effects of the business cycle, movement in unit labor costs, and real labor income in the sector.

III. Factors affecting productivity

A. Labor and education

3.001 Bartsch, W. H. "The Industrial Labor Force of Iran: Problems of Recruitment, Training and Productivity." *The Middle East Journal,* Vol. 25, No. 1, Winter 1971, pp. 15-30.

Attributes Iran's productivity growth almost entirely to improvements in capital quality and quantity, holding that there has been negligible growth in labor quality due to a lack of vocational training and management's hiring of cheap rather than capable labor.

3.002 Becker, Gary S. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education.* New York, National Bureau of Economic Research, 1965. 187 pp.

Examines activities—particularly on-the-job training and schooling—that increase worker qualifications and the effects these activities have on income in terms of rates of return on the investment in human capital. Presents theoretical and empirical analyses.

3.003 Ben-Porath, Yoram. "The Production of Human Capital and the Life Cycle of Earnings." *Journal of Political Economy,* Vol. 75, No. 4, Part I, August, 1967. pp. 352-365.

Develops a production function for human capital and examines its relation to the life cycle of earnings.

3.004 Bertram, Gordon W. *The Contribution of Education to Economic Growth.* Staff Study 12. Ottawa, Economic Council of Canada, 1965.

Examines economic aspects of expanded and improved education.

3.005 Besen, S. M. "Education and Productivity in U.S. Manufacturing: Some Cross-Section Evidence." *Journal of Political Economy,* Vol. 76, No. 3, May-June 1968, pp. 494-497.

Reports the results of an attempt to assess the role of labor force quality, as measured by educational attainment, in explaining interstate productivity differentials in manufacturing.

3.006 Bjeda, K. "The Pattern of Education and Economic Growth." *Economic Record,* Vol. 46, No. 115, September 1970, pp. 368-383.

Discusses limitations of studies of education as an investment in human capital in terms of patterns, content, and quantity of education in various countries in the postwar period. Correlates changes in education with changes in the rate of growth of GNP.

3.007 Blaug, M., ed. *Economics of Education, Selected Readings,* Volumes I and II. Baltimore, Penguin Books, 1968, Vol. 1, 441 pp.; Vol. 2, 396 pp.

Contains surveys of the pertinent literature and essays on the concept of investment in human capital, cost-benefit analysis of educational expenditures, and manpower forecasting.

3.008 Bowles, S. S. "The Aggregation of Labor Inputs in the Study of Growth and Planning: Experiments with a Two-Level CES Function." *Journal of Political Economy,* Vol. 78, No. 1, January-February 1970, pp. 68-81.

Develops a labor service index based on the aggregate supply of labor having different levels of schooling. Estimates a two-level constant elasticity of substitution function, using international cross-sectional data on relative earnings and factor supplies. Finds a consistent but quantitatively small relationship between relative factor earnings and relative factor supplies.

3.009 Bowman, Mary Jean. "The Human Investment Revolution in Economic Thought," in *Economics of Education, Selected Readings,* M. Blaug, ed. Baltimore, Penguin Books, 1968, pp. 101-134.

A survey of the recent literature and a critical interpretation of leading ideas.

3.010 Bowman, M. J., and Myers, R. G. "Schooling, Experience, and Gains and Losses in Human Capital Through Migration." *Journal of the American Statistical Association,* Vol. 62, No. 319, September 1967, pp. 875-898.

The authors apply concepts of human capital to migration through use of cost-benefit models. The models take as their point of departure "individual" viewpoints but are transformed into social decision models by readjusting parameters to allow for cost and income transfers, by replacing individually expected earnings by socially expected or realized productive contributions, and by applying probability values to allow for rates of return or nonreturn of migrants. The authors suggest new census tabulations to permit more sophisticated application of human capital concepts to migration.

3.011 Enarson, Harold L. "Education and the Wealth of Nations." *Monthly Labor Review,* Vol. 90, No. 3, March 1967, pp. 21-24.

A critique in the form of a review article of the contribution of economics to educational planning in developing countries. Upholds the universities as centers of creative thought, and opposes as being futile attempts to quantify the knowledge they generate in terms of rates of return.

3.012 Engerman, Stanley L. "Human Capital, Education, and Economic Growth," in *The Reinterpretation of American Economic History,* Robert W. Fogel and Stanley T. Engerman, eds. New York, Harper and Row, 1971. pp. 241-256.

Analyzes problems in the estimation of the costs and benefits of education. Shows how the rate of return on education may be measured.

3.013 Feldstein, M. S. "Specifications of Labor Input in the Aggregate Production Function." *Review of Economic Studies,* Vol. 34 (4), No. 100, October 1967, pp. 375-386.

Explores the importance of improving the specification of labor input by allowing the elasticity of output with respect to the number of employees to differ from the elasticity with respect to the average number of hours per employee. Discusses the implications of such inequality for economic analysis and policy, and suggests reasons why output elasticity with respect to hours may substantially exceed that with respect to number of employees.

3.014 Gintis, Herbert. "Education, Technology, and the Characteristics of Worker

Productivity." *American Economic Review,* Vol. 61, No. 2, May 1971, pp. 266-279.

Argues that schools contribute to worker productivity, not through their academic efforts, but rather by encouraging personality characteristics conducive to favorable performance in a work role.

3.015 Hansen, W. Lee, ed. *Education, Income, and Human Capital.* Studies in Income and Wealth, Vol. 35. New York, National Bureau of Economic Research, 1970. 320 pp.

A compendium of papers examining the interrelationships among education, income distribution, and production.

3.016 Hartley, K. "The Learning Curve and Aircraft Industry." *Journal of Industrial Economics,* Vol. 13, No. 2, March 1965, pp. 122-128.

Argues that economies of learning result from applying direct labor to a complex task, so that the more often the job is repeated the more the worker will learn. Draws on experience in the aircraft industry. Explains the use of learning curves in estimating average direct labor costs for a given output, and examines the implications of learning for the concept of capacity.

3.017 Kiker, B. F. *Human Capital in Retrospect.* Columbia, South Carolina, Bureau of Business and Economic Research, University of South Carolina, 1968. 142 pp.

Summarizes and appraises the methods of human capital evaluation which have appeared historically, and the uses to which the human capital concept has been put.

3.018 Kiker, B. F. "Von Thuenen on Human Capital." *Oxford Economic Papers,* Vol. 21, No. 3, November 1969, pp. 339-343.

Presents Von Thuenen's views on human capital. Von Thuenen treated human beings with the definitional schemes of capital, attempted to explain the influence of education on labor productivity, and suggested opportune policy measures, particularly in the area of conscription.

3.019 Kreinin, Mordechai E. "Comparative Labor Effectiveness and the Leontief Scarce-Factor Paradox." *American Economic Review,* Vol. 55, No. 1, March 1965, pp. 131-140.

Presents the results of a survey in which American firms were requested to compare the labor time required per unit of output in their operations in the United States with their operations abroad under similar organizational conditions and degrees of mechanization.

3.020 Kuznets, Simon. "The Contribution of Immigration to the Growth of the Labor Force." *The Reinterpretation of American Economic History,* Robert W. Fogel and Stanley T. Engerman, eds. New York, Harper and Row, 1971, pp. 396-401.

Studies immigration to the United States before restriction. Discusses the importance of immigration to the labor force and considers the importance of human capital to economic growth. Schooling and training in skills, received by immigrants in their countries of origin, represented a large capital inflow to the United States.

3.021 Levenson, Irving F. "Reductions in Hours of Work as a Source of Productivity Growth." *Journal of Political Economy,* Vol. 75, No. 2, April 1967, pp. 199 ff.

Discusses critically a 1947 study by the Bureau of Labor Statistics on the relation between hours of work and output.

3.022 Levhari, D. "Further Implications of Learning by Doing." *Review of Economic Studies,* Vol. 33 (1), No. 93, January 1966, pp. 31-38.

Explores certain implications of the "learning by doing" hypothesis advanced by Arrow in the *Review of Economic Studies,* June 1962. Discusses the divergence between social and private returns and the resulting divergence between income distributions implicit in Arrow's hypothesis. Among the findings is a measure of the magnitude of the subsidy required to bring social and private returns to equality.

3.023 Mathewson, Stanley B. *Restriction of Ouput Among Unorganized Workers.* Carbondale, Ill., Southern Illinois University Press, 1969. 212 pp.

Reissue of a classic first published in 1931, presenting case studies of unorganized workers' resistance to maintaining given output standards or to increasing output, and the reasons for it. Finds such resistance as widespread among the unorganized as it was thought to be among organized workers.

3.024 Merrett, S. "The Rate of Return to Education: A Critique." *Oxford Economic Papers,* Vol. 18, No. 3, November 1966, pp. 289-303.

Asserts that the positive correlation between education and other determinants of earning power will exaggerate the importance of education in any simple bivariate analysis. The use of the current pattern of earnings as a measure of differential productivities ignores such factors as age differentials, which have been determined in fact by past changes in relative supply conditions, or poor pay in some occupations, which may reflect transient demand conditions.

3.025 Migliore, Henry R. "Improving Worker Productivity through Communicating Knowledge of Work Results." *Management of Personnel Quarterly,* Vol. 9, No. 2, Summer 1970, pp. 26-32.

Arguing that knowledge of work results may enable the worker to attain personal goals and to satisfy higher level needs, the author evaluates the effectiveness of using knowledge-of-results techniques in a unionized industrial setting in terms of their impact upon productivity.

3.026 Morgan, James N.; Sirageldin, Ismail; and Baerwaldt, Nancy. *Productive Americans: A Study of How Individuals Contribute to Economic Progress.* Survey Research Center Monograph No. 43. Ann Arbor, The University of Michigan, 1966. 545 pp.

The authors present and discuss statistical findings from a sample survey of the productive use of time among American families, in both paid and unpaid pursuits, as well as of their reaction to change.

3.027 Musgrave, P.W. *Technical Change, the Labor Force, and Education: A Study of the British and German Iron and Steel Industries, 1860-1964.* New York, Pergamon Press, 1967. 286 pp.

Explores the types of economic and technical change which most strongly affect education, and how education may best promote change.

3.028 National Productivity Council of India. *Role of Labor in Productivity.* NPC Report No. 46. New Delhi, National Productivity Council, March 1966. 73 pp.

The report of an Indian study team sent to the United States to evaluate the contribution made by workers to productivity advance.

3.029 Nelson, Richard R., and Phelps, Edmund S. "Investment in Humans, Technological Diffusion, and Economic Growth." *American Economic*

Review, Vol. 56, No. 2, May 1966, pp. 69-75.

The authors hold that the more rapid the rate of technological discovery in an economy, the higher the payoff of increased education, since more educated managers are more receptive to innovative possibilities–implying that society should develop more human capital relative to tangible capital.

3.030 Novikov, H. "Problems in the Effective Utilization of Labor Resources." *Problems of Economics,* Vol. 12, No. 10, February 1970, pp. 72-88.

Discusses a broad range of problems bearing upon factors influencing labor productivity in the Soviet Union.

3.031 Organization for Economic Cooperation and Development (Study Group in the Economics of Education). *The Residual Factor and Economic Growth.* Paris, OECD, 1964. 275 pp.

Four papers with comment on the nature and sources of economic growth and technical progress and the importance of educational investment.

3.032 Pandit, N. H., ed. *Measurement of Cost Productivity and Efficiency in Education.* New Delhi, National Council of Educational Research and Training, 1969. 434 pp.

A collection of 32 papers discussing methods of costing, measurement of efficiency, economic criteria for investment, productivity, and problems in measuring cost-benefit relations in education.

3.033 Price, J. E., and Etherington, D. M. "The Paradox of Surplus Agricultural Labour and Positive Marginal Productivity of Labour." *The Indian Economic Journal,* Vol. 13, No. 5, April-June 1966, pp. 682-687.

The authors present some empirical findings about peasant agriculture which cannot be reconciled by traditional price theory.

3.034 Raimon, Robert L. "Changes in Productivity and the Skill-Mix." *International Labour Review,* Vol. 92, No. 4, October 1965, pp. 314-324.

Examines reasons for the rise in levels of skills in the labor force. Finds that the rise is closely associated with shifts towards industries requiring higher skills.

3.035 Raimon, Robert L., and Stoikov, Vladimir. "The Quality of the Labor Force." *Industrial and Labor Relations Review,* Vol. 20, No. 3, April 1967, pp. 391 ff.

Using the average earnings of occupational groups as a measure of the economic efficiency of their members, the authors undertake to evaluate the degree of improvement of the quality of the labor force in recent years. They find that from 1956 through 1964, the quality of employed workers increased less than 3 percent, with most of the increase resulting from the decline in the number of farmers and farm laborers.

3.036 Rapping, Leonard. "Learning and World War II Production Functions." *The Review of Economics and Statistics,* Vol. 57, No. 1, February 1965, pp. 80-86.

Discusses the sharp rise in shipbuilding productivity during World War II, emphasizing the role of organizational and individual learning resulting from accumulated production experience.

3.037 Rosenberg, Jerry M. *Automation, Manpower, and Education.* New York, Random House, 1966. 179 pp.

Outlines the responsibilities of educators in helping to alleviate economic hardships caused by rapidly changing

technology. Discusses government and business responses to educational needs arising from such change.

3.038 Schroeder, Gertrude. "Labor Planning in the U.S.S.R." *Southern Economic Journal,* Vol. 32, No. 1, July 1965, pp. 1-14.

States that planning related to the management of human resources has increased in scope and complexity in the U.S.S.R. as industrialization has accelerated. There is a wide discrepancy between plans and results because increases in population and labor force are frequently underestimated while increases in productivity and wages are usually overestimated.

3.039 Schultz, Theodore W. "Capital Formation by Education," in *The Reinterpretation of American Economic History,* Robert W. Fogel and Stanley T. Engerman, eds. New York, Harper and Row, 1971. pp. 241-256.

Describes problems in estimating the costs and benefits of education. Shows how the rate of return on education may be measured.

3.040 Schultz, Theodore W. *Investment in Poor People.* Seminar on Manpower Policy and Program. U.S. Department of Labor, Manpower Administration, 1967. 25 pp.

Using rate of return as a criterion for evaluating the efficiency of investment, the author concludes that there has been great underinvestment in human capital, particularly among the poor. Offers an explanation for this misallocation of resources.

3.050 Schwartzman, David. "The Contribution of Education to the Quality of Labor, 1929-63." *American Economic Review,* Vol. 58, No. 3, June 1968, pp. 508-514.

Presents estimates of improvements in educational attainment over the 1929-63 period. Finds that pertinent estimates by Denison overstate the improvement for the 1930-60 period.

3.051 Scully, Gerald W. "Human Capital and Productivity in U.S. Manufacturing." *Western Economic Journal,* Vol. 7, No. 4, December 1969, pp. 334-340.

Introduces a human capital term into the standard Cobb-Douglas function, containing measurable characteristics such as age and education.

3.052 Sellers, Walter E., Jr. *Labor Used on U.S. Farms, 1964 and 1966.* Rev., October 1970. Statistical Bulletin No. 456. U.S. Department of Agriculture, Economic Research Service, 1970. 23 pp.

Examines labor inputs by region, farm size, and farm type. Presents estimates of hours of labor used per $100 of farm products sold, by type of farm.

3.053 Sen, A. K. "Labor Allocation in a Cooperative Enterprise." *Review of Economic Studies,* Vol. 33, No. 96, October 1966, pp. 4-96.

Finds that income distribution according to "needs" tends to produce an underallocation of labor, and distribution according to "work" or productivity produces an overallocation of labor. Optimum allocation requires a mixture of the two distribution methods.

3.054 "Shortage of Workers Cramps Soviet Muscle." *Business Week,* March 21, 1970, p. 50+.

Discusses the problem of inefficiency and waste in the Soviet Union. Explains how political considerations have forced plant managers to overstaff in the face of labor shortages for new industry. Points to growing emphasis on productivity and incentives for both management and labor.

3.055 Singer, H.W. "The Notion of Human Investment." *Review of Social Economy,* Vol. 24, No. 1, March 1966, pp. 1-14.

Shows that changes in the relative levels of economic and social development result from a number of structural and functional relations between economic and social factors. Argues that there is a "social profile" made up of social components more strongly linked to one another than to economic levels. Construction of social profiles is inhibited by lack of adequate social indicators.

3.056 Stoikov, Vladimir. "Productivity and the Quality of the International Labor Force." *British Journal of Industrial Relations,* July 1968, pp. 156-165.

The author assigns weights to various sectors of the labor force for 37 countries to show how quality measurement of labor improves productivity estimates.

3.057 Sutermeister, Robert A., ed. *People and Productivity.* New York, McGraw-Hill, 1969. 511 pp.

Discusses sociological and psychological factors that influence productivity.

3.058 Sveikauskas, Leo. "Influences on Productivity." *MSU School of Labor and Industrial Relations,* Spring Quarter, 1971, pp. 5-6.

Reviews a study of major factors in productivity improvement. Concludes that the proportion of professionals and technicians and levels of skill represent the most important influences on productivity, followed by the relation of capital to labor and the age of the capital stock.

3.059 Temin, Peter. "Labor Scarcity and the Problem of American Industrial Efficiency in the 1850's." *The Journal of Economic History,* Vol. 26, No. 3, September 1966, pp. 277-298.

Examines statements made by British observers in the 1850's on labor scarcity and industrial efficiency in the United States. Discusses the inadequacy of these observations in light of empirical data, and of relative factor proportions of technologies referred to by those observers.

3.060 Terreblanche, S. J. "The Relative Contribution of Tangible and Human Capital Formation to Economic Growth." *South African Journal of Economics,* Vol. 38, No. 1, March 1970.

Discusses the "human investment revolution" in economic thought of the past decade.

3.061 Tjioe, B. Khing, and Burns, Leland S. "Housing and Productivity: Causality and Measurement," in *Proceedings of the Social Statistics Section,* American Statistical Association, 1966, pp. 155-160.

The authors explore the relation between the productivity of workers and changes in the quality of their housing.

3.062 U.S. Congress, House. Committee on Science and Astronautics, Subcommittee on Science, Research, and Development. *New Technology in Education. Selected References.* Compiled by the Education and Public Welfare Division, Congressional Research Service, Library of Congress. Washington, U.S. Government Printing Office, 1971. 140 pp.

Includes citations relating to (1) issues, problems, and future uses of educational technology; (2) the uses of a variety of specific media; and (3) alternative methods of organizing instruction.

3.063 Waud, R. N. "Man-Hour Behavior in U.S. Manufacturing: A Neoclassical Interpretation." *Journal of Political Economy,* Vol. 76, No. 3, May-June 1968, pp. 407-427.

Investigates the movement of production worker man-hours at the 2-digit SIC level for manufacturing industries for 1954-64, using labor costs and capital prices as explanatory variables. Estimates elasticity of man-hours with respect to real hourly labor costs and capital costs.

3.064 Weinberg, Edgar. *Improving Productivity: Labor and Management Approaches,* BLS Bulletin 1715. U.S. Department of Labor, Bureau of Labor Statistics, September 1971. 35 pp.

Describes efforts by labor and management to provide training opportunities, make greater use of worker know-how, establish more satisfactory work rules, and institute more effective work incentives. Cites experiences of a cross-section of American industries.

3.065 Welch, F. "Education in Production." *Journal of Political Economy,* Vol. 78, No. 1, January-February 1970, pp. 35-39.

Explores the reasons why the demand for and the rate of return on education have been maintained, even though the supply of highly educated workers has increased greatly.

3.066 Wysong, John W. *Labor Productivity and Labor Force Characteristics of Selected Types of Commerical Farms.* Mimeograph Series No. 28. College Park, Md., Department of Agricultural Economics, University of Maryland, 1968. 27 pp.

Argues that substantial gains in labor productivity are possible up to the point at which farmers fully utilize their labor force.

3.067 Willacy, Hazel M. "Changes in Factory Workweek as an Economic Indicator." *Monthly Labor Review,* Vol. 93, No. 10, October 1970, pp. 25-31.

Argues that changes in average weekly hours, and more particularly in overtime hours, occur as employers attempt to coordinate their labor inputs and production schedules in response to variations in the demand for their product. Hence, the workweek is a useful indicator of labor shortages or surpluses.

B. Management and organization

3.068 Asian Productivity Organization. *Achievements in the First Decade of the Productivity Drive in Japan.* Tokyo, Asian Productivity Organization, 1968. 117 pp.

Traces public and private efforts to spur industrial productivity in Japan, and the relationship of these efforts to Japan's economic growth. Among major topics are international exchange of study teams, management training, small business development, labor-management relations, research, and information activities.

3.069 Asian Productivity Organization. *Review of Activities of National Productivity Organizations in APO Member Countries.* Tokyo, Asian Productivity Organization, 1964- .

An annual summary of activities, such as organizing missions to study foreign expertise, handling technical inquiries, conducting training courses, etc.

3.070 Asian Productivity Organization. *Top Management Symposium.* Conference Report, Hong Kong, 1969. Tokyo, Asian Productivity Organization, 1969. 218 pp.

Presents papers on the role of management in accelerating economic growth, the role of research and development, the effect of traditional management systems on economic developments, and related subjects.

3.071 Becker, S. W., and Stafford, Frank. "Some Determinants of Organizational Success." *The Journal of Business,*

Vol. 40, No. 4, October 1967, pp. 511-518.

The authors analyze the relative effect on organizational efficiency of variables frequently utilized by psychologists, economists, and sociologists–such as organization size, adoption of innovations, psychological distance in the management team, and the environment. They use findings from a statistical study of the firms in the savings and loan industry.

3.072 Bock, Betty. "The Concentration-Productivity Quandary." *The Conference Board Record,* Vol. 4, No. 6, June 1967, pp. 2-7.

Examines the relationship between concentration (on the establishment level) and productivity (as measured by the dollar value of shipments per employee). Finds that industries with the highest productivity tend to be the more concentrated ones.

3.073 Bock, Betty, and Farkas, Jack. "The Productivity-Concentration Quandary Re-examined." *The Conference Board Record,* Vol. 5, No. 7, July 1968, pp. 13-19.

The authors refine measures, developed in an earlier article, designed to show relative productivity of the first four and the first eight companies in given industries. Measures are based on value added per employee and value of shipments per employee in 1963. They find that the first four and the first eight companies in an industry had on the average higher productivity than other companies in the same industry, and that industries with high concentration tended also to rank high in productivity.

3.074 Bock, Betty, and Farkas, Jack. *Concentration and Productivity: Some Preliminary Problems and Findings.* Studies in Business Economics, No. 103. New York, The Conference Board, 1969. 170 pp.

The authors examine the relationships between average "productivity", measured in terms of labor inputs, of the top companies in an industry and other companies in the same industry; the relationships between industry concentration and industry "productivity"; and the relative weight of the component parts of the "productivity" figures.

3.075 Butterworth, Jack. *Productivity Now.* New York, Pergamon Press, 1969. 148 pp.

Argues that productivity in Great Britain could be increased dramatically through better business organization, more labor-management communication, and more effective management. Presents eight case studies to illustrate his points.

3.076 Chao, Kang. *Agricultural Production in Communist China, 1949-1965.* Madison, University of Wisconsin Press, 1970. 357 pp.

Examines the effects of the socialist transformation on agricultural inputs, outputs, and technology.

3.077 Dahmen, Erik. *Entrepreneurial Activity and the Development of Swedish Industry, 1919-1939.* The American Economic Translation Series. Homewood, Ill., Richard D. Irwin, 1970. 440 pp.

Discusses problems of industrial transformation using Schumpeter's concepts of technological progress and economic development.

3.078 Diebold, John. *Business Decisions and Technological Change.* New York, Praeger, 1970. 268 pp.

A collection of the author's speeches and articles on how automation changes the decisionmaking environment of the manager, and on the facts he should consider in introducing new technology. Includes case studies in government and private industry.

3.079 Dovring, Folke. "Land Reform and Productivity in Mexico." *Land Economics,* Vol. 46, No. 3, August 1970, pp. 264-274.

Investigates the effect of the Mexican land reform on productivity in agriculture. Finds that the *ejidos* (created by land reform) obtain higher crop yields at lower input cost than large, privately owned farms.

3.080 Dubin, Robert; Homans, George C.; Mann, Floyd C.; and Miller, Delbert C. *Leadership and Productivity.* San Francisco, Chandler Publishing Company, 1965. 138 pp.

Contains four essays exploring the impact of supervisory practices on productivity and workers' behavior.

3.081 Fleming, M. C. "Inter-Firm Differences in Productivity and their Relation to Occupational Structure and Size of Firm." *Manchester School of Economic and Social Studies,* Vol. 38, No. 3, September 1970, pp. 223-245.

Demonstrates that the level of labor productivity attained by different firms is statistically related to the proportion of administrative, technical, and clerical staff rather than size. Shows higher productivity is dependent on resolving problems of industrial organization and management.

3.082 Hayami, Y. and Ruttan, V. W. "Korean Rice, Taiwan Rice and Japanese Agricultural Stagnation: An Economic Consequence of Colonialism." *Quarterly Journal of Economics,* Vol. 84, No. 4, November 1970, pp. 562-589.

The authors examine the stagnation in agricultural output and productivity in Japan after World War I. Rice imports from Korea and Taiwan were responsible for deterioration of domestic agriculture, and affected indigenous technological potential unfavorably.

3.083 "Japan: Now the Imitator Shows the Way." *Business Week,* May 16, 1970, pp. 88-89 +.

Discusses how and why Japanese industry develops its own technology in preference to purchasing Western know-how.

3.084 Jehring, J. J. "The Productivity Crisis," *Management of Personnel Quarterly.* Spring 1967, pp. 21-24.

Argues that the increasing demand for services and welfare programs can be met only by superior methods of improving productivity. This requires that systems be organized so as to spur motivation of the factors of production, i.e., managers, workers, and suppliers of capital.

3.085 Leibenstein, Harvey. "Allocational Efficiency vs. 'X-Efficiency'." *American Economic Review,* Vol. 56, No. 3, June 1966, pp. 393-415.

Argues that gains from improvements in allocational efficiency are frequently trivial, but in many instances considerable increases in productivity occur with substantially no technical change or increases in capital. This increase in efficiency is called "X-efficiency" and is related to motivational changes.

3.086 Leibenstein, Harvey. "Organizational or Frictional Equilibrium, X-Efficiency, and the Rate of Innovation." *Quarterly Journal of Economics,* Vol. 83, No. 4, November 1969, pp. 600-623.

Argues that firms frequently do not produce maximum output with given inputs ("X-inefficiency"), or increase output with the same inputs ("X-efficiency"). Examines the effect this behavior has on technological change and growth.

3.087 Melman, Seymour. "Industrial Efficiency Under Managerial vs. Cooperative

Decision-Making." *Review of Radical Political Economics,* Vol. 2, No. 1, Spring 1970, pp. 9-33.

Questions whether industrial production requires the managerial hierarchical mode of decisionmaking. Examines 12 Israeli establishments and finds that those that do not have a hierarchical management structure have productivity records equal or superior to those that do.

3.088 Mullen, James H. *Personality and Productivity in Management.* New York, Temple University Publications, distributed by Columbia University Press, 1966. 140 pp.

Explores the impact on productivity of widely varying differences in personality and leadership of three division managers in a large insurance company.

3.089 Noda, Nobuo. *How Japan Absorbed American Management Methods.* Translation Series No. 10. Tokyo, Asian Productivity Organization, 1969. 37 pp.

Presents a historical survey of the factors leading to the adoption of American methods of management by Japanese industry.

3.090 Patrick, G. F. and Eisgruber, L. M. "The Impact of Managerial Ability and Capital Structure on Growth of the Farm Firm." *American Journal of Agricultural Economics,* Vol. 50, No. 3, August 1968. pp. 491-506.

The authors conclude, on the basis of a simulated case study of farm firm behavior over a 20-year period, that managerial ability and long-term loan limits are major factors influencing farm firm growth.

3.091 Rimlinger, G. V. "Welfare Policy and Economic Development: A Comparative Historical Perspective." *The Journal of Economic History,* Vol. 26, No. 4, December 1966. pp. 556-571.

Hypothesizes that the development of modern health and welfare programs is at least in part a response to the rising productivity and increasing relative scarcity of labor accompanying economic development. The hypothesis is explored in the historical context of industrialization in England, Germany, the United States, and Russia.

3.092 Rosen, Ned A. *Leadership Change and Work-Group Dynamics, An Experiment.* Ithaca, N.Y., Cornell University Press, 1969. 261 pp.

Examines whether formal work-group leaders affect the productivity of work groups under highly structured technological conditions.

3.093 Sales, Stephen M. "Supervisory Style and Productivity: Review and Theory." *Personnel Psychology,* Vol. 19, No. 3, Autumn 1966, pp. 275-286.

Presents a theoretical framework for expected differential effects of democratic versus authoritarian supervision on productivity. Reviews and evaluates relevant literature.

3.094 Shultz, George P. and McKersie, Robert B. "Stimulating Productivity: Choices, Problems, and Shares." *British Journal of Industrial Relations,* Vol. 5, No. 5, March 1967, pp. 1-18.

The authors discuss three approaches frequently followed by management to raise productivity: (1) buying out of bad practices; (2) sharing of gains from productivity improvements; and (3) manpower policy conforming with technological changes. They discuss the circumstances under which these approaches promise to be most successful.

3.095 Sirota, David. "Productivity Management," *Harvard Busines Review,* Vol.

44, No. 5, September-October 1966, pp. 111-116.

Argues that work standards present barriers to high productivity. Recommends that standards of long-term improvement rather than daily output be the gauge of worker efficiency.

3.096 "Step Up Your Productivity?" *Medical Economics,* September 30, 1968, pp. 63-154.

A special issue, examining such topics in physicians' productivity as the formation of partnerships in place of single practice, and delegating more clinical tasks to aides. Also explores ways to raise productivity without impairing the quality of medical care.

3.097 "The Productivity Crisis." *New Society,* Vol. 8, No. 208, September 22, 1966, pp. 434-448.

A collection of articles investigating the obstacles to higher productivity in Great Britain.

3.098 Vepa, Ram K. *Productivity in Small Industries – Some Lessons from Japan.* Asian Productivity Organization, Tokyo, 1969. 98 pp.

Discusses the measures taken by the Japanese government to help small businesses cope with the cost squeeze arising from the fact that, while the wage rates they pay are rapidly nearing those paid by bigger firms, their productivity lags behind.

3.099 Walton, Gary M. "Sources of Productivity Change in American Colonial Shipping, 1675-1775." *The Economic History Review,* Vol. 20, No. 1, April 1967, pp. 67-78.

Cites evidence on sources of changing productivity in colonial shipping for the 100-year period preceding the American Revolution. Argues that most of the improvement in productivity arose from gains in economic organization and reduced hazards, rather than from technological changes.

C. Technological change

3.100 American Machinist. *AM on NC – How to Use Numerically Controlled Machine Tools with Maximum Efficiency.* New York, McGraw-Hill, 1967. 176 pp.

A compilation of articles on basic aspects of numerical control, applications, tooling-up procedures, and programing methods.

3.101 American Machinist. *AM on Computers – Their Role in Manufacturing.* New York, McGraw-Hill, 1971. 140 pp.

A compilation of articles on the management, cost, and factory applications of computers.

3.102 Arnfield, R. V., ed. *Technological Forecasting.* Edinburgh, Edinburgh University Press, 1969. 417 pp.

A collection of papers reviewing the history of technological forecasting, especially in Europe, and discussing techniques of forecasting.

3.103 Atkinson, Anthony B., and Stiglitz, Joseph E. "A New View of Technological Change." *Economic Journal,* Vol. 79, No. 315, September 1969, pp. 573-578.

The authors argue that mathematical theories implying generalized shifts in the production function due to technological change fail to take account of the "localization" of technological progress in particular fields. Improvement of technique in one field may have no effect on other techniques in the same or related fields. Some implications for research conducted in developing countries are discussed.

3.104 Ayres, Robert V. *Technological Forecasting and Long-Range Planning.* New York, McGraw-Hill, 1969. 237 pp.

Discusses various types and methods of forecasting and how these may be incorporated in overall economic planning.

3.105 Bagrit, Sir Leon. *The Age of Automation.* New York, New American Library of World Literature, 1965. 128 pp.

Discusses the social and political implications of automation. Predicts a fuller, more creative life for mankind.

3.106 Ball, Robert; Herman, Arthur; and Lyon, Richard. *Outlook for Computer Process Control,* BLS Bulletin 1658. U.S. Department of Labor, Bureau of Labor Statistics, 1970. 70 pp.

The authors examine the extent to which computers have been installed in six industries; how many will be installed in the future; what factors govern their adoption; what type of manpower is required for computer process control; and what kinds of industrial relations problems have arisen as a consequence of computer installation.

3.107 Baranson, Jack. *Role of Science and Technology in Advancing Development of Newly Industrializing States.* Mimeographed. U.S. Department of State, Office of External Research, January 1969. 73 pp.

Considers how developing countries may increase their ability to absorb and adapt—and how developed economies may more effectively transmit—advanced technologies.

3.108 Bennett, E. C. *Mechanization of the United States Printing Industry.* Sydney, Australia, Printing and Kindred Industries Union, New South Wales Branch, September 1966. 48 pp.

Reports on new printing technology, particularly typesetting technology, observed on a 6-week tour of 12 American cities and draws lessons for Australia.

3.109 Bright, James R., ed. *Technological Forecasting for Industry and Government.* Englewood Cliffs, N.J., Prentice-Hall, Inc., 1968. 484 pp.

A collection of papers summarizing the state of technological forecasting.

3.110 Brooks, George W. "Unions and Technological Change." *The Conference Board Record,* Vol. 5, No. 6, June 1968. pp. 23-25.

Contrasts the attitude of the United Auto Workers, oriented toward efficiency and rapid technological change, with that of trade unions more resistant to change. Concludes that the issue in labor management relations is the extent to which employers should be restricted in introducing new technologies.

3.111 Brown, Lester R. "The Agricultural Revolution in Asia." *Foreign Affairs,* Vol. 46, No. 4, July 1968, pp. 688-698.

Discusses the striking increases in food grain crops in major Asian countries in the late sixties, and the political and technological reasons for them.

3.112 Brown, Lester R. *The Social Impact of the Green Revolution.* International Conciliation Publication No. 581. New York, Carnegie Endowment for International Peace, 1971. 61 pp.

Discusses the implications of successful new agricultural technology for the relief of hunger, and for employment, population, and the distribution of benefits.

3.113 Brown, Murray. *On the Theory and Measurement of Technological Change.* Cambridge, England, Cambridge University Press, 1966. 214 pp.

Discusses the properties of the Cobb-Douglas and constant elasticity of substitution production functions. Presents various methods of measuring both neutral and non-neutral technological change and tests several of these methods, using U.S. historical data.

3.114 Bush, George P., and Hattery, Lowell H., eds. *Automation and Electronics in Publishing.* The American University Technology of Management Series, Volume 3. Washington, Spartan Books, 1965. 206 pp.

A collection of papers examining technological changes and their effects on production, management, organization, and labor relations in several types of publishing. Considerable attention is paid to computerized typesetting.

3.115 Capron, William M., ed. *Technological Change in Regulated Industry.* Studies in the Regulation of Economic Activity. Washington, The Brookings Institution, 1970. 211 pp.

Contains studies of the interaction between technological change and the regulatory process in the electric power generating industry, and in communications, commercial aviation, and surface transportation. Also presents a theoretical analysis of the impact of innovation on a number of regulatory practices, as well as an interpretive concluding essay.

3.116 Carter, Anne P. "Changes in the Structure of the American Economy, 1947 to 1958 and 1962." *The Review of Economics and Statistics,* Vol. 49, No. 2, May 1967, pp. 209-224.

Presents an overall picture of technological change in the United States by systematically comparing the 1947 and 1958 input-output tables.

3.117 Carter, Anne P. "The Economics of Technological Change." *Scientific American,* Vol. 214, No. 4, April 1966, pp. 25-31.

Uses input-output tables to evaluate technological change from 1947 to 1958.

3.118 Chang, W. W. "The Neoclassical Theory of Technical Progress." *American Economic Review,* Vol. 60, No. 5, December 1970, pp. 912-923.

Develops a set of parameters associated with Harrod's and Solow's classifications in a neoclassical two-sector model. Provides a unified treatment of Hick's, Harrod's, and Solow's classifications of bias in technological change. Examines the conditions for "aggregate neutrality."

3.119 Conference on the Communication of Scientific and Technical Knowledge to Industry (Stockholm, October 7-9, 1963). *Proceedings.* Paris, Organization for Economic Cooperation and Development, April 1965. 188 pp.

Reviews conditions necessary for the most efficient international transfer of scientific knowledge among small- and medium-sized firms as well as among large ones.

3.120 Critchlow, Robert V. "Technological Changes in the Printing and Publishing Industry." *Monthly Labor Review,* Vol. 93, No. 8, August 1970, pp. 3-9.

Reports that technology has been advancing strongly to meet a rapidly increasing demand for printed material. Finds that the occupational requirements of the industry have been changing significantly.

3.121 Crossman, E. R. F. W.; Laner, Stephen; Davis, Louis E.; and Caplan, Stanley H. *Evaluation of Changes in Skill Profile and Job Content Due to Technological Change: Methodology and Pilot Results from the Banking, Steel and Aerospace Industries.* Report submitted to the Director, Office of Manpower Policy, Evaluation and Research, U.S. Department of Labor. Berkeley, Department of Industrial

Engineering and Operations Research, University of California. October 1966. 100 pp. plus appendix.

The authors address the question of the skill levels required by advancing technologies and test the hypothesis that higher levels of mechanization and automation require lower levels of skill. They develop specific methods to measure the effect of new technologies on skills, controlling for such "extraneous" factors as differences in product quality or design or staffing patterns as compared with the old technology. They establish tentative criteria for the prediction of needed skills.

3.122 Dalrymple, Dana G. *Technological Change in Agriculture: Effects and Implications for Developing Nations.* U.S. Department of Agriculture, Foreign Agricultural Service, April 1969. 82 pp.

Examines the adoption process for agricultural technology. Surveys the economic, social, and political effects of the development of high-yield grains and of increased farm mechanization.

3.123 David, Paul A., and Van de Klundert, Th. "Biased Efficiency, Growth and Capital-Labor Substitution in the U.S., 1899-1960." *American Economic Review,* Vol. 55, No. 3, June 1965, pp. 357-394.

The authors measure the distribution of technological change between labor-associated and capital-associated improvements in factor efficiency. Their estimate of the elasticity of substitution casts doubt on the appropriateness of the Cobb-Douglas form of production function.

3.124 Diebold Group, Inc. *Automation: Impact and Implications: Focus on Developments in the Communications Industry.* Washington, Communications Workers of America, 1965. 182 pp.

Identifies and discusses sectors of the economy where automation has caused important changes in production processes and employment.

3.125 Diebold, John. "Is the Gap Technological?" *Foreign Affairs,* Vol. 46, No. 2, January 1968, pp. 276-291.

Examines factors underlying the technological superiority of American firms over their foreign counterparts, and finds that the difference results mainly from managerial and financial inadequacies of European firms.

3.126 Diwan, R. K. "About the Growth Path of Firms." *American Economic Review,* Vol. 60, No. 1, March 1970, pp. 30-43.

Deals with technological factors influencing the behavior of firms. Discusses elasticity of factor substitution, technological impact on labor efficiency, and bias of technological change. Finds that these factors at first grow with the firm, reach a maximum, and then start falling off as the size of firm keeps growing.

3.127 Doctors, Samuel I. *The Role of Federal Agencies in Technology Transfer.* Cambridge, Mass., The MIT Press, 1969. 230 pp.

Considers problems of technology transfer from government-sponsored research and development to the economy as a whole. Discusses NASA's Technology Utilization Plan.

3.128 Earl, Victor. *Technological Forecasting. The Economist,* Brief 11. London, The Economist Newspaper Ltd., 1968. 24 pp.

Discusses the kinds of problems technological forecasting tries to solve and how forecasters go about the task.

3.129 Evan, E. W. "Some Problems of Growth in the Machine Tool Industry."

Yorkshire Bulletin of Economic and Social Research, Vol. 75, May 1966, pp. 22-32.

Discusses obstacles to higher capacity and output in the British tool industry, especially the difficulty of expanding research activity; the scarcity of scientific, technical, and skilled labor; the problems created by cyclical variations in demand; and the barriers which exist to the substitution of labor.

3.130 Fabricant, Solomon. *Measurement of Technological Change.* Fourth Seminar on Manpower Policy and Program. U.S. Department of Labor, Manpower Administration, 1965. 32 pp.

Considers alternate concepts of technological change and discusses difficulties of measurement.

3.131 Ferguson, Walter. *Farm Labor Used for Fruits and Tree Nuts, 1964.* Statistical Bulletin No. 436. U.S. Department of Agriculture, Economic Research Service, 1969. 43 pp.

Presents data on man-hours required per acre at various stages of production in 1964, the first year in which much fruit and nut tree acreage was harvested mechanically.

3.132 Ferkiss, Victor C. *Technological Man, the Myth and the Reality.* New York, George Braziller, Inc. and New American Library, 1969. 276 pp.

Explores the relations between evolving technology and the web of society, economy, and culture.

3.133 Ford, Gordon W., ed. *Automation: Threat or Promise?* Sydney, Australia, The Australian and New Zealand Association for the Advancement of Science, 1969. 214 pp.

A series of papers discussing the impact of automation on production, manpower requirements, labor-management relations, and the social structure.

3.134 Freeman, Christopher. *The Measurement of Scientific and Technological Activities.* Paris, United Nations Educational, Scientific and Cultural Organization, 1969. 63 pp.

Puts forth proposals for the collection of statistics on science and technology on an internationally uniform basis. Discusses the need for such a collection and the difficulties of undertaking it.

3.135 Fulco, Lawrence J. "How Mechanization of Harvesting Is Affecting Jobs." *Monthly Labor Review,* Vol. 92, No. 3, March 1969, pp. 26-32.

Analyzes technological developments in harvesting of fruits and vegetables, and their implications for productivity, employment, training, and labor-management relations.

3.136 Gamble, William K.; Adams, Dale W.; and Dorner, Peter. "Institutional Reform: The Conflict Between Equity and Productivity: Discussion." *American Journal of Agricultural Economics,* Vol. 52, No. 5, December 1970, pp. 716-718.

The authors each comment on the uneven incidence of the benefits of new agricultural technology both between large and small farmers and between developed and less developed countries.

3.137 Gold, B.; Pierce, W. S.; and Rosegger, G. "Diffusion of Major Technological Innovations in U.S. Iron and Steel Manufacturing." *Journal of Industrial Economics,* Vol. 18, No. 3, July 1970, pp. 218-242.

The authors analyze the diffusion of fourteen major technological innovations in the U.S. iron and steel industries. They present a conceptual model of the decision process to explain varying diffusion rates and differing elaborations of innovation by different firms.

3.138 Goodwin, L. B.; Blase, M. G.; and Colyer, D. "A Development Planning Model for Technological Change in Agriculture." *American Journal of Agricultural Economics,* Vol. 52, No. 1, February 1970, pp. 81-90.

The authors examine a model for coordinating activities and allocating resources in the development process. They provide insights into the sporadic nature of economic development.

3.139 Great Britain. *Automation and Its Implications.* Papers given at the Industry '65 Exhibition Conference on Productivity, Technology, and Change. London, British Productivity Council. 51 pp.

Presents five papers on automation and its social and monetary costs, followed by a panel discussion.

3.140 Heilbroner, Robert L. *Automation in the Perspective of Long-Term Technical Change.* Seminar on Manpower Policy and Program. U.S. Department of Labor, Manpower Administration, 1966. 38 pp.

Briefly reviews the history of technological change in the United States in terms of the problem of technological displacement.

3.141 Hirsch, Werner Z. "Technological Progress and Microeconomic Theory." *American Economic Review,* Vol. 59, No. 2, May 1969, pp. 36-43.

Discusses some economic problems posed by technologically progressive firms and proposes a theoretical model to solve these problems.

3.142 Hugh-Jones, E. M., ed. *Economics and Technical Change.* Oxford, Basil Blackwell, 1969. 178 pp.

A compendium of papers describing the impact and benefits of technical change, exploring economies of scale, and discussing organized labor's reaction to change.

3.143 Hunter, Maxwell W. "Are Technological Upheavals Inevitable?" *Harvard Business Review,* Vol. 47, No. 5, September-October 1969, pp. 73-83.

Holds that technological change has come in disruptive surges rather than in an even flow because of subconscious "suppression techniques" employed by managers and designers of new programs. Urges more flexible corporate planning.

3.144 International Conference on Technological Change and Human Development (Jerusalem, April 1969). *Technological Change and Human Development.* Ithaca, N.Y., New York State School of Industrial and Labor Relations, Cornell University, 1970. 388 pp.

Considers the effects of technological change on the quality of life. Explores methods of maximizing the economic gains while minimizing the social costs of technical progress.

3.145 International Congress of Human Relations. *The Social and Economic Impact of Automation and Technical Change.* Proceedings of Congress at Melbourne, Australia, May 1965. Melbourne, Federation Promotions, 1965. 138 pp.

A compendium of papers discussing the effect of automation on education, production, economic growth, and employment.

3.146 Irgens, O. M. "Increased Productivity Through Exchange of Experience." *Productivity Measurement Review,* No. 42, August 1965, pp. 70-81.

Reports on the success of two international technical cooperation groups in increasing productivity in the textile industry.

3.147 Isenson, Raymond S. "Technological Forecasting, A Management Tool." *Business Horizons,* Vol. 10, No. 2, Summer 1967, pp. 37-46.

Differentiates between two bases of the technological forecast. The first is application- or need-oriented. The second is potential-oriented. Concludes that "it is not necessary to forecast on the naive assumption that historical growth assures future growth."

3.148 Jantsch, Erich. *Technological Forecasting in Perspective.* Paris, Organization for Economic Cooperation and Development, 1967. 401 pp.

Surveys techniques and trends in technological forecasting.

3.149 Jehring, J. J., ed. *Productivity and Automation.* Madison, Center for Productivity Motivation, School of Commerce, University of Wisconsin, 1965. 110 pp.

Presents three essays discussing the concept of productivity, workers'-relation to automation, and the past and possible future paths of technological change.

3.150 Jehring, J. J., ed. *Productivity and Automation.* Bulletin 39. Washington, National Council for Social Studies, 1966. 180 pp.

Essays primarily addressed to social studies teachers and students, dealing with the study and measurement of productivity, the nature of work, worker-management relations, social aspects of technological change, and approaches to increasing productivity.

3.151 Kaldor, Nicholas. "The Choice of Technology in Less Developed Countries." *Monthly Labor Review,* Vol. 92, No. 8, August 1969, pp. 50-53.

Takes issue with certain common assumptions about the kinds of technology developing countries are capable of absorbing. Urges that techniques be adopted which yield the highest profit, but warns against the introduction of the most advanced kinds of capital goods and methods.

3.152 Kaneda, Hiromita. "Regional Patterns of Technical Change in U.S. Agriculture, 1950-1963." *Journal of Farm Economics,* Vol. 49, No. 1, February 1967, Part I, pp. 199-212.

Examines and updates earlier empirical studies measuring the regional patterns of technical change in U.S. agriculture. Presents a regression model which recognizes explicitly the relation between labor input and labor cost and is based on regression of labor productivity on the wage rate.

3.153 Kaneda, Hiromita. "Substitution of Labor and Nonlabor Inputs in Japanese Agriculture." *The Review of Economics and Statistics,* Vol. 47, No. 2, May 1965, pp. 163-171.

Measures the elasticity of substitution between labor and nonlabor inputs by the use of data including and excluding intermediate product inputs. The elasticities of substitution are estimated from a combination of cross-section and time-series data from Japanese agriculture. Develops indexes reflecting changes in production efficiency for farms with different scales of operation.

3.154 Knauerhase, R. "The Compound Steam Engine and Productivity: Changes in the German Merchant Marine Fleet – 1871-1887." *The Journal of Economic History,* Vol. 28, No. 3, September 1968, pp. 390-403.

Investigates the changes in total industry productivity which resulted from the adoption of the compound steam engine. Compares productivity improvements resulting from that adoption with improvements in sailing ship technology. Discusses resulting declines in ocean freight rates after 1870.

3.155 Kumar, Dharma. "Technical Change and Dualism Within Agriculture in India." *The Journal of Development Studies,* Vol. 7, No. 1, October 1970, pp. 50-59.

Examines the changes in income distribution when technical progress does not include subsistence farms but is confined to the commercial sector of agriculture.

3.156 Lancaster, Kelvin. "Change and Innovation in the Technology of Consumption." *American Economic Review,* Vol. 56, No. 2, May 1966, pp. 14-23.

Argues a theory of consumption along the lines of production theory, with consumer goods as the inputs and a set of satisfying "characteristics" as the output. Draws a parallel between the role of technology in increasing production and its role in increasing consumer satisfaction.

3.157 Lave, Lester B. *Technological Change: Its Conception and Measurement.* Englewood Cliffs, N.J., Prentice-Hall, 1966. 228 pp.

Reviews and explains alternate methods of measuring technological change.

3.158 Lovell, C. A. Knox. "Biased Technical Change and Factor Shares in United States Manufacturing." *Quarterly Review of Economics and Business,* Vol. 9, No. 3, Autumn 1969, pp. 17-33.

Examines the nature of technical change in 19 American industries during the postwar period, and the effects of technical change upon estimates of the elasticity of substitution and upon trends in relative factor shares.

3.159 Lydall, H. "On Measuring Technical Progress." *Australian Economic Papers,* Vol. 8, No. 12, June 1969, pp. 1-12.

Develops a method involving the use of index numbers of prices and wages to circumvent the difficulties in measuring technological progress and estimating capital stock.

3.160 Macut, John J. *Outlook for Numerical Control of Machine Tools,* BLS Bulletin 1437. U.S. Department of Labor, Bureau of Labor Statistics, March 1965. 63 pp.

Discusses new techniques of automatic machining in the metalworking industries and their implications for productivity, occupational requirements, and employment.

3.161 Macut, John J. "Prospects for Numerical Control of Machine Tools." *Monthly Labor Review,* Vol. 88, No. 4, April 1965, pp. 403-406.

Reports on the present and potential use of automated machining of metal parts and implications for productivity, employment, and occupational requirements.

3.162 Mansfield, Edwin. *The Economics of Technological Change.* New York, W. W. Norton, 1968. 257 pp.

Investigates basic problems relating to technological change, such as what motivates it, how it is measured, where inventions originate, and what the lag is between technological invention and its introduction.

3.163 Marsden, Keith. "Progressive Technologies for Developing Countries." *International Labour Review,* Vol. 101, No. 5, May 1970, pp. 475-502.

Argues that technology transferred from highly industrialized states is not always appropriate for developing states. Suggests criteria for choosing technologies which will make optimal use of given resources.

3.164 Markuson, Barbara Evans. *Libraries and Automation.* Proceedings of the Conference on Libraries and Automation held at Airlie Foundation, Warrenton, Virginia, May 26-30, under sponsorship of the Library of Congress, National Science Foundation, and Council on Library Resources. Washington, Library of Congress, 1964. 268 pp.

Presents essays intended to acquaint librarians with the technology of library mechanization and its problems. The essays cover the design requirements for a future library; file organization and conversion; file storage and access; graphic storage; library communications networks; the automation of library systems; and related subjects.

3.165 McCloskey, S. N. "The British Iron and Steel Industry, 1870-1914: A Study of the Climacteric in Productivity." *The Journal of Economic History,* Vol. 29, No. 1, March 1969, pp. 173-175.

Argues that the exhaustion of technological possibilities explains most of the retardation in British iron and steel productivity growth before 1914.

3.166 Melman, Seymour. *Our Depleted Society.* New York, Holt, Rinehart and Winston, 1965. 366 pp.

A critical view of the impact of the cold war on the U.S. economy, particularly in science and technology and the productivity of industry.

3.167 Melvin, J. R. "Intermediate Goods and Technological Change." *Economica N.S.,* Vol. 36, No. 144, November 1969, pp. 400-408.

Presents a diagrammatic analysis of the effects of technological change in an intermediate-input model. Shows that a technological change which substitutes the intermediate good for labor need not change prices or output. Such change could in fact result in less output for both intermediate and final goods. Thus, concentration on how technological change affects only primary factors may give misleading results if the new processes use more intermediate inputs.

3.168 Merhaw, Meir. *Technological Dependence, Monopoly, and Growth.* New York, Pergamon Press, 1969. 204 pp.

Argues that the importation of advanced technologies into a developing economy which does not have the markets for the volume of goods these techniques produce will lead to monopolistic business structures, which will in turn lead to a premature halt in the nation's economic growth.

3.169 Mishan, E. J. *Technology and Growth: The Price We Pay.* New York, Praeger, 1970. 193 pp.

Discusses the social and environmental costs of the increasing rate of technological change. Finds these costs excessive.

3.170 Morse, Dean, and Warner, Aaron W., eds. *Technological Innovation and Society.* New York, Columbia University Press, 1966. 214 pp.

The authors present a series of discussions on the transformation of scientific knowledge into technological innovation, and on the social and political implications of technological change.

3.171 Nelson, Richard R. *The "Technology Gap" and National Science Policy.* Center Discussion Paper. Mimeographed. New Haven, Economic Growth Center, Yale University, May 1970. 25 pp.

Argues that there has been a "technological gap" between the United States and Europe for more than 100 years, and that gearing science and technology policy toward either maintaining or eliminating the gap yields suboptimal results.

3.172 Nelson, Richard R.; Peck, Merton J.; and Kalachek, Edward D. *Technology, Economic Growth and Public Policy.* Washington, The Brookings Institution, 1967. 238 pp.

The authors interpret recent findings on the relationship between research and development and productivity; the allocation of resources to advances in technology; and the rate of absorption of new technologies in the economy. They develop an "operational" concept of technological knowledge. They also deal with the ways the economy adjusts to technological change and with pertinent public policies.

3.173 Nordhaus, William D. "An Economic Theory of Technological Change." *American Economic Review,* Vol. 59, No. 2, May 1969, pp. 18-28.

Constructs an econometric model of the process of invention to sort out sources of productivity change, in an effort to explain why growth in input does not explain most of the growth in output.

3.174 O'Carroll, Lloyd T. "Technology and Manpower in Nonelectrical Machinery." *Monthly Labor Review,* Vol. 94, No. 6, June 1971, pp. 56-62.

Describes innovations being introduced in the industry and their impact on productivity, employment, and skill requirements.

3.175 Olken, Hyman. "Technological Growth and the Evolution of New Industry." *Economic and Business Bulletin,* Vol. 22, No. 1, Fall 1969, pp. 15-24.

Criticizes present methods of predicting technological changes. Discusses laws of the "biology" of industries making intensive use of new technology. Knowledge of these "laws" makes prediction of upcoming technological breakthroughs possible.

3.176 Organization for Economic Cooperation and Development. *Gaps in Technology.* Set of six studies. Paris, OECD.
Electronic Components, 1968. 190 pp.
Scientific Instruments, 1968. 178 pp.
Electronic Computers, 1969. 209 pp.
Pharmaceuticals, 1969. 149 pp.
Plastics, 1969. 162 pp.
Non-Ferrous Metals, 1969. 202 pp.

The reports examine in detail the production process and market situation of the given industry in OECD member countries. They discuss international differences in growth and technological development, and explore reasons for these differences.

3.177 Organization for Economic Cooperation and Development. *Gaps in Technology: Analytical Report.* Comparisons Between Member Countries in Education, Research and Development, Technological Innovation, International Economic Exchanges. Paris, OECD, 1970. 300 pp.

Examines the nature and extent of differences in scientific and technological potential among OECD member countries, and their effect on the attainment of economic and other objectives. Recommends policies insuring that the potentials of all member countries will be increased and be most effectively utilized.

3.178 Organization for Economic Cooperation and Development. *Gaps in Technology: General Report.* Paris, OECD, 1968. 42 pp.

Summarizes the results of OECD studies on differences in innovation and technological potential among OECD member countries. Offers several interpretations of these results and outlines national and international policies to improve performance.

3.179 Pack, Howard, and Todaro, Michael. *Technological Transfer, Labor Absorption, and Economic Development.*

Center Discussion Paper No. 65. Mimeographed. New Haven, Economic Growth Center, Yale University, May 1969. 14 pp.

The authors urge that developing countries maintain their own capital goods industries so that they will not be forced to employ increasingly labor-saving technology in a labor-abundant economy because of new or used capital goods available from developed economies.

3.180 Phillips, Almarin. *Technology and Market Structure: A Study of the Aircraft Industry.* Lexington, Mass., Heath Lexington Books, 1971. 233 pp.

Examines the impact of changes in industrial technology on market structure for the period 1932-1965.

3.181 Porter, R. C. "Technological Change with Unlimited Supplies of Labor." *Manchester School of Economic and Social Studies,* Vol. 36, No. 1, March 1968, pp. 69-74.

Examines some implications of the Lewis model of technological change. Shows that under certain conditions, technological progress may depress rather than raise the relative share of profits in an economy with "unlimited supplies" of labor.

3.182 Quinn, James B. "Technological Competition: Europe vs. U.S." *Harvard Business Review,* Vol. 44, No. 4, July-August 1966, pp. 113-130.

Finds that the United States has a large technological advantage over Western Europe. Believes that this lead could be dissipated by a concerted technological effort in Europe and by U.S. failure to direct more resources into meaningful research.

3.183 Quinn, James B. "Technological Forecasting." *Harvard Business Review,* Vol. 45, No. 2, March-April 1967, pp. 89-106.

Discusses methods of technological forecasting, its purposes, limitations, and data requirements. Suggests ways to integrate this type of forecasting into the business decision-making process.

3.184 Rosenberg, Nathan, ed. *The Economics of Technological Change. Selected Readings.* Baltimore, Penguin Books Inc., 1971. 509 pp.

A collection of essays on the process, determinants, long-term consequences, and international aspects of technological change, and the diffusion of new technology. Among authors included are Schumpeter, Usher, Blaug, Nelson, Griliches, Fellner, Mansfield, Abramovitz, Solow, Denison, and Vernon.

3.185 Rosenbloom, Richard S., and Wolek, Francis W. *Technology and Information Transfer.* Boston, Graduate School of Business Administration, Harvard University, 1970. 174 pp.

The authors discuss the flow of technical information across organizational lines in large firms.

3.186 Salter, W. E. G. *Productivity and Technical Change.* With an addendum by W. B. Reddaway. Second edition. University of Cambridge Department of Applied Economics Monograph. Cambridge, England, and New York. Cambridge University Press, 1969. (Paper edition of 1966 edition.)

A theoretical and empirical analysis of technical change in the United States and Britain before and after World War II.

3.187 Scott, J. T., Jr., and Reiss, F. J. "Changing Technology and Lease Adjustment: Theory and Practice." *Land Economics,* Vol. 45, No. 4, November 1969, pp. 400-405.

The authors show how technological changes in agriculture frequently change relative returns to landowners and farm tenants. They suggest new allocation of

inputs and profits after the new technologies have been introduced.

3.188 Scrupski, Stephen E. "Special Report: Automation for Survival and Profit." *Electronics,* Vol. 44, No. 22, October 25, 1971, pp. 62-73.

Argues that the electronics industry, although essential to the computerized and automated technologies of other industries, has itself lagged in adopting automation, partly owing to lack of standardization. Suggests ways by which the industry can overcome this problem.

3.189 Spencer, Daniel L., and Woroniak, Alexander, eds. *The Transfer of Technology to Developing Countries.* Papers and Proceedings of a Conference Held at Airlie House, Warrenton, Virginia, April 1966. U.S. Department of Commerce, National Bureau of Standards, December 1966. 260 pp.

Participants discuss how technological know-how can effectively be imparted to developing countries, with particular attention to the role of the military.

3.190 Steiner, George A. "Improving the Transfer of Government-Sponsored Technology." *Business Horizons,* Vol. 9, No. 3, Fall 1966, pp. 55-62.

Discusses some of the problems involved in the adoption of scientific knowledge by businessmen for new processes and products. Suggests the establishment of a government commission to aid in the transfer and use of this knowledge.

3.191 Strassman, W. Paul. *Technological Change and Economic Development.* Ithaca, N.Y., Cornell University Press, 1968. 353 pp.

Considers the determinants of technological change in manufacturing during early industrialization. Deals with access to foreign technical knowledge, the supply and quality of management, labor, and capital, and the receptiveness of society. Examines the experiences of Mexico and Puerto Rico in particular.

3.192 Sturm, Herman M. "Technological Developments and Their Effects Upon Health Manpower." *Monthly Labor Review,* Vol. 90, No. 1, January 1967, pp. 1-8.

Reporting on a study sponsored by the Department of Labor, the author describes the rapid technological changes that are affecting health services and attendant manpower needs. Also discusses trends in productivity and presents estimates of employment by occupation to 1975.

3.193 Sturm, Herman M. *Technology and Manpower in the Health Service Industry, 1965-75.* Manpower Research Bulletin No. 14. U.S. Department of Labor, Manpower Administration, May 1967. 109 pp.

Presents and analyzes trends in the structure and characteristics of health service employment; technological developments likely to have an impact on manpower over the period under study; and effects of the expected trends on the demand for health services.

3.194 Sultan, Paul, and Prasow, Paul. "Technology and Talent." *Western Economic Journal,* Vol. 3, No. 3, Summer 1965, pp. 247-273.

The authors use the marginal productivity framework to explore the probable changes in the types and amount of labor demanded because of technical change. They foresee a quickening rate of automation, accentuated by management mistrust of labor and foreign competition. They consider the barriers to successful manpower programs to be substantial.

3.195 Fellner, W. "Trends in the Activities Generating Technological Progress."

American Economic Review, Vol. 60, No. 1, March 1970, pp. 1-29.

Discusses average and marginal social rates of return of progress-generating inputs.

3.196 The Atlantic Institute. *Technology Gap: U.S. and Europe.* New York, Praeger, 1970. 158 pp.

Contains two papers and discussions concerning the extent of any "technological gap" that might exist, the causes of such a gap, and the methods by which it might best be closed.

3.197 "The Diffusion of New Technology: A Study of Ten Processes in Nine Industries." *National Institute Economic Review,* No. 48, May 1969, pp. 40-83.

Examines the introduction of several new technologies in an attempt to discover the factors governing the time required for a new invention to be applied internationally.

3.198 Thompson, F. M. L. "The Second Agricultural Revolution, 1815-1880." *Economic History Review,* Second Series, Vol. 21, No. 1, April 1968, pp. 62-77.

Suggests that technical and economic trends in agriculture between 1815 and 1880 differed fundamentally from trends in previous periods. Argues that the period under review is characterized by the growth of purchased inputs, rather than inputs produced on the farm. Examines implications for commercial and financial operations.

3.199 United Nations Economic Commission for Europe. *Economic Aspects of Automation.* New York, United Nations, 1971. 60 pp.

Reviews the scope of automation and discusses the economic conditions which permit or are required for its development and the economic effects that may result from it.

3.200 United Nations Economic Commission for Europe. *Mechanization and Automation in Coking Plants.* New York, United Nations, 1967. 41 pp.

Surveys methods of processing coal in Europe and the United States. Briefly discusses the cost of mechanization and its effect on workers' safety.

3.201 United Nations Economic Commission For Europe. *Policies and Means of Promoting Technical Progress.* Papers presented to the Fifth Meeting of Senior Economic Advisors to ECE Governments. New York, United Nations, 1968. 159 pp.

Reviews the difficulties in formulating policies on technological change, and reports on some of the programs which have been pursued. Presents case studies of the policies of several countries.

3.202 United Nations Economic Commission for Europe. *Symposium on the Automation of Mining Operations.* (Hombourg, France, April 1970.) New York, United Nations, 1970. 285 pp.

A collection of papers detailing the innovations which have been introduced at various locations and stages of development of mining.

3.203 United Nations Educational, Scientific and Cultural Organization. *Conference on the Application of Science and Technology to the Development of Asia.* Final Reports (two volumes). Paris, UNESCO, June 1969.

Volume I contains the conclusions and recommendations arising from the conference. Volume II contains five messages directed to the conference.

3.204 United Nations Educational, Scientific and Cultural Organization. *Science and Technology in Asian Development.*

Conference on the Application of Science and Technology to the Development of Asia (New Delhi, August 1968). Paris, UNESCO, 1970. 216 pp.

Presents reports on technology in individual Asian countries. Investigates the conditions necessary for a more intensive application of science and technology, finding adequate science education to be the most crucial requirement. Presents a mathematical model for planning the supply of professional and technical manpower and for research and development spending.

3.205 United Nations Educational, Scientific and Cultural Organization. *World Summary of Statistics on Science and Technology.* Paris, UNESCO, 1970. 66 pp.

Summary of statistics on scientific manpower, research and development expenditures, graduates in science and technology, etc.

3.206 United Nations Industrial Development Organization. *Technological Developments in Lead and Zinc Production and Their Significance to Developing Countries.* Report of the Expert Group Meeting on Lead and Zinc Industries. New York, United Nations, 1970. 85 pp.

Reviews recent technological developments in light of their possible application in developing nations. Provides recommendations for both developing and developed countries.

3.207 U.S. Department of Labor, Bureau of Labor Statistics. *Technological Trends in Major American Industries,* BLS Bulletin 1474, 1966. 269 pp.

Appraises major technological changes and their effects on manpower requirements in individual American industries.

3.208 U.S. National Science Foundation. *Technology Transfer and Innovation.* Proceedings of a Conference held in Washington, D.C., May 1966, U.S. Government Printing Office, 1966. 126 pp.

Discusses factors which promote or impede the application of scientific and technological findings resulting from the defense and space programs.

3.209 Vatter, H. G., and Will, R. E. "Technology and the New Philosophy of Poverty." *Southern Economic Journal,* Vol. 33, No. 4, April 1966, pp. 559-571.

The authors argue that technological advance has made private investment and saving less important and consumption more important, providing the foundation for a new philosophy of poverty. The traditional philosophy was appropriate to a capital-hungry society, whose goal was to minimize consumption and maximize investment, saving, and growth. But technological advance causes ever more capacity to be created, permitting community preferences to shift towards higher ratios of consumption to total output. In a capital-rich economy with high per capita income, poverty becomes dysfunctional.

3.210 Vernon, Raymond, ed. *The Technology Factor in International Trade.* New York, National Bureau of Economic Research, 1970. 493 pp.

A collection of papers on theoretical problems of incorporating the effect of technology in international trade theory.

3.211 Vilenskii, M. "On the Economic Management of Scientific and Technological Progress." *Problems of Economics,* Vol. 13, No. 12, April 1971, pp. 3-24.

Argues that the planning of technological progress must be dovetailed with the national economic plan of the Soviet Union. Indicates how this could be done.

3.212 Walton, Gary M. "Productivity Change in Ocean Shipping After 1870: A Comment." *The Journal of Economic History,* Vol. 30, No. 2, June 1970, pp. 435-442.

Presents a methodological critique of an article by Knauerhase concerning the changes in productivity related to the adoption of steam ships and the decline of sailing vessels. (See entry 3.154.)

3.213 Warner, Aaron W. "Technology and the Labor Force in the Offshore Maritime Industry," in Industrial Relations Research Association, *Proceedings of the Eighteenth Annual Winter Meeting* (December 28-29, 1965), 1966, pp. 139-150.

Argues that since government subsidies are given only to ships on regularly scheduled routes, the "tramp" sector of the industry has declined sharply. Its equipment is outdated and out of repair. States that by 1985 automation will have reduced manpower requirements per ship to one half of 1945 requirements, but that this reduction is not actually likely to take place because of a lack of adequately trained personnel and resistance by unions.

3.214 Westfield, F.M. "Technical Progress and Returns to Scale." *The Review of Economics and Statistics,* Vol. 48, No. 4, November 1966, pp. 432-448.

Examines the relation between technical progress and returns to scale, using Kendrick-Kuznets data for the United States for 1917-1960 and 1890-1960, and applying special methods of nonlinear estimation to the data.

3.215 Weinberg, Edgar. *Mechanization and Automation of Building Site Work.* National Response Paper for the Economic Commission for Europe, Committee on Housing, Building and Planning. Third Seminar on the Building Industry, Moscow, October 1970. Mimeographed. U.S. Department of Labor, Bureau of Labor Statistics, 1970. 8 pp.

Discusses the economic setting of major trends in, and measures to facilitate, mechanization in the construction industry.

3.216 Wolfbein, Seymour L. "The Pace of Technological Change and the Factors Affecting It." in *Manpower Implications of Automation.* U.S. Department of Labor, Manpower Administration. 1965. pp. 15-28.

Discusses current directions of technological change, its likely future pace, and the factors which may speed or impede this pace.

3.217 Yeh, M. H., and Lin, Leon. "Technological Change in the Canadian Livestock Industry: An Input-Output Approach." *Canadian Journal of Agricultural Economics,* Vol. 17, No. 2, July 1969, pp. 63-84.

The authors analyze the rate of technological change in the beef industry and conclude that there was little improvement in efficiency between 1951 and 1961.

3.218 Yudelman, Montague; Banerji, Ranadev; and Butler, Gavan. "The Use of an Identity to Examine the Association Between Technological Changes and Aggregate Labour Utilization in Agriculture." *The Journal of Development Studies,* Vol. 7, No. 1, October 1970, pp. 37-49.

The authors examine the relationship between output per person in agricultural land under cultivation and average yield per acre in terms of Japanese, Taiwanese, and Mexican agricultural experience. They argue that governments should be more aware of how their policies influence the direction of technological change and of the possible implications of these changes on labor utilization.

3.219 Zeisel, Rose N. *Technology and Manpower in the Textile Industry of the 1970's,* BLS Bulletin 1578. U.S. Department of Labor, Bureau of Labor Statistics, August 1968. 79 pp.

Examines changes in technology; their impact on productivity, employment, and occupational requirements; and methods of adjustment.

3.220 Zeisel, Rose N. "Technology and Labor in the Textile Industry." *Monthly Labor Review,* Vol. 91, No. 2, February 1968, pp. 49-55.

Analyzes the general economic setting of, and major technological developments in, the textile industry as well as their impact on productivity, employment, and skill requirements. Also discusses industry provisions for adjustments to these changes.

D. Research and development

3.221 Adams, W. J. "Firm Size and Research Activity: France and the United States." *Quarterly Journal of Economics,* Vol. 84, No. 3, August 1970, pp. 386-409.

Compares the effect of firm size on innovation in the United States and France. Concludes that the large firm is not an essential ingredient of technological change.

3.222 Ahmad, Syed. "On the Theory of Induced Invention." *Economic Journal,* Vol. 76, No. 302, June 1966, pp. 344-357.

Discusses past contributions to the theory of induced invention, relating innovation to changes in relative factor prices. Provides an analytic basis for the concept.

3.223 Arrow, Kenneth J. "Classificatory Notes on the Production and Transmission of Technological Knowledge." *American Economic Review,* Vol. 59, No. 2, May 1969, pp. 29-34.

Discusses invention and innovation within the framework of uncertainty and communication theories. Argues that this approach yields more meaningful results than traditional economic approaches.

3.224 Arvidsson, G. "A Note on Optimal Allocation of Resources for R and D." *Swedish Journal of Economics,* Vol. 72, No. 3, September 1970, pp. 171-195.

Discusses mechanisms for optimal research and development and the possible lack of optimality in a private enterprise economy. Examines the case of optimality in a small country like Sweden with a considerable foreign trade in pharmaceuticals.

3.225 Becker, S. W., and Whistler, T. L. "The Innovative Organization: A Selective View of Current Theory and Research." *Journal of Business of the University of Chicago,* Vol. 40, No. 4, October 1967, pp. 462-469.

The authors review the status of theory on the subject of innovation. They distinguish between organizations which innovate and are the first to use new methods and organizations which are more cautious and tend to adapt to the innovations of others.

3.226 Brown, R. H. "The Achievement Norm and Economic Growth: The Case of Elizabethan England." *Review of Social Economics,* Vol. 27, No. 2, September 1969, pp. 181-201.

Bases his argument on the need for a stratum of innovative businessmen to propel economic growth. Explores the values of Elizabethan England in terms of sociology, literature, education, child socialization, etc. Argues that an "achievement norm" developed about a generation before economic growth accelerated, and was causally related to it.

3.227 Carroll, Jean. "A Note on Departmental Autonomy and Innovation in Medical Schools." *Journal of Business,* Vol. 40, No. 4, October 1967, pp. 531-534.

Compares the process of innovation in medical schools with that described by March and Simon for Federal Government departments, where innovations are passed on from the top.

3.228 Coleman, D. C. "An Innovation and its Diffusion: The 'New Draperies'." *Economic History Review,* Vol. 22, No. 3, December 1969, pp. 417-429.

Illustrates the difficulties of incorporating the emergence of new products in econometric models by tracing the innovation, diffusion, and growth in use of new draperies, a product of the West European textile industry in the 16th and 17th centuries. Finds that a search for cost reduction or factor substitution in the industry was of secondary importance, that diffusion of new techniques was dependent on such non-economic factors as overseas migration induced by religious persecution, and that national market economies are inappropriate entities within which to investigate innovations and their diffusion.

3.229 Comanor, William S. "Research and Technical Change in the Pharmaceutical Industry." *The Review of Economics and Statistics,* Vol. 47, No. 2, May 1965, pp. 182-190.

Investigates the relationship between research and development and the rate of new product introduction in the pharmaceutical industry.

3.230 Cooper, Joseph D., ed. *The Economics of Drug Innovation.* Proceedings of the first seminar on economics of pharmaceutical innovations, April 27-29, 1969. Washington, The American University, Center for the Study of Private Enterprise, School of Business Administration, 1970. 285 pp.

A collection of essays on the sources of innovation in the drug industry, modern drug research, costs and returns of innovation, patents, constraints, and related subjects. Discussion by seminar participants is included.

3.231 Davis, Vincent. *The Politics of Innovation: Patterns in Navy Cases.* The Social Science Foundation and Graduate School of International Studies Monograph Series in World Affairs, Vol. 4, Monograph No. 3. Denver, University of Denver, 1967. 69 pp.

Examines the process of weapons system innovation in the Navy in terms of the behavioral sciences. Focusses on weapons systems adaptation to nuclear deterrence strategies and competition with the Air Force.

3.232 Evan, William M., and Black, Guy. "Innovation in Business Organizations: Some Factors Associated with Success or Failure of Staff Proposals." *Journal of Business,* Vol. 40, No. 4, October 1967, pp. 519-530.

The authors analyze factors affecting the success of proposals for innovation submitted to line management by staff specialists.

3.233 Feller, Irwin. "The Urban Location of United States Invention; 1860-1910." *Exploration of Economic History,* Vol. 8, No. 3, Spring 1971, pp. 285-303.

Presents data for 35 of the largest and most industrialized U.S. cities from 1860 to 1910 in an effort to relate their growth and population and employment characteristics to inventive activity.

3.234 Goldsmith, Maurice, ed. *Technological Innovation and the Economy.* A Science of Science Foundation Symposium on Technological Innovation and Growth of the Economy

(Churchill College, Cambridge, England, April 1969). New York, Wiley-Interscience, 1970. 292 pp.

Discusses the roles of government and of the educational system, and the attitudes of management and labor.

3.235 Griliches, Zvi. "Hybrid Corn and the Economics of Innovation," in *The Reinterpretation of American Economic History,* Robert W. Fogel and Stanley T. Engerman, eds. New York, Harper and Row, 1971. pp. 207-213.

Examines differences by area in the acceptance of hybrid corn. Notes the S-shaped pattern of diffusion, corresponding to that of technical change in general. Finds that adoption of hybrid corn depends mainly upon market factors.

3.236 Havelock, Ronald G., and associates. *Planning for Innovation Through Dissemination and Utilization of Knowledge.* Ann Arbor, Center for Research on Utilization of Scientific Knowledge, University of Michigan, July 1969. About 300 pp.

Provides a framework for evaluating the factors affecting innovation, dissemination, and utilization of knowledge. Reviews the literature on the subject.

3.237 Higgs, R. "American Inventiveness, 1870-1920." *Journal of Political Economy,* Vol. 79, No. 2, March-April 1971, pp. 661-667.

Extends the wealth maximization model of invention by taking account of costs of information and relating these costs to the urban-rural distribution of population. Concludes that the proportion of the population in urban areas and the number of inventions per capita were closely associated.

3.238 Hirshleifer, Jack. "The Private and Social Value of Information and the Reward to Inventive Activity." *American Economic Review,* Vol. 61, No. 4, September 1971, pp. 561-574.

Maintains that individuals believe that any information they can discover may be useful for speculative or resale purposes, and therefore they tend to overinvest in inventive activity, rather than underinvest, as most commentators have assumed.

3.239 Johnston, R. E. "Technical Progress and Innovation." *Oxford Economic Papers N.S.,* Vol. 18, No. 2, July 1966, pp. 158-176.

Examines the factors which affect innovation and its diffusion. These factors include research and development activity, purchase of knowledge, economic and market structures, and availability of financing. Discusses the methods used in assessing the relative importance of innovations in terms of productivity, cost reductions, profits and sales, and patents.

3.240 Kamien, M. I., and Schwartz, N. "Market Structure, Elasticity of Demand and Incentive to Invent." *Journal of Law and Economics,* Vol. 13, No. 1, April 1970, pp. 241-252.

Argues that between industries of like structure, the industry with the greater demand elasticity has the greater invention incentive, and that monopoly provides a greater incentive to invent than a competitive industrial structure.

3.241 Kleiman, Herbert S. "A Case Study of Innovation." *Business Horizons,* Vol. 9, No. 4, Winter 1966, pp. 63-70.

Discusses the development of the integrated circuit, illustrating government and industry roles in innovation.

3.242 Knight, Kenneth E. "A Descriptive Model of the Intra-Firm Innovation Process." *Journal of Business,* Vol. 40, No. 4, October 1967, pp. 478-496.

Discusses the process of innovation in terms of psychological, sociological, economic, and historical perspectives. Shows that innovation tends to be the product of small contributions by many individuals.

3.243 Leonard, William N. "Research and Development in Industrial Growth." *Journal of Political Economy,* Vol. 79, No. 2, March-April 1971, pp. 232-256.

Finds that research intensity, measured by company R and D spending, relates significantly to growth rates in sales, assets, and net income in 16 industries. Results begin to appear two years after initial spending. Research intensity as measured by manpower ratios is less related to growth. Also finds that excessive allocation to defense and space R and D slows industrial growth.

3.244 Mansfield, Edwin. *Industrial Research and Technological Innovation: An Econometric Analysis.* New York, W. W. Norton, 1968. 235 pp.

Presents brief conclusions on such topics as the determination of the rate of technological change, the amount of research and development going on in the United States, the determinants of industrial research and development expenditures, and the relationship between such expenditures and innovation.

3.245 Mansfield, Edwin. "Innovation and Technical Change in the Railroad Industry," in *Transportation Economics,* John R. Meyer, ed. New York, National Bureau of Economic Research, 1965. pp. 169-198.

Discusses trends in labor and total factor productivity, shifts in the production function, distribution of inventions over time, the role of the largest railroads in introducing new techniques and their adoption by other companies, and the most promising technologies likely to develop in the future and their effects on employment.

3.246 McAdams, A. K. "Big Steel, Invention, and Innovation Reconsidered." *Quarterly Journal of Economics,* Vol. 81, No. 3, August 1967. pp. 457-474.

Argues that, contrary to assertions by some researchers, the U.S. steel industry did not lag behind industry of other countries in installing the oxygen converter process. Shows that all of the innovators – in Japan and Austria, as well as in the United States – met Schumpeter's criteria that large firms with substantial market power have comparatively great incentives, in addition to ample resources, for research and innovation. Details a number of economic and technological factors which complicate the decision to introduce new technology at one stage in an integrated plant.

3.247 Metcalfe, J. S. "Diffusion of Innovation in the Lancashire Textile Industry." *Manchester School of Economic and Social Studies,* Vol. 38, No. 2, June 1970, pp. 145-159.

Investigates the diffusion of three cost-saving innovations in the weaving sector of the Lancashire textile industry. Finds that innovations which are similar in their economic and technical aspects are diffused in a similar manner.

3.248 Minasian, Jora R. "Research and Development, Production Functions, and Rates of Return." *American Economic Review,* Vol. 59, No. 2, May 1969, pp. 80-85.

Estimates a Cobb-Douglas production function for 17 chemical firms with technology dependent on R & D expenditures. Estimates separate rates of return on R & D expenditures and capital.

3.249 Mueller, Dennis C. *Patents, Research and Development, and the Measurement of Inventive Activity.* Reprint No. 129.

Washington, The Brookings Institution, 1967. 11 pp.

Presents estimates of correlation between research and development expenditures, R&D employment, etc., as inputs, and the number of patents as outputs, in an attempt to measure inventive activity. Finds the correlation to be high.

3.250 Myers, Sumner, and Marquis, Donald B. *Successful Industrial Innovations.* Washington, National Science Foundation, 1969. 117 pp.

The authors examine innovations in five industries, as well as the processes which led to commercial success.

3.251 Nelkin, Dorothy. *The Politics of Housing Innovation.* Ithaca, N.Y., Cornell University Press, 1971, 124 pp.

Examines critically the "important but finally abortive" Civilian Industrial Technology Program, instituted in the early sixties to foster innovation in "lagging" industries such as housing and textiles. Highlights the problems involved in attempts to restructure Federal research and development policy to respond to social needs.

3.252 Nordhaus, William D. *Invention, Growth and Welfare: A Theoretical Treatment of Technological Change.* Cambridge, Mass., MIT Press, 1969. 168 pp.

Discusses the problem of the inventive process at the firm level. Considers the problems of invention in an economy-wide, general equilibrium framework.

3.253 Organization for Economic Cooperation and Development. *Government and Technical Innovation.* Paris, OECD, 1966. 60 pp.

Foresees governments becoming increasingly involved in the innovative process as the pace of technological change quickens. Discusses how a government should stimulate innovation.

3.254 Organization for Economic Cooperation and Development. *Science, Growth and Society: A New Perspective.* Paris, OECD, 1971. 113 pp.

Reviews the strengths and weaknesses of national science policies in the 1960's, and explores the relationships between economic growth, technology, and society. Argues that society will demand more of technology in improving the quality of life as well as products and production processes in the 1970's.

3.255 Organization for Economic Cooperation and Development. *The Conditions for Success in Technological Innovation.* Paris, OECD, 1971. 169 pp.

Examines the roles of government, private industry, and the university in technological change. Concludes that the most important factors encouraging successful change are assurance of reward, competition among industries, labor mobility, and manpower planning.

3.256 Rudelius, W., and Wood, G. L. "Life Insurance and Product Innovations." *Journal of Risk and Insurance,* Vol. 37, No. 2, June 1970, pp. 185-190.

The authors analyze six important life insurance innovations. Larger rather than smaller, and mutual rather than stock firms accepted innovation first. A firm that was an early adopter of one innovation was found to be an early adopter of another. There was no apparent relation between growth of sales and rapid adoption of innovation.

3.257 Ruff, L. E. "Research and Technological Progress in a Cournot Economy." *Journal of Economic Theory,* Vol. 1, No. 4, December 1969, pp. 397-415.

Applies techniques of optimal control theory to investigate the relations between the number of firms, the degree to which technological knowledge is a "public good," and the institutional structure of the economy. The effect of

these relations on the rate of aggregate technological progress in an economy of independent producing-researching firms is examined.

3.258 Rumiantsev, A. "Problems of Scientific and Technological Progress." *Problems of Economics,* Vol. 13, No. 12, April 1971, pp. 25-45.

Explores the problems of measuring the contribution of research and development to an economy in the Russian context.

3.259 Samuelson, Paul A. "A Theory of Induced Innovation Along Kennedy-Weizsaecker Lines." *The Review of Economics and Statistics,* Vol. 47, No. 4, November 1965, pp. 343-356.

Explores the notion, common among economists, that innovation has a labor-saving bias. Argues that, if it can be assumed that there is a tradeoff between innovational reductions in labor versus capital input requirements, long-run equilibrium in constant relative shares will exist.

3.260 Sapolsky, Harvey M. "Organizational Structure and Innovation." *The Journal of Business of The University of Chicago,* Vol. 40, No. 4, October 1967, pp. 497-510.

By means of an illustrative study of department stores the author discusses problems of structuring an organization which will maximize utilization of innovations. Decentralized organization facilitates innovation, yet putting innovations into effect requires more centralization. There is conflict between the search for and the adoption of innovation.

3.261 Schmookler, Jacob. *Invention and Economic Growth.* Cambridge, Mass., Harvard University Press, 1966. 328 pp.

Examines the causes of fluctuations in the number of inventions over time and at a moment in time between industries. Analyzes the effects of economic growth on technology by focusing on inventions.

3.262 Schon, Donald A. *Technology and Change: The New Heraclitus.* New York, Pergamon Press, 1967. 248 pp.

Discusses technological change in terms of the process of invention, the patterns and effects of innovation in industry, and the consequences of technological change for social objectives.

3.263 Shanks, Michael. *The Innovators: The Economics of Technology.* Baltimore, Penguin Books, 1967. 294 pp.

Explores social and economic factors which determine the pace of the application of scientific knowledge in industry.

3.264 Shell, Karl. "Towards a Theory of Inventive Activity and Capital Accumulation." *American Economic Review,* Vol. 56, No. 2, May 1966, pp. 62-68.

Argues that the rate of technical change may be estimated on the basis of the amount of economic resources devoted to inventive activity.

3.265 Shepard, Herbert A. "Innovation-Resisting and Innovation-Producing Organizations." *Journal of Business,* Vol. 40, No. 4, October 1967, pp. 470-477.

Discusses organizations in terms of ability to innovate and resistance to innovation. Stresses need for restructuring organizations to accept or generate innovations.

3.266 U.S. Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development. *Selected Readings on Science, Technology, and the Economy.* Compiled by the Economics Division and the Science Policy Research Division, Congressional Research Service, Library of

Congress. Washington, U.S. Government Printing Office, 1971. 95 pp.

A compilation of comments on the relation between science, technology, and the economy.

3.267 U.S. National Science Foundation, Division of Science Resources and Policy Studies. *A Review of the Relationship between Research and Development and Economic Growth/Productivity.* Washington, D.C., February 1971. 76 pp.

A collection of papers focussing on the effects of R&D on economic growth and productivity.

3.268 Verma, P. "Patents in British Industry." *Yorkshire Bulletin of Economic and Social Research,* Vol. 21, No. 2, November 1969, pp. 114-118.

Explains the relationship between productivity and technological change in British manufacturing industries over the period 1954-61. Uses the trend in patents as an indicator of technological change.

3.269 Williams, Bruce R. *Technology, Investment and Growth.* London, Chapman and Hall, Ltd., 1967. 206 pp.

A collection of the author's essays dealing with the "technology gap," the process of innovation, the relation between research and development and economic growth, and related topics.

3.270 Wilson, Andrew H. *Science, Technology and Innovation.* Special Study No. 8. Ottawa, Economic Council of Canada, 1968. 139 pp.

Presents a short history of the growth of science and technology. Discusses the process of innovation. Seeks to identify pertinent factors related to Canada's future development.

3.271 Wu, Yuan-li, and Sheeks, Robert B. *The Organization and Support of Scientific Research and Development in Mainland China.* New York, Praeger, 1970. 592 pp.

The authors assemble the available facts on organization and support of science and make some observations on the methods by which the Chinese have acquired and used new knowledge.

IV. Productivity, prices, and costs

4.001 Anton, Frank R. *Wages and Productivity: The New Equation.* Toronto, The Capp Clark Publishing Company, 1969. 152 pp.

Explains the theories of wage determination in layman's terms. Discusses the implications of, and alternatives to, an incomes policy for Canada.

4.002 Argy, V. "International Comparisons of Rates of Change in Earnings." *Oxford Economic Papers,* Vol. 20, No. 3, July 1968, pp. 221-232.

Explains intercountry differences in rates of change in earnings in terms of two variables: differential unemployment rates and productivity growth rates.

4.003 Barnes, Irston R. "Do Productivity Gains Warrant Wage Increases?" *The Conference Board Record,* Vol. 8, No. 11, November 1971, pp. 39-42.

Holds that productivity gains should be distributed through lower prices rather than higher wages, and that higher wages necessarily lead to inflation.

4.004 Beller, Irving. "Unit Labor Costs and the Worker's Share." *The American Federationist,* Vol.72, No. 12, December 1965, pp. 8-12.

Argues that unit labor costs in manufacturing have declined significantly in recent years because increases in wages, salaries, and fringe benefits have been lagging behind productivity. Sees a trend toward economic stagnation if a disproportionate share of income continues to go to those who save and invest.

4.005 Beller, Irving. "A Social Role for Productivity." *The American Federationist,* Vol. 74, No. 5, May 1967, pp. 6-13.

Explains the meaning and importance of productivity and reviews the productivity record of American workers. Argues that management is unjustly reaping the benefits of labor's improved productivity.

4.006 Blakeman, L. T. "Incomes, Productivity, and Planning." *Long Range Planning,* Vol. 1, No. 4, June 1969, pp. 10-13.

Describes industrial relations planning at Ford of England and explains how the company attempts to formulate a wage program which is equitable and which encourages productivity gains.

4.007 Bliss, Charles A. "Flaw in the Wage-Price Guideposts." *Harvard Business Review,* Vol. 44, No. 3, May/June 1966, pp. 73-78.

Argues that using a measure of "physical" productivity in a "financial" context results in confusing gross and net productivity.

4.008 Bloom, Gordon F. "Productivity: Weak Link in Our Economy." *Harvard Business Review,* Vol. 49, No. 1, January-February 1971, pp. 4-14.

Maintains that productivity must rise as fast as capital and labor costs to prevent inflation.

4.009 Bodkin, Ronald G. *The Wage-Price-Productivity Nexus.* Philadelphia, University of Pennsylvania Press, 1966. 302 pp.

Analyzes econometrically the relationship between wages and prices in the American economy, 1900-1957, in an attempt to determine the compatibility of full employment and price stability as national economic goals.

4.010 Bottomley, A., and Nudds, D. "Factor Pricing with 'Unlimited' Supplies of Labor." *Manchester School of Economic and Social Studies,* Vol. 35, No. 3, September 1967, pp. 277-284.

Finds that the price of labor will rise with increasing demand for it, even though an "unlimited" number of persons would still be willing to work at the subsistence wage, because of differences in labor productivity.

4.011 Brand, Horst. "Labor Costs: Major Sources of Recent Pressures." *The Conference Board Statistical Bulletin,* Vol. 2, No. 1, January 1969, pp. 2-5.

Analyzes the relationship between labor costs and output per man-hour during the sixties.

4.012 Bronfenbrenner, Martin. "A Guidepost Mortem." *Industrial Labor Relations Review,* Vol. 20, No. 4, July 1967. pp. 637-649.

Refutes the position of the Chicago School that macroeconomic policy, if administered sensibly, can eliminate any need for wage-price guideposts. Suggests changes in guideposts.

4.013 Canadian Labor Congress. *Labor Costs in Canada.* Ottawa, Canadian Labor Congress, February 1966. 40pp.

This pamphlet presents organized labor's point of view, reviews recent trends in labor costs, and discusses the relationships between wages, productivity, profits, and prices.

4.014 Chandler, John H., and Jackman, Patrick C. *Unit Labor Costs in Manufacturing: Trends in Nine Countries, 1950-65,* BLS Bulletin 1518. U.S. Department of Labor, Bureau of Labor Statistics, 1966. 34 pp.

The authors present and discuss indexes of unit labor costs, hourly compensation, output per man-hour, and related statistics for the United States, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, and the United Kingdom.

4.015 Chandler, John H., and Jackman, Patrick C. "Unit Labor Cost in Nine Countries: Cost Trends in Nine Industrial Nations." *Monthly Labor Review,* Vol. 88, No. 9, September 1965, pp. 1064-1068.

The authors discuss long-term trends in comparative labor costs and in the components of cost ratios.

4.016 Close, Guy C., Jr. *Work Improvement.* New York, John Wiley & Sons, Inc., 1960. 388 pp.

Discusses methodology and techniques used by business, industry, and service organizations to reduce costs and increase productivity.

4.017 Confederation of British Industry. *Productivity Bargaining.* London, Confederation of British Industry, May 1968. 17 pp.

Sets forth the CBI's view of productivity bargaining. Suggests guidelines for the optimal implementation of productivity bargaining.

4.018 Delagrave, Pierre M. "Wage Parity in Canada Not Possible Without Equal Increase in Productivity." *Canadian Vocational Journal,* Summer, 1967, Vol. 3, No. 1, pp. 4-14.

Holds that the Canadian wage structure cannot be raised to the level prevailing in the United States until parity in productivity has been achieved.

4.019 Douty, H. M. "Living Costs, Wages, and Wage Policy." *Monthly Labor Review,* Vol. 90, No. 6, June 1967, pp. 1-7.

Holds that wage policy in the United States represents an element in a strategy for price stability under conditions of high employment. The basic guidepost for wage adjustment is the trend of output per man-hour in the private sector.

4.020 Douty, H. M. "Productivity Bargaining in Britain." *Monthly Labor Review,* Vol. 91, No. 5, May 1968, pp. 1-6.

Discusses economic conditions in Britain leading to productivity agreements between labor and management. Explains these agreements as an exchange of higher wages for greater management control and new standards of work to insure more efficiency in production. Discusses relation to costs, prices, and devaluation.

4.021 Dunlop, John T. "Guideposts, Wages, and Collective Bargaining." *Monthly Labor Review,* Vol. 89, No. 6, June 1966, pp. 630-633.

Argues that a wide range of structural adaptations in government policies, in collective bargaining, and in other private decisions is needed to stabilize wages and prices at sustained high levels of employment.

4.022 Fox, Harland. "Comparing the Cost of Fringe Benefits." *The Conference Board Record,* Vol. 4, No. 5, May 1967, pp. 29-35.

Discusses the similarities and differences between Bureau of Labor Statistics and Chamber of Commerce definitions of fringe benefits.

4.023 Freeman, R. E. "Roles of Farm Productivity and Marketing Margins in Postwar Decline in Farm Prices." *Journal of Farm Economics,* Vol. 48, No. 1, February 1966, pp. 31-41.

Finds that changes in the farm prices of several food groups were associated negatively with changes in output per man-hour, and changes in marketing margins were not related to farm price changes.

4.024 Glejser, Herbert. "Inflation, Productivity and Relative Prices: A Statistical Study." *The Review of Economics and Statistics,* Vol. 47, No. 1, February 1965, pp. 76-80.

Investigates the influence on the magnitude of long-run relative price changes of inflation and increases in labor productivity. Formulates statistical models for intercountry comparisons of rates of increase in the consumption price level and in industrial productivity for each of 15 countries.

4.025 Great Britain, Department of Employment and Productivity. *Productivity, Prices, and Incomes Policy After 1969.* London, Her Majesty's Stationery Office, December 1969. 43 pp.

A White Paper reviewing past governmental efforts to stabilize and strengthen the economy. Discusses long-term growth and stabilization policies.

4.026 Great Britain, National Board for Prices and Incomes. *Productivity Agreements.* Report No. 36. London, Her Majesty's Stationery Office, 1967. 77 pp.

Discusses characteristics and effects of productivity bargaining in light of seven specific agreements.

4.027 Great Britain, National Board for Prices and Incomes. *Productivity and Pay During the Period of Severe Restraint.* Report No. 23. London, Her Majesty's Stationery Office, 1966. 22 pp.

Discusses the purposes and characteristics of productivity agreements and weighs the resulting gains and costs.

4.028 Great Britain, National Economic Development Council. *Productivity, Prices, and Incomes: A General Review.* London, National Economic Development Office, 1967. 41 pp.

Presents and discusses statistics on prices, productivity, and income from employment and other sources in the United Kingdom.

4.029 Great Britain, Royal Commission on Trade Unions and Employers' Associations. "Productivity Bargaining," in *Research Papers, 4.* London, Her Majesty's Stationery Office, 1967. pp. 1-46.

Reviews the operation of productivity bargaining and the gains and losses to be realized from it.

4.030 Gwartney, J. D. "Employment Discrimination, Productivity Factors, and Income Differentials Between White and Non-White Males in 1959." *American Economic Review,* Vol. 60, No. 3, June 1970, pp. 396-408.

Using data from the census and the U.S. Department of Health, Education, and Welfare, the author discusses the "productivity factors" affecting the income of nonwhites as compared with whites. He finds that between two-fifths to two-thirds of the income differential is due to lower educational attainment and lower scholastic achievement of nonwhites, as well as to their higher concentration in the low-income South.

4.031 Harmston, Floyd K., and Hino, Hiroyuki. *Technological Change and the Inequality of Income Distribution.* Discussion Paper 71-1. Columbia, Mo., University of Missouri, May 1971. 22 pp.

The authors develop a theoretical model for the size distribution of income with labor's relative share as a function of technological change. They analyze the impact of technological change, education, transfer payments, and inflation on the inequality of income distribution.

4.032 Harris, E. Marjorie, ed. *The Realities of Productivity Bargaining.* Industrial Relations Committee Report. London, Institute of Personnel Management, May 1968. 46 pp.

Discusses aspects of productivity bargaining, particularly in labor-intensive situations. Examines three existing productivity agreements in detail.

4.033 Hartman, Paul T. *Collective Bargaining and Productivity: The Longshore Mechanization Agreement.* Berkeley, Calif., University of California Press, 1969. 307 pp.

Discusses origins of restrictive labor practices and their eventual elimination through collective bargaining and other union actions. Provides quantitative estimates of productivity change after restrictive rules were abandoned.

4.034 Horvitz, Wayne L. "The ILWU-PMA Mechanization and Modernization Agreement," in Industrial Relations Research Association, *Proceedings of the Twenty-First Annual Winter Meeting* (December 29-30, 1968), 1969, pp. 144-151.

Reviews and evaluates results of the 1963 agreement between the Longshoremen's Union and shippers to avoid expected upheavals caused by rapid technological change in cargo loading procedures.

4.035 Hultgren, Thor. *Costs, Prices, and Profits: Their Cyclical Relations.* New York, National

Bureau of Economic Research, 1965. 229 pp.

Examines the behavior of profits and the factors determining profits during the business cycle.

4.036 Hunt, E. H. "Labour Productivity in English Agriculture: 1850-1914." *Economic History Review,* Vol. 20, No. 2, August 1967, pp. 280-292.

Explains why agricultural wages in northern England from 1850-1914 were substantially above those in southern England. Regional variations in wages were associated with differences in labor productivity. Farmers in high-wage areas found themselves at no competitive disadvantage.

4.037 International Labor Office. *Statistics of Labour Cost.* Report prepared for the Eleventh International Conference of Labor Statisticians (Geneva, October 1966). Geneva, ILO, 1966. 53 pp.

Discusses the need to develop reliable measures of the level, composition, and trend of labor costs.

4.038 Isaac, Julius E. *Wages and Productivity.* Melbourne, Canberra, Australia, F. W. Chesire, 1967. 157 pp.

Discusses the principles by which the Commonwealth Conciliation and Arbitration Commission (Australia) determines its wage awards. Also discusses the structure and level of actual earnings.

4.039 Jones, Ken, and Golding, John. *Productivity Bargaining.* Fabian Research Series 257. London, Fabian Society, November 1966. 38 pp.

Strongly advocating productivity bargaining, the authors discuss some features of, and experience with, actual agreements.

4.040 Kamerschen, David R. "Inter-Industry Earnings Differentials, Productivity, Size, and Concentration." *Journal of Industrial Relations,* Vol. 9, No. 1, March 1967, pp. 52-64.

Tests, by means of multiple regression analysis, the influence of productivity, size, and concentration upon inter-industry wage differentials.

4.041 Kuh, Edwin. "A Productivity Theory of Wage Levels—An Alternative to the Phillips Curve." *Review of Economic Studies,* Vol. 34(4), No. 100, October 1967, pp. 333-360.

Presents an econometric model incorporating wage determination equations. Scrutinizes the role of profits in the wage equation, which are considered to be a proxy for productivity. Formulates a productivity determination theory. Finds that the unemployment level does not provide a strong explanation of wage changes and that quarterly statistical explanations of wage changes are of poor quality. Productivity explained more variance in wage change than profits or the Phillips curve.

4.042 Lamson, Robert D. "Measured Productivity and Price Change: Some Empirical Evidence on Service Industry Bias; Motion Picture Theaters." *Journal of Political Economy,* Vol. 78, No. 2, March-April 1970, pp. 291-305.

Discusses the problem of measuring quality change in the motion picture theater industry. Finds that greater attention to the specification of the output of service industries may alter relative appraisals of price and productivity performance.

4.043 Li-Tien, F., and Chien, W. "A Quantitative Analysis of the Relationship Between the Rate of Growth of Productivity and the Average Wage." *Chinese Economic Studies,* Vol. 3, No. 1, Fall 1969, pp. 70-91.

The authors hold that labor should receive in the form of wages the benefits from increases in productivity due to increased quality of labor, but that savings due to technological advance should for the most part be retained to further the capital accumulation of the State and the capacity to produce.

4.044 Mark, Jerome A. *Wage-Price Guidepost Statistics: Problems of Measurement. Paper*

presented before the American Statistical Association, Pittsburgh, August 20-22, 1968.

Reviews problems associated with the development of output per man-hour measures used for implementing the guidepost policy.

4.045 Mark, Jerome A., and Kahn, Elizabeth. "Unit Labor Cost in Nine Countries: Recent Unit Cost Trends in U.S. Manufacturing." *Monthly Labor Review,* Vol. 88, No. 9, September 1965, pp. 1056-1060.

The authors discuss trends in post-war labor costs, productivity, and real labor payments.

4.046 Mauer, J. J., and Hemley, D. D. "Racial Discrimination, Productivity, and Negro-White Income." *Review of Social Economy,* Vol. 28, No. 2, September 1970, pp. 164-172.

Examines reasons for wage differentials between whites and Negroes. Finds that labor productivity mostly explains white-nonwhite income differentials in States outside the South and discrimination mostly explains them in the South.

4.047 Mazel, Joseph L. "The Productivity Gap Gets Wider." *Modern Manufacturing*, August 1968, pp. 56-61.

Discusses disparity between productivity trends and compensation trends in the postwar period, and what management can do to narrow this gap in terms of increased efficiency.

4.048 Mitchell, Edward J. "Explaining the International Pattern of Labor Productivity and Wages: A Production Model with Two Labor Inputs." *The Review of Economics and Statistics,* Vol. 50, No. 4, November 1968, pp. 461-469.

Seeks an explanation of wage and labor productivity differentials among eleven countries by introducing a rough measure of labor quality in estimating each country's production function. Concludes that a substantial portion of the cross-national differences can be explained by differences in the skill composition of the labor force.

4.049 Moes, J. E., and Bottomley, A. "Wage Rate Determination with Limited Supplies of Labour in Developing Countries." *Journal of Development Studies,* April 1968, Vol. 4, No. 3, pp. 380-386.

The authors argue that with an increase in wages over a certain range, the increase in resulting productivity is proportionately higher than the wage increase itself.

4.050 Myers, John G. "Productivity Is Up." *The Conference Board Record,* Vol. 7, No. 10, October 1970, pp. 10-14.

Discusses the relationship between output, productivity, employment, and unit labor costs in Spring 1970, as well as over the longer term.

4.051 Neef, Arthur. "Unit Labor Costs in Eleven Countries." *Monthly Labor Review,* Vol. 94, No. 8, August 1971, pp. 3-12.

Discusses comparative trends in unit labor costs, labor compensation, and productivity during the 1960's.

4.052 North, Dick T. B., and Buckingham, G. L. *Productivity Agreements in Wage Systems.* London, Gower Press, 1969. 262 pp.

The authors discuss the main problems in productivity bargaining at the plant level and suggest some ways of solving them. They provide a conceptual framework in which productivity agreements can be understood, and summarize the salient features of experience gained.

4.053 Organization for Economic Cooperation and Development. *Forms of Wage and Salary Payment for High Productivity.* International Management Seminar (Versailles, September 26-29, 1967). Paris, OECD, 1970. 411 pp.

Reviews and assesses the effectiveness of forms of wage and salary compensation in 11 member countries. Reports on several new approaches to improving productivity through pecuniary incentives.

4.054 Organization for Economic Cooperation and Development. *Productivity Bargaining.* Report by the British Joint Team which visited the United States from 15th-25th May, 1966, to study productivity bargaining. Paris, OECD, 1966. 25 pp.

Compares the institutional and policy backgrounds of American and British industrial relations bearing on the concept of productivity bargaining and its implementation. Presents case studies.

4.055 Organization for Economic Cooperation and Development. *Wages and Labor Mobility.* Paris, OECD, 1965. 258 pp.

Examines the relationship between changes in wage structures and changes in employment patterns. Points out several wage situations which can, with economic justification, be given as exceptions to productivity guidelines.

4.056 Phelps-Brown, E. H. *A Century of Pay: The Course of Pay and Production in France, Germany, Sweden, the United Kingdom, and the United States of America, 1860-1960.* New York, St. Martin's Press, 1969. 476 pp.

Shows that the rise in real wages owed much to productivity increases, and that both of these variables are dependent on technical change and the expectations of businessmen.

4.057 Phipps, Anthony J. "The Roles of Labor Productivity and Demand in the Pricing Process: An Inter-Industry Study Using Time-Series Data." *Bulletin.* Oxford University Institute of Economics and Statistics, Vol. 31, No. 4, November 1969, pp. 285-297.

Finds that in labor-intensive industries, prices are cyclically sensitive to changes in productivity and demand, while in capital-intensive industries, prices are cyclically relatively insensitive.

4.058 Pitchford, J. D. "Wage Policy and Distribution Theory." *Economica,* Vol. 34, No. 134, May 1967, pp. 167-180.

Investigates the determination of wage policy in the context of factor substitution. Also discusses output per unit of labor, product substitution, and labor mobility as determinants of sectoral wage movements.

4.059 Raines, Frederick Q. "Price and Productivity Trends in Manufacturing Industries." *The Review of Economics and Statistics,* Vol. 49, No. 3, August 1967, pp. 393-403.

Examines the relationship between price trends and productivity trends in manufacturing in terms of (1) wage-price guideposts and (2) expected price movements where an industry seeks to maintain a target rate of return on capital.

4.060 Read, L. M. "The Measure of Total Factor Productivity Appropriate to Wage-Price Guidelines." *Canadian Journal of Economics,* May 1968.

Suggests a solution of the simultaneous type in calculating capital carried and capital consumed when computing total factor productivity. Also discusses wage-price relations in terms of productivity change.

4.061 Rees, Albert, and Hamilton, Mary T. "The Wage-Price-Productivity Perplex." *Journal of Political Economy,* February 1967, pp. 63-70.

Discusses the limitations of Phillips curves in explaining the relationship between changes in price and wage levels and unemployment. The context of the discussion is a critical review of *The Wage-Price-Productivity Nexus,* by Ronald G. Bodkin. (See entry 4.009.)

4.062 Reynolds, Lloyd G., and Gregory, Peter. *Wages, Productivity, and Industrialization in Puerto Rico.* Homewood, Ill., Richard D. Irwin, 1965. 357 pp.

The authors report on industrial development, management policies, and labor price characteristics between 1945 and 1955. They find management skill the most important factor affecting productivity.

4.063 Robertson, D. J. "Guideposts and Norms: Contrasts in U.S. and U.K. Wage Policy." Reprinted from *The Three Banks Review,*

December 1966, No. 72. Reprint no. 294. California, Institute of Industrial Relations, 1967. 29 pp.

Examines similarities and differences in U.S. and U.K. wage policies.

4.064 Robertson, D. J. *Productivity Bargaining and the Engineering Industry.* London, Kogan Page Associates, for the Engineering Employers' Federation, 1968. 60 pp.

Presents guidelines for planning, negotiating, and implementing productivity agreements, and discusses pertinent problems. Also presents a case study, and shows how factors involved in productivity bargaining may be quantified.

4.065 Robinson, Derek. "Implementing an Incomes Policy." *Industrial Relations,* Vol. 8, No. 1, October 1968. pp. 73-90.

Outlines four stages in adopting a voluntary price and incomes policy, using Britain as a model: (1) obtaining general acceptance of its need, (2) determining policy content, (3) establishing means for implementation, and (4) implementing the policy. Predicts new attitudes towards collective bargaining as government becomes more involved in labor management relations. Sees a need for patience if policies are to be accepted over the long term.

4.066 Shrivastav, Omkar S. *Economics of Wages, Productivity and Employment.* Gwalior, India, Kailash Pustak Sadan, 1968. 257 pp.

Analyzes the relation between wages, productivity, and employment, with special application to developing economies. Reviews and criticizes present theories.

4.067 Shultz, George P., and Aliber, Robert Z., eds. *Guidelines, Informal Controls and the Market Place: Policy Choices in a Full Employment Economy.* Chicago, Ill., The University of Chicago Press, 1966. 357 pp.

Contains the proceedings of a conference held at the University of Chicago in April 1966 on policies to influence the market behavior of individual businesses, banks, and labor unions. Productivity change is among the criteria for guidelines and controls.

4.068 Stettner, Nora. *Productivity Bargaining and Industrial Change.* London and New York, Pergamon Press, 1969. 185 pp.

Defines and assesses productivity bargaining in terms of what is expected from it for economic growth, efficiency in the use of labor, the distribution of income, and the labor-management bargaining process.

4.069 "Symposium on Productivity Bargaining." *British Journal of Industrial Relations,* Vol. 5, No. 1, March 1967, pp. 1-62.

Includes five papers assessing the advantages and disadvantages of various productivity bargaining approaches.

4.070 Topham, Tony. *Productivity Bargaining and Workers' Control.* Nottingham, England, The Institute for Workers' Control, 1968. 11 pp.

Reviews recent trends in productivity bargaining, arguing that it aims at wage control and higher profitability, and that it undermines workers' control at the plant level.

4.071 Towers, B., and Whittingham, T. G., eds. *The New Bargainers: A Symposium on Productivity Bargaining.* Nottingham, England, Department of Adult Education, University of Nottingham, 1970. 179 pp.

A compendium of papers analyzing the nature of productivity bargaining, tracing its development, assaying its effects, and assessing its future.

4.072 Trades Union Congress. *Productivity, Prices and Incomes.* London, Trades Union Congress, 1965. 71 pp.

Discusses economic policy in light of the economic situation of Great Britain. Gives an account of discussions between the TUC, the Government, and employer organizations.

4.073 Turner, Marjorie S. "A Comparison of Some Aspects of the Cambridge Theory of Wages and Marginal Productivity Theory." *Journal of Economic Issues,* Vol. 1, No. 3, September 1967, pp. 189-198.

Compares the two theories in terms of realism of assumptions in model construction; success of approximation schemes; possibility of distinguishing the model from the theory; and predictive capability. Also discusses possibilities of integrating the two theories.

4.074 Towers, B., and Whittingham, T. G. "Productivity Bargaining in the United Kingdom: An Overview." *Journal of Industrial Relations,* Vol. 13, September 1971, pp. 251–273.

The authors define the concept and trace the development of productivity bargaining, as well as its repercussions for industrial relations and for the British economy.

4.075 Ulman, Lloyd. "Collective Bargaining and Industrial Efficiency." Reprinted from Richard E. Caves and Associates, ed., *Britian's Economic Prospects.* London, George Allen and Unwin Ltd., 1968. Reprint No. 326. Berkeley, University of California, 1968. pp. 323-380.

Identifies and evaluates restrictions on industrial efficiency resulting from the British system of collective bargaining, and discusses policies designed to increase labor productivity.

4.076 U.S. Congress, Joint Economic Committee. *Productivity, Prices, and Incomes.* Materials prepared by the Committee Staff, 89th Congress, 2nd session. Washington, U.S. Government Printing Office, 1967. 213 pp.

Presents data dealing with productivity, prices, wages, and profits for the economy as a whole and for two selected industrial areas—food products and metals. Characteristics and limitations of the data are summarized. Significant changes in the economy, as revealed by the data, are indicated.

4.077 U.S. Congress, Joint Economic Committee. *The Wage Price Issue: The Need for Guideposts.* Hearing 90th Congress, 2nd session. Washington, U.S. Government Printing Office, January 31, 1968. 82 pp.

Examines the evidence on the stabilizing effects of guideposts, and the need for their revival. Commenting on the suggestions set forth in the committee are Gary Fromm, John W. Kendrick, George L. Perry, and John Sheahan.

4.078 U.S. Council of Economic Advisers. "Guideposts for Noninflationary Wage and Price Behavior," in *Labor and the National Economy.* New York, W. W. Norton, 1965, pp. 88-94.

Explains how long-run, economy-wide changes in productivity can be used as a guide for appraising the behavior of wages and prices.

4.079 U.S. Department of Labor, Manpower Administration. *Management Decisions to Automate.* Manpower/Automation Research Monograph No. 3, 1965. 37 pp.

Reports on the factors that influenced managerial decisions to automate in eight firms. Compares automation results with expectations. Finds expectations of cost reductions through increased labor productivity to be the determining factor.

4.080 U.S. Secretary of Labor James D. Hodgson. "The Role of Productivity in the Attainment of National Goals." *Speech* before the National Machine Tool Builders Association, Washington, D.C., November 11, 1971. 10 pp.

Reviews the recent productivity performance of the economy. Discusses the impact of rising productivity on inflation, the international competitiveness of U.S. goods, and the quality of life.

4.081 Wiles, R. C. "The Theory of Wages in Later English Mercantilism." *Economic History Review,* Vol. 21, No. 1, April 1968, pp. 113-126.

Suggests that one of the views most commonly attributed to mercantilist economic thought is the desirability of low wages as a guarantee of a favorable balance of trade. However, the "later English mercantilists" recognized that high wages did not conflict with low or competitive prices because of the relationship between productivity and prices.

4.082 Williams, Roger. "Profits: A Fruit of Productivity." *Nation's Business,* Vol. 58, No. 10, October 1970, p. 101.

Argues that productivity data are the best guide for management to improve profits. Shows that profits have increased since World War II only when gains in GNP were larger than cost increases. Productivity decreases when there has been a period of growth with extended low unemployment. Suggests executives examine cost records regularly, not just when profits are pinched.

4.083 Wise, David. *An International Comparison of Unit Labor Cost in the Iron and Steel Industry, 1964: United States, France, Germany, United Kingdom,* BLS Bulletin 1580. U.S. Department of Labor, Bureau of Labor Statistics, 1968. 64 pp.

Provides a detailed comparison of, and discusses factors affecting, unit labor costs.

4.084 Wood, Ian, and Lawler, Edward E. "Effects of Piece-Rate Overpayment on Productivity." *Journal of Applied Psychology,* Vol. 54, No. 3, June 1970, pp. 234-238.

The authors maintain that "excessive" wage rates lead to lower productivity and a higher quality of workmanship.

4.085 Zudak, L. S. "Productivity, Labor Demand, and Cost in a Continuous Production Facility." *Journal of Industrial Economics.* Vol. 18, No. 3, July 1970, pp. 256-275.

Analyzes output, capital, and labor requirements in continuous process facilities, holding that marginal product analysis is inapplicable.

V. Productivity and employment

5.001 Alterman, Jack. "Interindustry Employment Requirements." *Monthly Labor Review,* Vol. 88, No. 7, July 1965, pp. 841-850.

Explains the interindustry employment tables showing U.S. direct and indirect employment per billion dollars of delivery to final demand and how they were derived from 1958 input-output relationships and converted into employment requirements through productivity and price adjustments.

5.002 American Foundation on Automation and Employment. *Automation and the Middle Manager.* New York, American Foundation on Automation and Employment, 1966. 49 pp.

Surveys the impact of computer technology on the lower level executive ranks, finding that automation has eliminated or radically changed many of these positions.

5.003 Ammer, Dean S. *Mechanization and Manpower in Gray Iron Foundries.* Boston, Bureau of Business and Economic Research, Northeastern University, September 1965. 234 pp.

Examines technological changes and their effects on production and employment. Compares management and automation decisions in foundries of widely varying levels of technology.

5.004 Aronson, Robert L. *Jobs, Wages and Changing Technology: Recent Experience.* Bulletin 55. Ithaca, N.Y., Cornell University, July 1965. 74 pp.

Discusses ways to ease the adjustments necessitated by technological change.

5.005 Automobile Manufacturers Association. *Technological Change and Employment in the Automotive Industry.* Detroit, Automobile Manufacturers Association, Inc., 1965. 8 pp.

Discusses the manpower and collective bargaining policies of U.S. automakers.

5.006 Bardwell, George E., and Mahar, James F. *A Method of Measuring Short-Term Impacts of Technological Change on Employment and Occupations.* Denver, Colo., Denver Research Institute, University of Denver, September 1965. 92 pp.

The authors study the innovation process in a sample of power laundries. They formulate a model to predict the impact of innovative capital equipment on employment and skill requirements.

5.007 Barkin, Solomon, ed. *Technical Change and Manpower Planning.* Paris, Organization for Economic Cooperation and Development, 1967. 287 pp.

Presents 29 case studies prepared in eight countries on the methods of programing technological change and manpower adjustments.

5.008 Bauer, L. L. "The Effect of Technology on the Farm Labor Market." *American Journal of Agricultural Economics,* Vol. 51, No. 3, August 1969, pp. 605-618.

Estimates the time path of the effect of technology, as measured by expenditures for research and extension services, on the farm labor market.

5.009 Bauer, Raymond A., ed. *Second-Order Consequences: A Methodological Essay on the Impact of Technology.* Cambridge, Mass., The M.I.T. Press, 1969. 240 pp.

Discusses the indirect effects of technological change on society, industry, and the environment. Focuses on the secondary effects of the space program.

5.010 Bonwick, George J., and Cox, R. W., eds. *Automation on Shipboard.* Proceedings of a seminar held at Elsinore, Denmark, by the International Institute for Labor Studies, September 1965. London, Macmillan Co. Ltd., 1967. 127 pp.

A collection of papers detailing recent technological changes and their effects on employment, skill requirements, and labor relations.

5.011 Bowen, Howard R., and Mangum, Garth L., eds. *Automation and Economic Progress.* Englewood Cliffs, N.J., Prentice-Hall, 1966. 170 pp.

A summary of the Report of the National Commission on Technology, Automation, and Economic Progress.

5.012 Buck, P. B. "Technological Change and the Merchant Seaman." *International Labour Review,* Vol. 92, No. 4, October 1965, pp. 298-313.

Details the technological changes that have occurred and can be expected to occur in the future on several classes of ships. Discusses the effect of the changes on employment, working conditions, and worker attitudes.

5.013 Canada Department of Labor. *Response to Technological Change.* Ottawa, Canada Department of Labor, 1967. 17 pp.

Surveys the methods that unions and management have adopted to soften the adverse effects of technological change on workers.

5.014 Canada Department of Labor. *Technological Changes in the Railway Industry: Employment Effects and Adjustment Process.* Ottawa, Canada Department of Labor, Economics and Research Branch, 1967. 161 pp.

Examines the interaction between technological changes and employment on the basis of observations in a major railroad repair shop.

5.015 Christensen, Eric. *Automation and the Workers.* London, LRD Publications, 1968. 100 pp.

Explores questions relating to the effects of automation and its ramifications in several British industries.

5.016 Cottrell, Fred. *Technological Change and Labor in the Railroad Industry.* Lexington, Mass., Heath Lexington Books, 1970. 159 pp.

Compares the effects of changing technology on workers in the United States, the United Kingdom, and New Zealand.

5.017 Crossman, E. R. F. W. *Automation, Skill, and Manpower Predictions.* Seminar on Manpower Policy and Program. U.S. Department of Labor, Manpower Administration, 1966. 53 pp.

Develops a general model for employment in an automated economy and discusses the manpower changes associated with progress towards a thoroughly automated society. Theorizes that labor will come to depend more on capital in place than on demand.

5.018 Day, R. H. "The Economics of Technological Change and the Demise of the Sharecropper." *American Economic Review,* Vol. 57, No. 3, June 1967, pp. 427-449.

Summarizes findings on production, technological change, resource utilization, and labor demand from a recursive programing model of the Mississippi Delta farm economy. Shows that a "two-stage" push forced workers out of year-round employment in agriculture, and then forced them out of agriculture altogether.

5.019 Delehanty, George E. *Nonproduction Workers in U.S. Manufacturing.* Amsterdam, North-Holland Publishing Company, 1968. 256 pp.

Analyzes the nature, causes, and implications of the increase in the number of nonproduction workers relative to production workers in manufacturing during the postwar period. Finds a positive correlation between increases in productivity and increases in the number of nonproduction workers.

5.020 Domangue, Dennis A. "Technology Changes the Sugarcane Labor Force." *Employment Service Review,* Vol. 2, Nos. 1 and 2, January-February 1965, pp. 5-8.

Describes how increased mechanization over the last 25 years has nearly eliminated the unskilled, seasonal worker.

5.021 Dorner, Peter. "Needed Redirections in Economic Analysis for Agricultural Development Policy." *American Journal of Agricultural Economics,* Vol. 53, No. 1, February 1971, pp. 8-16.

Urges close examination of the secondary effects of increases in agricultural productivity, such as changing employment and income distribution patterns.

5.022 Foster, Howard G. "Unemployment and Shorter Hours." *Labor Law Journal,* Vol. 17, No. 4, April 1966, pp. 211-225.

Evaluates shorter working hours as a device to combat unemployment. Includes a discussion of productivity and unit labor costs.

5.023 Freedman, Audrey; Elliott, Mable; and Keyes, J. Stephen. *Impact of Office Automation in the Insurance Industry,* BLS Bulletin 1468. U.S. Department of Labor, Bureau of Labor Statistics, 1966. 71 pp.

The authors examine the extent and pace of the introduction of electronic data processing, and its implications for employment and occupational requirements.

5.024 Freedman, Audrey. "Office Automation in the Insurance Industry." *Monthly Labor Review,* Vol. 88, No. 11, November 1965, pp. 1313-1319.

Discusses a 1963 BLS study of the extent of electronic data processing and its effects on employment patterns.

5.025 Freedman, Audrey; Hammerman, Herbert; and Riche, Richard. *Manpower Planning for Technological Change: Case Studies of Telephone Operators,* BLS Bulletin 1574. U.S. Department of Labor, Bureau of Labor Statistics, 1968. 34 pp.

The authors describe the manpower policies and experiences of several companies within the Bell Telephone System in converting from manual to long-distance dial telephone systems.

5.026 Freedman, Audrey, and Weinberg, Edgar. "Changing Manpower Needs in Telephone Offices." *Monthly Labor Review,* Vol. 91, No. 2, February 1968, pp. 56-58.

The authors describe how manpower adjustments were made in four cases of shifts from manual to automatic dialing and highlight the importance of a variety of measures to minimize dislocation of workers arising from technological change.

5.027 Friedrichs, Gunter. "Planning Social Adjustment to Technological Change at the Level of the Undertaking." *International Labour Review,* Vol. 92, No. 2, August 1965, pp. 91-105.

Outlines minimum trade union demands for the right to plan with management for adjust-

ment to technological change. Suggests that indemnities be paid to workers who are laid off.

5.028 Fryer, John L. "The Implications of Technological Change for Collective Bargaining." *Industrial Relations,* Vol. 22, No. 3, July 1969, pp. 411-421.

Stresses the importance of collective bargaining in solving problems created by technological change. Sees a need for new approaches and an enquiry to investigate aspects of technological change in Canada.

5.029 Fuchs, Victor R. "The Growing Importance of the Service Industries." *Journal of Business of the University of Chicago.* Vol. 38, No. 4, October 1965, pp. 344-373.

Examines the shift in employment and in the gross national product from the goods to the service sector. Discusses some of the implications for employment opportunities and stability, labor, demand for capital goods, and industrial organization as well as the complicating effects the shift will have on the economic analysis of productivity.

5.030 Gaevskaia, V. "Certain Findings of a Study on the Utilization of Labor Resources." *Problems of Economics,* Vol. 12, No. 12, April 1970, pp. 45-60.

Summarizes a survey of collective farms in Russia, finding large-scale underutilization and uneven utilization of farm labor, especially of women. Argues for the establishment of secondary industries to employ laborers during the long non-growing season.

5.031 Goldberg, Joseph P. "Containerization as a Force for Change on the Waterfront." *Monthly Labor Review,* Vol. 91, No. 1, January 1968, pp. 8-13.

Discusses the effect of containerization on shipping, longshore labor requirements, and operations. Reviews the union-management agreements made to ease the changes.

5.032 Greenberg, Leon. *Productivity Trends and Unemployment.* Address to Seminar on Automation, Manpower, and Retirement Policy, sponsored by the National Council on the Aging, Washington, D.C., October 26, 1965. U.S. Department of Labor, Bureau of Labor Statistics, 1965. 8 pp.

Discusses past productivity trends, the relationship between productivity and employment change, and the future of productivity change and its impact on employment.

5.033 Greenberg, Leon. "Technological Change, Productivity, and Employment in the United States," in *Manpower Implications of Automation.* U.S. Department of Labor, Manpower Administration, 1965, pp. 1-14.

Reviews the 20th century productivity pattern in the United States, with particular reference to the effects of productivity increase on employment, and discusses possible future trends in productivity and employment.

5.034 Haase, Peter E. "Technological Change and Manpower Forecasts." *Industrial Relations,* Vol. 5, No. 3, May 1966, pp. 59-71.

Examines the information available on how technology affects employment, occupational requirements, and job content. Outlines methods of forecasting the manpower impact of technological change.

5.035 Helfgott, Roy B. "Easing the Impact of Technological Change on Employees: A Conspectus of United States Experience." *International Labour Review,* Vol. 91, No. 6, June 1965, pp. 503-519.

Reviews measures taken by companies and unions to minimize the social and economic disruption due to technological change.

5.036 Herman, Arthur S. "Manpower Implications of Computer Control in Manufacturing." *Monthly Labor Review,* Vol. 93, No. 10, October 1970, pp. 3-8.

Finds from a survey of six industries that expanded use of computers created new jobs and that it did not displace many workers, although it required retraining.

5.037 Hubbard, Norman S. "Short-Run Changes in Labor Productivity in United States Manufacturing, 1954-59." *Yale Economic Essays,* Vol. 8, No. 2, Fall 1968. 74 pp.

Estimates short-run employment elasticity for individual manufacturing establishments.

5.038 Illinois. *Report of the State of Illinois Commission on Automation and Technological Progress, 1967.* Prepared under the direction of William Karp. Springfield, 1967. 108 pp.

Presents several case studies of key Illinois industries where the problem of technological disemployment was encountered. Makes a series of recommendations.

5.039 International Labor Office. *Effects of Technological Developments on the Occupational Structure and Level of Employment in the Leather and Footwear Industry.* Geneva, ILO, 1969. 73 pp.

Outlines present and expected future changes in technology, production, and employment with a view towards facilitating required adjustments.

5.040 International Labor Office. *Labor and Automation: A Tabulation of Case Studies on Technological Change.* Geneva, ILO, 1965. 87 pp.

Summarizes information on 160 case studies in 14 countries.

5.041 International Labor Office. *Labor and Automation: Automation and Nonmanual Workers.* Geneva, ILO, 1967. 113 pp.

Investigates the effects of automation on the nature of work, manpower requirements, economic organization, and labor union attitudes, particularly in Europe.

5.042 International Labor Office. *Labor and Automation: Technological Change and Manpower in a Centrally Planned Economy.* Geneva, ILO, 1966. 92 pp.

Analyzes material from 163 Soviet publications on the effects of automation on occupations, with special reference to the metalworking industry.

5.043 International Labor Office. "Technical Progress and Its Social Consequences in the French Textile Industry." *International Labour Review,* Vol. 92, No. 1, July 1965, pp. 51-62.

Reviews recent changes in technology and their effects on the labor force.

5.044 International Labor Office. *The Effects of Advanced Technology on Employment and Conditions of Work in the Chemical Industries.* Geneva, ILO, 1969. 77 pp.

Reviews the characteristics of the industry and discusses the effect of accelerating technological change on production and employment.

5.045 Jaffe, A. J., and Froomkin, Joseph. *Technology and Jobs.* New York, Praeger, 1968. 284 pp.

The authors examine the relationship between technological change and the labor force, with emphasis on the post-World War II period, and compare trends in the United States with those abroad.

5.046 Ketterling, Virgil H. "Productivity, Output, and Employment." American Statistical Association, *Proceedings of the Business and Economic Statistics Section,* 1965, pp. 175-183.

Examines the statistical relations between output, productivity, and man-hours in the U.S. economy.

5.047 Klotz, Benjamin P. *Disemployment of Labor at the Establishment Level.* U.S. Department of Labor, Bureau of Labor Statistics, 1966. 17 pp.

Assesses the relative impact of productivity and output changes on employment in 17 selected 4-digit industries. Finds that, in general, output did not increase sufficiently to avoid disemployment.

5.048 Lawrence, Paul R. "How to Deal with Resistance to Change." *Harvard Business Review,*

Vol. 47, No. 1, January-February 1969, pp. 4-5+.

Urges managers to seek out meaningful worker participation when introducing change. Finds most resistance the result of thoughtless management practices.

5.049 Levine, Morton. "Adjusting to Changing Technology on the Railroads." *Monthly Labor Review,* Vol. 92, No. 11, November 1969, pp. 36-42.

Reports on measures taken to retrain or otherwise help railroad workers displaced by technological and other changes in the railroad industry.

5.050 Lovejoy, Robert J. "Labor Productivity in Italian Agriculture." *Industrial and Labor Relations Review,* Vol. 21, No. 4, July 1968, pp. 570-580.

Discusses the dynamics of employment and output and their relationship to productivity in Italian agriculture. Forecasts future trends in productivity.

5.051 Mandelstamm, Allan B. "The Effects of Unions on Efficiency in the Residential Construction Industry: A Case Study." *Industrial and Labor Relations Review,* Vol. 18, No. 4, July 1965, pp. 503-521.

Compares efficiency and costs in residential construction in Ann Arbor and Bay City, Michigan, and explains the approximately equal costs of building a house as resulting from effective apprenticeship programs (sponsored by unions), entrepreneurial efficiency, and wage and other competitive pressures.

5.052 Mueller, Eva, and associates. *Technological Advance in an Expanding Economy.* Ann Arbor, Institute for Social Research, The University of Michigan, 1969. 254 pp.

Reports on a nationwide cross-sectional survey of the effect of technological advance on employment, income, job satisfaction, and job content, and of the effect of education and training on worker adjustment to change.

5.053 National Commission on Technology, Automation, and Economic Progress. *Technology and the American Economy, The Report of the Commission.* Washington, U.S. Government Printing Office, February 1966. 115 pp.

Summarizes and interprets findings of a year-long investigation, commissioned by the Congress, into the impact of technological and economic change on production and employment. Assesses past effects of such change as well as job requirements and major types of manpower displacement likely to occur during the decade ahead. Defines areas of unmet community and human needs toward which application of new technologies might be effectively directed. Assesses the means by which new technologies might be channeled into other promising directions. Recommends pertinent manpower and other policies. (See also following entries for the appendix volumes to the Commission Report.)

5.054 National Commission on Technology, Automation and Economic Progress. *The Outlook for Technological Change and Employment.* Appendix Volume I to *Technology and The American Economy, The Report of the Commission.* Washington, U.S. Government Printing Office, February 1966. 373 pp.

Contains projections of employment, manpower requirements, and industry productivity to 1975 and discussions of technological developments, particularly in the computer field.

5.055 National Commission on Technology, Automation, and Economic Progress. *The Employment Impact of Technological Change.* Appendix Volume II to *Technology and The American Economy, The Report of the Commission.* Washington, U.S. Government Printing Office, February 1966. 399 pp.

Contains studies of disemployment; of technological change and its impact on jobs by industry; of skill requirements arising from the installation and use of automated equipment; and of hours of work and leisure.

5.056 National Commission on Technology, Automation, and Economic Progress. *Adjusting to*

Change. Appendix Volume III to *Technology and the American Economy, The Report of the Commission.* Washington, U.S. Government Printing Office, February 1966. 275 pp.

Assesses income maintenance programs and other programs aiding the poor; compares U.S. and Western European programs aiding displaced workers in adjusting to technological and other changes; examines problems posed for Negroes by recent technological changes; surveys needs of users of manpower projections; examines the effect of a minimum wage on the employment of unskilled workers; and reports on a computer experiment in analyzing labor market data bearing upon the impact of technological change.

5.057 National Commission on Technology, Automation, and Economic Progress. *Educational Implications of Technological Change.* Appendix Volume IV to *Technology and the American Economy, The Report of the Commission.* Washington, U.S. Government Printing Office, February 1966. 151 pp.

Explores experimental developments in the use of computers and other new technologies in the education process and analyzes the implications.

5.058 National Commission on Technology, Automation, and Economic Progress. *Applying Technology to Unmet Needs.* Appendix Volume V to *Technology and the American Economy, The Report of the Commission.* Washington, U.S. Government Printing Office, February 1966. 291 pp.

Examines the possibilities of the computer and other modern planning tools for solving problems of urban planning and metropolitan development; summarizes results of feasibility studies of applying the systems skills of the aerospace industry to the solution of social problems; describes problems of air and water pollution and of waste disposal and suggests methods for their control; examines attempts underway to deal with transportation problems and to use computerized diagnostic screening systems in health care; presents an inventory of computer-aided modeling and simulation techniques in the solution of social and economic problems; and evaluates techniques designed to assure civilian and commerical uses of technologies developed in defense and space efforts.

5.059 National Commission on Technology, Automation, and Economic Progress. *Statements Relating to the Impact of Technological Change.* Appendix Volume VI to *Technology and the American Economy, The Report of the Commission.* Washington, U.S. Government Printing Office, February 1966. 309 pp.

Statements by interested organizations and individuals in response to a request by the Commission for their views on the impact of technological change.

5.060 Organization for Economic Cooperation and Development. *Acceptance and Resistance.* A resume of Touraine, Alain, and Associates, *Workers' Attitudes to Technical Change.* Paris, OECD, 1965, 116 pp.

Summarizes the major findings concerning worker reactions to technological change.

5.061 Organization for Economic Cooperation and Development. *Manpower Aspects of Automation and Technical Change.* (European Conference, Zurich, February 1-4, 1966.) Paris, OECD, 1966. 138 pp.

Discusses the rate of penetration of automation in Europe and the impact of technical change on jobs and the location of industry. Explores the requirements for effective manpower policy.

5.062 Organization for Economic Cooperation and Development. *The Requirements of Automated Jobs.* (North American Joint Conference, December 1964.) Paris, OECD, 1965. 453 pp.

The report of a conference on the impact of automation upon broad occupational trends. Discusses the contributions which both private and public measures can make to facilitate manpower adjustments.

5.063 Pejovich, S. "Technological Progress and Technical Schools." *Review of Social Economy,* Vol. 26, No. 1, March 1968, pp. 40-49.

Seeks to provide a basis for evaluating two alternative manpower programs–training in technical schools and training on the job. Suggests that the average expected rate of return from technical school training is higher than the corresponding rate for on-the-job training. Simple cost-benefit analysis, however, may be misleading. While on-the-job training yields lower returns, it tends to provide greater protection against cyclical unemployment than does technical school training.

5.064 Piore, M. "On-the-Job Training and Adjustment to Technological Change." *Journal of Human Resources,* Vol. 3, No. 4, Fall 1968, pp. 435-449.

Discusses the role of on-the-job training in preventing structural imbalances in labor markets. Holds that its role in adjustments to technological change suggests new interpretations of labor productivity.

5.065 Rezler, Julius. *Automation and Industrial Labor.* New York, Random House, 1969. 224 pp.

Analyzes changes in workers' jobs, unions, and relations with employers brought about by technological change.

5.066 Riche, Richard W. *Manpower Planning to Adapt to New Technology at an Electric and Gas Utility: A Case Study.* BLS Bulletin 293. U.S. Department of Labor, Bureau of Labor Statistics, April 1965. 25 pp.

Describes the methods used in introducing laborsaving technology with a minimum of hardship to employees.

5.067 Riche, Richard W. "Manpower Planning at an Electric and Gas Utility." *Monthly Labor Review,* Vol. 88, No. 8, August 1965, pp. 965-967.

Discusses a study by the BLS concerning technological changes in both plant and auxiliary operations and how they were dealt with by management and labor.

5.068 Rothberg, Herman J. "A Study of Office Automation in the IRS." *Monthly Labor Review,* Vol. 92, No. 10, October 1969, pp. 26-31.

Reports how conversion to automatic data processing in the Atlanta Internal Revenue Service was accomplished without involuntary transfers or separations.

5.069 Scott, W. H., ed. *Office Automation: Administrative and Human Problems.* Paris, Organization for Economic Cooperation and Development, 1965. 103 pp.

Discusses some of the manpower problems which industries in four European countries encountered when they introduced computers in their offices in the early 1960's. Suggests how manpower changes might be made more smoothly.

5.070 Shepard, Jon M. *Automation and Alienation: A Study of Office and Factory Workers.* Cambridge, Mass., MIT Press, 1971. 163 pp.

Discusses the influence of technology and the degree of job specialization on the worker's integration into or alienation from work. Finds that alienation levels seem to be reduced by automated technology in both factory and office.

5.071 Shirai, Takamasa. "Improvements in Labor Productivity and Employment in Keynes' So-called Classical System." *Osaka Economic Paper,* Vol. 14(2), No. 27, December 1965.

Examines the effect of an increase in the marginal disutility of labor, an increase in labor productivity, or an increase in the price of non-wage goods on employment in a two-sector Keynesian system.

5.072 Shirom, Arie. *Industrial Cooperation and Adjustment to Technological Change: A Study of Joint Management-Union Committees.* U.S. Department of Commerce, National Bureau of Standards, 1968. 340 pp.

Evaluates the potential of joint management-union committees for effective planning of adjustment to technological change.

5.073 Siegel, B. N. "Technical Change and Employment in the United States, 1890-1965." *Western Economic Journal,* Vol. 6, No. 2, March 1968, pp. 121-133.

Deals with changes in the historical relationship between private-sector output growth and employment growth in the United States. The employment elesticity of the rate of output growth has tended to decline over the period of 1890-1965, the decline evidently being associated with acceleration in the rate of technical change.

5.074 Siegel, Irving H. "Productivity Measures and Forecasts for Employment and Stabilization Policy," in *Dimensions of Manpower Policy: Programs and Research,* Levitan, Sar A., and Siegel, Irving H., eds. Baltimore, Johns Hopkins Press, 1966. 299 pp.

Explores certain aspects of the meaning, measurement, and use of productivity statistics in the light of policy requirements concerning employment and wage-price stabilization.

5.075 Silberman, Charles E. "The Real News About Automation." *Fortune,* Vol. 71, No. 1, January 1965, p. 124+.

Discusses long-term productivity growth in the private economy. Argues that the effect of automation on employment in the United States has been irresponsibly exaggerated.

5.076 Smith, A. D. *Redundancy Practices in Four Industries.* Paris, Organization for Economic Cooperation and Development, 1966. 129 pp.

Examines the practices of the steel, railroad, textile, and telecommunications industries in the United States and the United Kingdom in assisting workers whose jobs have been permanently eliminated by technical change. Explores the reasons for differing practices among these industries.

5.077 Society for Personnel Administration. *Automation Around the Nation.* Fourth Annual Conference on Automation and Personnel Administration, May 13, 1965. Washington, Society for Personnel Administration, 1965. 68 pp.

Outlines the benefits and problems brought about by automatic data processing. Pays particular attention to the effect of automation on education.

5.078 Stieber, Jack and Paukert, Liba. "Manpower and Technological Change in Czechoslovakia." *Industrial Relations,* Vol. 8, No. 1, October 1968, pp. 91-107.

The authors discuss the system of "planned management" introduced in 1964, which increases the role of incentives to make the economy more responsive to change. Postwar trends in employment and manpower planning preceding the introduction of the new system are reviewed.

5.079 Striner, Herbert E. "Technological Displacement as a Micro Phenomenon." *Monthly Labor Review,* Vol. 90, No. 3, March 1967, pp. 30-31.

Argues that the report of the National Commission on Technology, Automation, and Economic Progress obscures the problem of labor displacement due to technology by treating unemployment on a macroeconomic basis, while the problem in fact occurs on the microeconomic level. Significant numbers of workers may be affected by displacement, but a macroeconomic treatment will tend statistically to offset their loss of employment by gains elsewhere.

5.080 "The Key to Full Employment." *American Machinist,* June 28, 1971.

Discusses capital investment in manufacturing, the impact of imports on employment and investment, and suggests a program to ensure full employment.

5.081 Touraine, Alain, and associates. *Workers' Attitudes to Technical Change.* Paris, Organization for Economic Cooperation and Development, 1965. 177 pp.

Considers the determinants of workers' attitudes toward change. Indicates how managers

might gain the cooperation of their workers when instituting change.

5.082 Ulman, Lloyd. *Automation in Perspective.* Reprint No. 305. Berkeley, California, Institute of Industrial Relations, University of California, 1967. 18 pp.

Suggests that the impact of automated control technologies on the economy does not essentially differ from that of conventional technologies, and that postwar productivity gains are related to high employment levels rather than to changes in the pattern of technological innovations and their diffusion.

5.083 U.S. Department of Labor, Bureau of Labor Statistics. *Technician Manpower 1966-80,* BLS Bulletin 1639. Washington, U.S. Government Printing Office, March 1970. 28 pp.

Discusses the employment outlook of technicians in various technician occupations and industries in terms of projected requirements. Also discusses criteria for qualifying as a technician. Stresses the need for further research.

5.084 U.S. Department of Labor, Manpower Administration. *Manpower Implications of Automation.* 1965. 86 pp.

Presents a compendium of papers on technological change and manpower presented by the U.S. Department of Labor at the OECD North American Regional Conference.

5.085 U.S. Department of Labor, Women's Bureau. *Automation and Women Workers.* 1970. 11 pp.

Argues that predictions of persistent technological unemployment made in the fifties and early sixties have proved false. Rather, automation has caused a significant expansion in job opportunities for women.

5.086 Walton, F. T. "Manufacturing Employment, Growth and Labor Supply." *Scottish Journal of Political Economy,* Vol. 14, No. 1, February 1967, pp. 30-47.

Based on the experience of 12 OECD countries between 1955 and 1964, the author finds that substantial increases in manufacturing employment are a suitable and effective means of achieving rapid growth in total output, although he finds it desirable that the rate of increase in manufacturing output substantially exceeds that in employment.

5.087 Wedderburn, Dorothy. *Enterprise Planning for Change.* Paris, Organization for Economic Cooperation and Development, 1968. 140 pp.

Summarizes 40 case studies in eight countries on experience with coordinating technological change and manpower planning at the enterprise level.

5.088 Weinberg, Edgar. "Some Manpower Implications," in *Automation Management: A Social Perspective.* Athens, Georgia, Second Annual Georgia-Reliance Symposium, 1970. pp. 78-91.

Discusses the nature and rate of technological change and its implications for employment, education, and occupational training in the 1970's.

5.089 Weinberg, Edgar, and Ball, Robert A. "The Many Faces of Technology." *Occupational Outlook Quarterly,* Vol. 11, No. 2, May 1967, pp. 7-10.

The authors summarize major developments in technology and industry growth patterns and their impact on job skills.

5.090 Weiss, Jeffrey. "The Changing Job Structure of Health Manpower," in *Proceedings of the Twenty-Third Annual Winter Meeting,* Industrial Relations Research Association. (December 28-29, 1970), 1971. pp. 162-172.

Criticizes the assumption of fixed manpower coefficients in past studies of the health industries. Using dentistry as an example, the author argues that the increasing employment of technical personnel to perform the more routine tasks once done by highly trained professionals has been the primary force in raising the productivity of these professionals and in allowing the health industries to meet rising demand.

5.091 Wolfe, J. N. "Productivity and Growth in Manufacturing Industry: Some Reflections on Professor Kaldor's Inaugural Lecture." *Economica,* Vol. 35, No. 138, May 1968, pp. 117-126.

Shows that assertions that a shortage of productive labor exists in manufacturing are not supported by the statistics of either unemployment or wage rates. Various branches of manufacturing have been able to expand their work force rapidly.

VI. Productivity and economic growth

6.001 Almon, Clopper, Jr. *The American Economy to 1975.* New York, Harper and Row, 1966. 169 pp.

Presents internally consistent projections, based on interindustry matrices, of consumer spending, capital expenditures, government purchases, exports and imports, and technological changes.

6.002 Alterman, Jack. "Input-Output Projections of the U.S. Economy to 1980 and Some Implications," in American Statistical Association, *Proceedings of the Business and Economic Statistics Section,* 1970, pp. 73-83.

Explains the construction and uses of BLS projections of labor force growth, final demand, potential output, industry output, productivity, and employment.

6.003 Alterman, Jack. "Studies of Long-Term Economic Growth." *Monthly Labor Review,* Vol. 88, No. 8, August 1965, pp. 983-987.

Explains the activities and goals of the Federal Interagency Growth Study Project. States that the main objective of the project is to establish a framework for analyzing the long-term implications for economic growth of shifts in the economy, particularly with respect to manpower utilization.

6.004 Alterman, Jack. *The Use of Input-Output Analysis by the Federal Interagency Growth Project in the United States. Paper* presented at the Seminar on Input-Output Analysis, Bucharest, Romania, September 8-18, 1969. 15 pp.

Describes how input-output tables are used as a framework for projections in terms of final demand, interindustry relationships, output, and employment under conditions of stable economic growth and high employment.

6.005 Baldwin, Robert E. *Economic Development and Growth.* New York, John Wiley & Sons, 1966. 133 pp.

An introductory text surveying growth patterns in developed and less developed economies, major theories of growth, and alternative policies for encouraging economic growth.

6.006 Berri, L. "Methodological Problems in Forecasting Economic Development and Technical Progress." *Problems of Economics,* Vol. 12, No. 10, February 1970, pp. 51-71.

Urges Soviet planners to take account of possible technological improvements and the social and economic changes these may initiate when considering future economic programs.

6.007 Bhattacharyya, M. A. *Capital Longevity and Economic Growth: An Analytical Study.* Calcutta, India, Bookland Private Ltd., July 1965. 143 pp.

Discusses and analyzes the major theoretical investigations of the relation between the economic life of capital and economic growth. Offers his own growth model.

6.008 Blackett, P. M. S. *Technology, Industry, and Economic Growth.* The 13th Fawley Foundation Lecture. Southampton, England, University of Southampton, 1966. 19 pp.

Reviews some of the reasons for the British economic crisis. Discusses Britain's position in the world, and the changes in the educational and industrial structure necessary to realize its potential.

6.009 Blitzer, C. R. "Elasticity of Substitution and the Retardation of Soviet Growth Rates." *The Review of Economics and Statistics,* Vol. 52, No. 1, February 1970, pp. 104-108.

Discusses an article by Norman M. Kaplan on the subject in terms of two "extreme" assumptions--i.e., that the decline in the Soviet growth rate is due entirely to a decline in technological progress, or that it is due to a decline in the growth rate of combined factor inputs.

6.010 Blyth, C. A., and Hamer, P. "Output, Employment, and Productivity Growth in New Zealand Manufacturing Industries." *Productivity Measurement Review,* No. 41, May 1965.

Investigates some of the sources of growth in New Zealand's economy.

6.011 Bruton, Henry J. "Import Substitution and Productivity." *Journal of Development Studies,* Vol. 4, No. 3, April 1968, pp. 306-326.

After broadly defining the term "import substitution", the author examines possible approaches to a "successful" import substitution policy—one which contributes to raising the rate of growth of output without sowing at the same time the seeds of its own failure. The approach is based on divergent rates of growth of productivity among several sectors.

6.012 Bruton, Henry J. "Productivity Growth in Latin America." *American Economic Review,* Vol. 57, No. 5, December 1967, pp. 1099-1116.

Presents estimates of the rates of growth of capital, labor, and output for various time periods since 1940 for five Latin American countries. The contribution to growth of output by capital and labor is identified and subtracted from total output growth to give the productivity growth rate as a residual.

6.013 Chambers, E. J., and Gordon, D. F. "Primary Products and Economic Growth: An Empirical Measurement." *Journal of Political Economy,* Vol. 74, No. 4, August 1966, pp. 315-332.

The authors show that the increase in income to an economy from expansion in primary-product exports can be measured by the rents paid to specialized natural resources critical in the production of those exports. They calculate that Canadian prairie agriculture in the first decade of this century contributed a much smaller share to increases in income than past judgments indicated. They suggest that for most underdeveloped countries even large-scale expansion of primary-product exports cannot be expected to contribute substantially to increases in per-capita income.

6.014 Chao, Kang. *Rate and Pattern of Industrial Growth in Communist China.* Ann Arbor, University of Michigan Press, 1965. 188 pp.

Constructs indexes of industrial output for the period 1949-1959. Seeks to eliminate upward biases in indexes published by the Chinese government.

6.015 Christian, James W. "The Dynamics of Economic Growth, Technological Progress, and Institutional Change." *Journal of Economic Issues,* Vol. 2, No. 3, September 1968, pp. 298-311.

Argues that, with cyclical stabilization of the economy having been nearly attained, inquiry into structural stabilization should now be emphasized. Development of theory pertaining to institutional change is as necessary as theory pertaining to technological progress. Constructs a dynamic general equilibrium model of conditions for the full employment of capital and labor resources. The model is designed to highlight the interaction of technological progress and institutional change.

6.016 Clark, Colin. "The Fundamental Problem of Economic Growth." *Welt Wirtschaftliches Archiv,* Vol. 94, No. 1, March 1965, pp. 1-9.

Concludes that the most important factors in economic growth are not of a physical nature – natural resources or capital – but reside in human nature. Economists should abandon their preoccupation with capital investment as a source of growth and emphasize productivity resting on a variety of human and material factors – such as improvement in education, the development of the institutional framework, a dependable currency, a smoothly working banking and currency system, etc.

6.017 Colm, Gerhard, and Geiger, Theodore. *The Economy of the American People.* Third ed. Washington, National Planning Association, 1967. 220 pp.

The authors present an account of how the American economy operates and achieves high productivity and living standards, and what future problems it faces.

6.018 Cornwall, John. "Postwar Growth in Western Europe: A Re-evaluation." *The Review of Economics and Statistics,* Vol. 50, No. 3, August 1968, pp. 361-368.

Reviews several studies of postwar economic growth in Europe, with particular attention to the importance given to the role of capital formation.

6.019 Cukor, Gy. "Long-Term Planning and Technical Progress." *Acta Oeconomica,* Vol. 4, No. 3, 1969, pp. 239-258.

Investigates the conceptual and methodological problems in forecasting technical progress and analyzes the importance for prognosis of changes in patterns of production, consumption, and technology.

6.020 David, Paul A. "The Mechanization of Reaping in the Ante-Bellum Midwest," in *The Reinterpretation of American Economic History,* Robert W. Fogel and Stanley L. Engerman, eds. New York, Harper and Row, 1971, pp. 214-227.

Uses the example of the reaping machine to show how demand by the agricultural sector stimulated industrial growth and how industrial growth in turn stimulated the growth of agriculture.

6.021 David, Paul A. "Transport Innovation and Economic Growth: Professor Fogel on and off the Rails." *Economic History Review, 2nd Session,* Vol. 22, No. 3, December 1969, pp. 506-525.

Discusses critically the approach of Professor Fogel to the study of the impact of railroads upon economic growth in the United States, which was to investigate the extent of reduction in GNP had railroad service been withdrawn in 1890. Finds that Fogel's method involves drastic simplification and empirically unsubstantiated specifications of demand and supply elasticities in markets for transportable goods, that the benefit-cost analyses he offers are problematical, and that social benefits are underestimated. Concludes that, on the basis of Fogel's own estimates, the railroad gave rise to spectacular investment opportunities.

6.022 Davis, Lance E. "Capital Mobility and American Growth," in *The Reinterpretation of American Economic History,* Robert W. Fogel and Stanley L. Engerman, eds. New York, Harper and Row, 1971. pp. 285-300.

Discusses the institutions and institutional innovations which arose to overcome interregional and interindustry barriers to capital mobility.

6.023 Divatia, V. V., and Bhatt, V. V. "On Measuring the Pace of Development." *Banca Nazionale Del Lavor Quarterly Review,* Vol. 22, No. 89, June 1969, pp. 190-206.

The authors present a new method of measuring the pace of economic development in India, which is not adequately reflected by the growth rate in national income. They formulate an index of development potential, which shows a much more rapid rate of increase than national income, and reflects the rapid rate at which the process of structural transformation has taken place.

6.024 Eltis, W. A. "Capital Accumulation and the Rate of Industrialization of Developing Countries." *Economic Record,* Vol. 46, No. 114, June 1970, pp. 153-168.

Discusses conditions under which a developing country with an elastic labor supply can achieve rapid industrial growth at moderate capital costs.

6.025 Eltis, W. A. "Technical Progress, Profits, and Growth." *Oxford Economic Papers,* Vol. 20, No. 2, July 1968, pp. 162-194.

Examines the assumption that the rate of technical progress depends entirely on invest-

ment and not at all on the passage of time. Argues that the annual rate of technical progress varies proportionately with the share of gross investment in GNP, and that any steady growth rate is a possible one, even with a constant labor force.

6.026 Enke, Stephen. "The Economic Aspects of Slowing Population Growth." *Economic Journal,* Vol. 76, No. 301, March 1966, pp. 45-56.

Argues that per capita incomes have not been increasing in many countries because productivity per worker has not increased and capital per worker has not expanded. Argues that greater effort should be made to retard population growth and less to accelerate output.

6.027 Erlich, Alexander. "Development Strategy and Planning: The Soviet Experience," in *National Economic Planning,* Max F. Millikan, ed. New York, National Bureau of Economic Research, 1967. pp. 233-278.

Examines the impact of centralized planning upon economic growth in the Soviet Union. A comment by Abram Bergson follows.

6.028 Fellner, William. "Measures of Technological Progress in the Light of Recent Growth Theories." *American Economic Review,* Vol. 57, No. 5, December 1967, pp. 1073-1098.

Shows that growth of capital and output at the same rate, with a constant rate of interest, is possible in two ways: (a) If there is a Cobb-Douglas function; (b) if there is a more general constant elasticity of substitution (CES) function but innovations are slanted to make use of the more scarce factor. Argues that the second form is a more accurate representation of the reality of U.S. growth.

6.029 Goddard, Frederick Owen. *A Two-Sector Model of Economic Growth with Technological Progress.* University of Florida Monographs, Social Sciences, No. 36. Gainsville, Fla., University of Florida Press, 1969. 62 pp.

Examines the long-run equilibrium growth path of a two-sector model of economic growth, using an activity analysis approach with real outputs and commodity price variables. Discusses neoclassical, Solow-Swan, Kaldor, and Pasinetti saving assumptions and examines the effects of technological progress on stability and growth rates.

6.030 Guha, A. "Accumulation, Innovation, and Growth under Conditions of Disguised Unemployment." *Oxford Economic Papers,* Vol. 21, No. 3, November 1969, pp. 360-372.

Argues that even with zero marginal labor product in agriculture, labor can be drawn into industry only by a fixed wage just sufficient to offset the cost of moving. If incomes grow with rising industrial output but agricultural output remains constant, food prices will rise and workers will seek to protect their real wages. With static technology, rising wages spell declining rates of profits and decelerating growth.

6.031 Hamberg, Daniel. *Models of Economic Growth.* New York and London, Harper and Row, 1971. 246 pp.

An advanced text discussing Harrod-Domar and other growth models.

6.032 Harbison, Frederick R.; Maruhnic, Joan; and Resnick, Jane R. *Quantitative Analysis of Modernization and Development.* Princeton, N.J., Industrial Relations Section, Princeton University, 1970. 224 pp.

The authors argue that development cannot be measured by economic growth indicators alone. Cultural, educational, health, and political factors should be considered and quantitative indicators developed for these variables.

6.033 Hicks, John. *Capital and Growth.* Oxford, England, Clarendon Press, 1965. 343 pp.

Reviews the methods of dynamic economics. Presents theoretical discussions of growth equilibrium and optimum growth.

6.034 Hill, T. P. *The Measurement of Real Product, A Theoretical and Empirical Analysis of Growth Rates for Different Industries and*

Countries. Paris, Organization for Economic Cooperation and Development, February 1971. 119 pp.

Discusses the theoretical and practical problems involved in measuring the growth of real product. Compares industry growth with national growth, finding little relationship between the two in many instances. Analyzes the effects of alternative methods of measurement of growth rates.

6.035 Holmes, R. A. "Factor Inputs, Technological Progress and Economic Growth in Canada." *The Western Economic Journal,* Vol. 4, No. 3, Summer 1966, pp. 247-260.

Refines Abramowitz's total factor productivity model, and uses it to estimate productivity in some of the major sectors of the Canadian economy between 1941 and 1961. Concludes that technical change (as opposed to simple increase in factor inputs) was responsible for at least one-third of the increase in output in all sectors examined.

6.036 Kaplan, Norman M. "Retardation in Soviet Growth." *The Review of Economics and Statistics,* Vol. 50, No. 3, August 1968, pp. 295-303.

Presents data on the decline in the economic growth rate of the Soviet Union. Explains the decline tentatively in terms of a decline in the rate of increase in factor productivity. Suggests that the decline may reflect changes in the efficiency of economic organization after 1958, resulting in less emphasis on the quantitative aspects of resource allocation.

6.037 Kennedy, Kieran A. *Productivity and Industrial Growth: The Irish Experience.* Oxford, England, Clarendon Press, 1971. 276 pp.

Analyzes the causes of differences among manufacturing industries in the growth of labor productivity, and the association between longer term changes in productivity and output, with special reference to the Irish manufacturing industry.

6.038 Kim, Y. C. "Sectoral Output-Capital Ratios and Levels of Economic Development: A Cross-Sectional Comparison of Manufacturing Industry." *The Review of Economics and Statistics,* Vol. 51, No. 4, November 1969, pp. 453-458.

Using data in 2-digit and 3-digit manufacturing industries in a number of developed and undeveloped countries, the author shows empirically that output-capital ratios are not inversely related to the level of economic development.

6.039 Kindleberger, Charles P. "French Planning," in *National Economic Planning,* Max F. Millikan, ed. New York, National Bureau of Economic Research, 1967, pp. 278-303.

Examines the role of planning in terms of postwar economic growth in France, and how it differs from other aspects of economic policy. A comment by Stanislaw Wellisz follows.

6.040 Kindleberger, Charles P. *Europe's Postwar Growth: The Role of Labor Supply.* Cambridge, Mass., Harvard University Press, 1967. 270 pp.

Argues that high European growth rates since World War II have been chiefly due to large supplies of labor Believes that this supply is now being exhausted, and growth will soon slow to more normal rates.

6.041 Kurihara, Kenneth K. *The Growth Potential of the Japanese Economy.* Baltimore, Johns Hopkins Press, 1971. 148 pp.

Analyzes the fundamental forces underlying present and future Japanese economic growth. Deals with consumption, savings, private investment, and labor shortages.

6.042 Kuznets, Simon. *Economic Growth of Nations: Total Output and Production Structure.* Cambridge, Mass., Harvard University Press, 1971. 363 pp.

Reviews historical growth trends in major developed countries and several developing economies.

6.043 Kuznets, Simon. "Notes on the Pattern of U.S. Economic Growth," in *The Reinterpretation*

of American Economic History, Robert W. Fogel and Stanley L. Engerman, eds. New York, Harper and Row, 1971, pp. 17-24.

Compares growth in population, labor force, product per capita, and product per worker in the United States with other developed countries. Discusses characteristics of long-term U.S. growth and the variability of U.S. growth rate.

6.044 Lal, Brij Bhushan. *Industrial Productivity and Economic Growth.* Allahabad, India, Chaitanya Publishing House, 1965. 390 pp.

Reviews India's productivity performance, noting why and how this performance must be improved.

6.045 Makdisi, S. A. "Syria: Rate of Economic Growth and Fixed Capital Formation 1936-1968." *The Middle East Journal,* Vol. 25, No. 2, Spring 1971, pp. 157-179.

Reviews and comments on Syrian economic developments.

6.046 Minami, R. "The Turning Point in the Japanese Economy." *Quarterly Journal of Economics,* Vol. 82, No. 3, August 1968, pp. 380-402.

Seeks to discover at what point in its development Japan had "unlimited supplies of labor" available.

6.047 Neher, Philip A. *Economic Growth and Development: A Mathematical Introduction.* New York, John Wiley and Sons, 1971. 32 pp.

A college text, presenting analyses of macroeconomic theory, mathematical economics, and economic growth and development on an intermediate level.

6.048 Nelson, Richard R. "The CES Production Function and Economic Growth Projections." *The Review of Economics and Statistics,* Vol. 47, No. 3, August 1965, pp. 326-328.

Finds that the constant elasticity of substitution production function is more useful than the Cobb-Doublas production function only where the capital-output ratio is changing rapidly.

6.049 Nowshirrani, V.F. The Regional and Cropwise Patterns of the Growth of Per-Acre Output in India." *Bulletin.* Oxford University Institute of Economics and Statistics, Vol. 32, No. 1, February 1970, pp. 59-79.

Analyzes the rates of growth per acre for different crops in different regions. Argues that economic forces rather than social and institutional factors are significantly correlated with growth.

6.050 Organization for Economic Cooperation and Development. *Agriculture and Economic Growth.* A Report by a Group of Experts. Paris, OECD, 1965. 121 pp.

Deals with the prospects for agricultural development, emphasizing its role in economic growth. Suggests policies for increasing agricultural productivity and improving both the national and international allocation of agricultural resources.

6.051 Organization for Economic Cooperation and Development. *Economic Growth, 1960-1970: A Mid-Decade Review of Prospects.* Paris, OECD, 1966. 113 pp.

Reviews economic growth between 1960 and 1965, and discusses growth problems anticipated for the latter part of the decade.

6.052 Organization for Economic Cooperation and Development. *Food Marketing and Economic Growth.* Paris, OECD, 1970. 130 pp.

Analyzes developments in food distribution since World War II. Explores the interdependence of those developments with agricultural and national economic growth.

6.053 Organization for Economic Cooperation and Development. *Productivity and Economic Planning.* Paris, OECD, 1970. 323 pp.

A compendium of papers on the numerous national productivity bodies established after World War II and their contributions to economic planning.

6.054 Organization for Economic Cooperation and Development. *The Growth of Output, 1960-1980.* Paris, OECD, December 1970. 280 pp.

Reviews growth and factors affecting it in member countries during the 1960's. Evaluates their growth potential and the difficulties likely to be encountered in managing growth through the 1970's.

6.055 Organization for Economic Cooperation and Development. *The Outlook for Economic Growth.* Paris, OECD, May 1970. 40 pp.

Summarizes a longer report on the economic growth of member countries during the 1960's, their prospects for growth in the 1970's, and the difficulties in economic management they are likely to encounter.

6.056 Ramachandra, N.; Lee, Tieh-Sheng; Mehta, P. C.; and Hou, Chia-Chu. *Role of Productivity in Asian Economic Growth.* Tokyo, Asian Productivity Organization, 1970. 186 pp.

A series of essays dealing with the significance of productivity as well as of nonproductivity factors (including attitudes towards work and change) to economic growth.

6.057 Schuh, G. Edward; Nair, Kusum; and Owen, Wyn F. "Implications of the Green Revolution for Economic Growth." *American Journal of Agricultural Economics,* Vol. 52, No. 5, December 1970, pp. 719-722.

The authors discuss the impact of technological developments in agriculture on the economies of less developed nations.

6.058 Schultz, Robert S. "Understanding Economic Growth." *Harvard Business Review,* Vol. 44, No. 6, November-December 1966, pp. 32-34+.

Defines the major factors determining growth and outlines the businessman's role in promoting growth.

6.059 Stiglitz, Joseph and Uzawa, Hirofumi. *Readings in Modern Theory of Economic Growth.* Cambridge, Mass., MIT Press, 1969. 497 pp.

A collection of papers dealing with basic growth models, production functions, and institutional theory.

6.060 Thompson, E. J. "Productivity: Major Element in Economic Change?" *Productivity Measurement Review,* August 1965, pp. 23-30.

Suggests that productivity change is not as large an element in economic change as it is usually taken to be.

6.061 Thorbecke, Erik, ed. *The Role of Agriculture in Economic Development.* New York, National Bureau of Economic Research, 1969. 480 pp.

A collection of papers discussing the relation of agriculture to other sectors of national economies and the transformation of traditional agriculture in Russia, China, Japan, Brazil, and Peru.

6.062 Thurow, Lester C., and Taylor, Lester D. "The Interaction Between the Actual and the Potential Rate of Growth." *The Review of Economics and Statistics,* Vol. 48, No. 4, November 1966, pp. 351-360.

The authors present a method for analyzing the interaction between the actual and the potential rate of growth of the American economy from 1949 to 1970. The method makes use of production function analysis to estimate the potential growth of productivity.

6.063 U.S. Department of Commerce, Bureau of the Census. *Long Term Economic Growth, 1860-1965.* 1966. 256 pp.

Includes approximately 400 annual economic time series and nearly 800 component series that are useful for studying economic growth. Presents basic measures of economic growth, and deals with factors vitally related to economic growth. Also shows long-range regional and industry growth trends, and compares U.S. economic growth with that of 6 major foreign countries.

6.064 U.S. Department of Labor, Bureau of Labor Statistics. *Projections 1970: Interindustry*

Relationships, Potential Demand, Employment, BLS Bulletin 1536, 1966. 155 pp.

Discusses assumptions and methodology of projections based on input-output matrices. Representing an effort to develop a framework for analyzing long-term growth trends and their implications for policy, the work is a phase of the Interagency Growth Study Project.

6.065 U.S. Department of Labor, Bureau of Labor Statistics. "The U.S. Economy in 1980: A Preview of BLS Projections." *Monthly Labor Review,* Vol. 93, No. 4, April 1970, pp. 3-34.

Presents estimates of the labor force, growth in the economy, and employment by industry and occupation. Discusses prospective gains in productivity by major sectors.

6.066 U.S. Secretary of Labor James D. Hodgson. *Speech* before the National Association of Manufacturers, New York, December 3, 1970. 25 pp.

Argues that resource savings from increased productivity will allow the United States to combat poverty, clean up pollution, and enhance leisure without reducing present consumption.

6.067 Vanek, Jarasslow. "A Theory of Growth with Technological Change." *American Economic Review,* Vol. 57, No. 1, March 1967, pp. 73-89.

Explores a growth theory incorporating technical progress saving labor and capital in equal proportions, as well as growth in productive resources. Includes growth theories formulated by Harrod, Domar, and Solow as special cases.

6.068 Vanek, Jarasslow. "Towards a More General Theory of Growth with Technological Change." *The Economic Journal,* Vol. 76, No. 304, December 1966, pp. 841-854.

Explores theories of growth with autonomous capital-augmenting and labor-augmenting (i.e., non-neutral) innovation, while retaining the conventional assumption of constant returns to scale.

VII. Theses and dissertations

Asher, Ephraim. *Relative Productivity, Factor Intensity and Technology in the Manufacturing Sectors of the U.S. and U.K. During the Nineteenth Century.* Thesis presented to the University of Rochester, 1970. 174 pp.

Compares productivity and technology, particularly in the textile industry. Finds capital and labor in the United States to be more productive than in the United Kingdom, and U.S. technology to be biased toward labor saving.

Attiyeh, Richard E. *Estimation of a Fixed Coefficient Vintage Model of Production.* Doctoral thesis presented to Yale University, 1966. 63 pp.

Interprets the growth in output and changes in factor productivity in U.S. manufacturing by means of a model which disaggregates capital into vintages, each with its own fixed production coefficients.

Ban, Sung Hwan. *The Long-Run Productivity Growth in Korean Agricultural Development, 1910-1968.* Doctoral thesis presented to the University of Minnesota, 1971. 243 pp.

Finds increasing productivity gains in the post World War II period after a poor prewar productivity performance.

Behr, Michael R. *Technical Progressiveness in the Agricultural Processing Sector: A Structural Analysis.* Thesis presented to the University of Wisconsin, 1969. 218 pp.

Presents a cross-sectional study of the effects of industry structure and firm characteristics on technological change. Finds some support for Schumpeter's theory of innovation.

Belinfante, Alexander E. *Technical Change in the Steam Electric Power Generating Industry.* Thesis presented to the University of California at Berkeley, 1969. 190 pp.

Examines the effects of embodied and disembodied technological change, returns to scale, and capital depreciation on overall technological progress.

Chandrasekar, Krishnamurti. *U.S. and French Manufacturing Productivity and Competition in the World*

Market: A Study in the Theory of Comparative Cost. Doctoral thesis presented to the New School for Social Research, 1969. 182 pp.

Reexamines the theory that, as between two countries, each will export those goods for which the ratio of its output per worker to that of the other's exceeds the ratio of its money wage rate to that of the other's. Finds a significant relationship between productivity differentials and exports, but not between wage differentials and exports.

Chung, William K. *A Study of Economic Growth in Postwar Japan for the Period of 1952-1967: An Application of Total Productivity Analysis.* Doctoral thesis presented to the New School of Social Research, 1971. 290 pp.

Quantifies the sources of Japanese economic growth. Attributes its record of rapid growth to an abundance of well-educated labor, to generous capital and research investment, and to manpower shifts from the agricultural sector.

Cox, William A. *Manpower and Productivity in Austrian Industry.* Doctoral thesis presented to Princeton University, 1968. 148 pp.

Examines sources of output growth in Austria from 1956 to 1964, concluding that nearly one-half of the increased output was due to substitution of capital for labor. One-third was due to technical progress and one-sixth to increases in the quality and quantity of labor inputs.

Daniels, Mark R. *International Differences in Productive Efficiency.* Doctoral thesis presented to Johns Hopkins University, 1966. 159 pp.

Estimates industry productivity in eight developing nations.

Day, Ernest H. *An Empirical Study of the Influence of Inventive Activities on Value Added per Man-Hour, Sales and Investments in the Chemical and Allied Products Industry.* Doctoral thesis presented to the American University, 1969. 220 pp.

Finds inventive activities, as measured by number of patents and by investment in all phases of research and development, to be highly significant explanatory variables of value added per man-hour when time lags are allowed for. Estimates the lags to run from 2 to 5 years.

Eldor, Dan. *An Empirical Investigation of Hospital Output, Input, and Productivity.* Doctoral thesis presented to New York University, 1969. 226 pp.

Presents a case study of a large New York City hospital and a cross-sectional study of short-term, general U.S. hospitals. Finds a negative trend in productivity in both cases.

Engberg, Vernon, L. *Agricultural Productivity and Economic Development in Mexico.* Thesis presented to the University of Texas at Austin, 1970, 284 pp.

Explores the factors determining agricultural output in Mexico.

Erlichman, Shmuel. *The Attitude of Trade Unions Toward Productivity: The Cases of Norway, Israel, and Ghana.* Doctoral thesis presented to the New School for Social Research, 1966. 363 pp.

Argues that although unions speak in favor of increased productivity, in practice they often impede productivity improvements.

Farmer, Berkwood M. *Man-Hour Productivity and Future U.S. Agricultural Adjustment.* Doctoral thesis presented to North Carolina State University at Raleigh, 1970. 132 pp.

Analyzes the long-run effects of technological change on output and labor inputs and predicts the resulting price and income changes within agriculture.

Fernandez, Anibal. *Productivity and Technological Progress of the Venezuelan Petroleum Industry.* Doctoral thesis presented to the University of Pittsburgh, 1971. 205 pp.

Offers estimates of average annual increases in productivity. Finds that gains are distributed to workers in the form of higher wages, or appropriated by the government.

Fishelson, Gideon. *Returns to Human and Research Capital, United States Agriculture 1949-1964.* Doctoral thesis presented to the North Carolina State University at Raleigh, 1968. 121 pp.

Estimates the rates of return on investments in education, training, and research in U.S. agriculture. Finds them to run above those prevailing in the economy in general.

Flueckiger, Gerald E. *The Structure and Behavior of Technological Change in the Iron and Steel Industry: 1700-1899.* Doctoral thesis presented to Purdue University, 1970. 206 pp.

Describes organizational and production processes, and how they changed.

Foster, Bennett B. *Dynamic Production Paths and Labor Productivity Trends: A Comparative Study of the Major Timber-Based Industries of the South and the West Coast.* Doctoral thesis presented to Duke University, 1966. 183 pp.

Finds that productivity in the lumber, plywood, and lumber-based industries runs at or above the total manufacturing rate. Disputes the contention that wood-based industry is suffering from increased relative output costs.

Gemery, Henry A. *Productivity Growth, Process Change and Technical Change in the U.S. Glass Industry.* Doctoral thesis presented to the University of Pennsylvania, 1967. 206 pp.

Identifies the conditions under which changes in industry production techniques may be related to labor productivity growth. Undertakes to measure the impact of technical change on the U.S. glass industry.

Grossman, Philip. *Hours and Output: The Reduction in the Soviet Workweek, 1956-1960.* Thesis presented to the American University, 1970. 182 pp.

Assesses the consequences for productivity of the workweek reduction in Soviet industry from 48 to 41 hours in 1960. Finds that productivity did not increase sufficiently to offset lost work hours, especially in heavy industry.

Hanieski, John F. *An Explanatory Model of Technologically New Products.* Thesis presented to Purdue University, 1970. 206 pp.

Explores technological change at the level of the firm.

Hansen, John R. *The Acquisition of Technology for Development.* Doctoral thesis presented to the University of Colorado, 1970. 385 pp.

Identifies and evaluates factors critical to successful acquisition of technology at lowest cost.

Hayashi, Kichiro. *Technical Change in Japan–Its Measurement.* Thesis presented to Indiana University, 1970. 189 pp.

Examines the sources of Japan's rapid economic growth and compares Japanese with American and Canadian growth patterns. Finds interindustry shifts an important factor in productivity gains in Japan.

Hyde, Charles K. *Technological Change and the Development of the British Iron Industry, 1700-1870.* Doctoral thesis presented to the University of Wisconsin, 1971. 355 pp.

Reviews technological changes in the industry. Shows that changes in the relative costs of different iron-making processes explain both the timing and the speed of their adoption.

Kleiman, Herbert S. *The Integrated Circuit: A Case Study of Product Innovation in the Electronics Industry.* Doctoral thesis presented to George Washington University, 1966. 260 pp.

Reviews the introduction of the integrated circuit, with special emphasis on the role of government in the innovation process.

Larvas, Jose M. *Output Growth, Technological Change and Employment of Resources in Philippine Agriculture: 1948-1975.* Doctoral thesis presented to Purdue University, 1968. 288 pp.

Identifies the sources of farm growth from 1948-1960, and estimates the agricultural output that will be required by the economy in 1975, as well as alternate combinations of resources needed to meet these requirements.

Lee, Joe Won. *The Impact of Technological Change on the Functional Distribution of Income.* Doctoral thesis presented to the City University of New York, 1969. 195 pp.

Assesses the impact of continuous factor-augmenting technological change on the relative factor shares at the level of two-digit manufacturing industries.

Lorant, John H. *The Role of Capital-Improving Innovations in American Manufacturing During the 1920's.* Doctoral thesis presented to Columbia University, 1966. 311 pp.

Attributes a sharp increase in capital productivity between 1919 and 1929 to a great wave of relatively minor technological advances and to the introduction of mass-production techniques.

Mayer, Peter C. *Technical Change in the Typesetting of Daily Newspapers.* Doctoral thesis presented to the University of California at Berkeley, 1969. 175 pp.

Investigates the effect of wage rates, unionization, and conditions in the equipment market on innovation. Examines the impact of innovative equipment on wages and the frequency of newspaper publication.

Meyer, Robert A., Jr. *Optimal Policies for Equipment Replacement with Stochastic Technological Change.* Doctoral thesis presented to Stanford University, 1969. 135 pp.

Discusses factors affecting the decision to innovate, and presents a rule for deciding when to introduce more advanced equipment.

Mintcheff, Alexander. *Technological Change: A Demand-Pull Model.* Doctoral thesis presented to the University of Cincinnati, 1968. 127 pp.

Argues that innovations are guided primarily by the profit motive, and that there is a tendency toward inventing devices that would substitute for the factor that is relatively more scarce at a given time.

Mitchell, Edward J. *An Econometric Study of International and Interindustrial Differences in Labor Productivity.* Doctoral thesis presented to the University of Pennsylvania, 1966. 121 pp.

Argues that a particular production function exists for each industry. Develops a model which describes the general pattern of labor productivity and wages, as well as of international trade.

Nowill, Paul H. *Productivity and Technological Change in Electric Power Generating Plants.* Doctoral thesis presented to the University of Massachusetts, 1971. 224 pp.

Develops a composite production function, eliminating the assumption of constant elasticity of substitution, thus seeking to explain the existence of several production technologies in an industry at one time.

Obermiller, Frederick W. *Factors Associated with Agricultural Development and Growth in Latin America.* Doctoral thesis presented to the University of Missouri, Columbia, 1969. 373 pp.

Offers empirical evidence showing that increases in productivity depend primarily on increased quality (as measured by literacy) and quantity of labor, and on increased credit extended to agriculture. Argues that mechanization has had a negative influence on productivity.

Oh, Moonsong. *The Role of International Corporations in the Transfer of Technology to Developing Countries.* Doctoral thesis presented to the University of Pennsylvania, 1970. 291 pp.

Analyzes and evaluates the process by which technology is transferred to developing countries. Cites expatriate personnel and training programs for indigenous workers as the primary transfer vehicles.

Petersen, Dietrick L. *The Economic Effects of Technological Innovations on Class I Line-Haul Railroads 1947-1963.* Doctoral thesis presented to the University of Pittsburgh, 1968. 322 pp.

Finds that rapid technological change increased labor productivity and reduced material requirements, but failed to increase the rate of return on investment. Argues that modernization efforts were concentrated on cost reduction rather than on expansion of capacity.

Reinfeld, William. *An Economic Analysis of Recent Technological Trends in the United States Steel Industry.* Doctoral thesis presented to Yale University, 1968. 184 pp.

Examines the relation of firm size to willingness to explore new technologies. Finds that the largest steel makers have been more interested in market-oriented changes designed to increase gross revenues, while the smaller firms have been more concerned with cost-reducing innovation.

Rettig, Raymond B. *Productivity Change in the Transmission of Electricity.* Doctoral thesis presented to the University of Washington, 1969. 71 pp.

Analyzes the importance of economies of scale, factor substitution, and technological change in the transmission of electricity.

Reynolds, William A. *Innovation in the United States Carpet Industry, 1947-1963.* Doctoral thesis presented to Columbia University, 1967. 283 pp.

Presents an empirical analysis of the origin, diffusion, and economic results of technological innovation. Finds that the introduction of new tufting processes and of man-made fibers caused significant changes in industry structure and product price.

Scheppach, Raymond C., Jr. *A Canadian-United States Productivity Comparison.* Doctoral thesis presented to the University of Connecticut, 1970. 153 pp.

Compares total postwar factor productivity in the United States and Canada. Examines the effects of reduced trade barriers between the two countries on productivity.

Schlenher, Robert E. *Health Improvements and Economic Growth: Neoclassical Theory and the Puerto Rican Experience.* Doctoral thesis presented to the University of Michigan, 1968. 128 pp.

Views public health programs as investments in human capital and examines their effect on per-capita output.

Shen, Tsung-yuen. *A Quantitative Study of Production in the American Textile Industry.* Doctoral thesis presented to Yale University, 1966. 289 pp.

Finds a long lag between the introduction of new technology in the industry and widespread indifference toward innovation.

Sonny, Jacob. *Technological Change in the U.S. Machine Tool Industry.* Doctoral thesis presented to the New School of Social Research, 1971. 238 pp.

Attributes lagging technological change in the industry to slow replacement of aged machine tools due to product durability and to widely fluctuating demand for the industry's output.

Sosin, Helen K. M. *Technological Aspects of Economic Growth: Demand-Induced Technical Progress.* Doctoral thesis presented to the University of Nebraska, 1970. 144 pp.

Argues that technological improvements in capital goods are induced by their producers' expectations of rising demand, and that therefore technological change should be conceived as an endogenous rather than as an exogenous variable in production functions.

Stephens, John K. *Differentiation of Labor in Macro-economic Growth Models.* Doctoral thesis presented to the University of Illinois, 1967. 233 pp.

Estimates the parameters of several growth models, postulating a non-homogeneous labor force. Labor is differentiated by skill level, by education, or by time in the labor force.

Stephenson, Matthew A. *The Role of Technological Change in the English Classical School of Economics.* Doctoral thesis presented to Tulane University, 1965. 293 pp.

Examines the works of economists from Adam Smith to John Stuart Mill. Disputes the modern view that classical economists ignored the effects of technological change.

Sveikauskas, Leopold A. *Capital-Labor Substitution and Efficiency in United States Manufacturing.* Thesis presented to Yale University, 1969. 341 pp.

Examines the conditions associated with high efficiency in each 2-digit U.S. manufacturing industry. Finds that science, technology, and education are the key sources of efficiency.

Yan, Chiou-Shuang J. *Technical Change and Investment.* Doctoral thesis presented to Purdue University, 1966. 191 pp.

Investigates the relationship between investment and the rate of embodied technological change. Estimates the relative importance of embodied and disembodied technological change.

Zarka, Muhammed. *Product, Capital, and Productivity in Syrian Agriculture.* Doctoral thesis presented to the University of Pennsylvania, 1969. 209 pp.

Develops a continuous time series for product and capital. Uses a Cobb-Douglas production function to measure total factor productivity.

VIII. Bibliographies, annual reports, etc.

Asian Productivity Organization. *Dissemination of Knowledge Series.* Tokyo, Asian Productivity Organization, 1964- ; irregular.

Presents summaries of articles on productivity and related subjects which have appeared in publications of member and nonmember countries. Also devotes entire issue to subjects pertinent to productivity improvement.

Canada, Economic Council of Canada. *Annual Review.* Ottawa, Queen's Printer, 1964- .

Published annually, the *Review* presents discussions of, and data on, economic trends and policy. Each report deals extensively with a particular theme, e.g., prices, productivity, and employment; Canada's position in the world economy; economic goals; performance of major sectors, etc.

Economic Report of the President (together with the Annual Report of the Council of Economic Advisers). Washington, U.S. Government Printing Office, 19 .

Issued annually, the *Economic Report* regularly discusses developments in productivity, labor costs, and related topics.

Educational Technology. Englewood Cliffs, N.J.: Educational Technology Publications, Inc. Monthly. 1961 to date.

A periodical regularly presenting articles on the relation between technology and education, and the use of technology in education.

Harrison, Annette. *Bibliography on Automation and Technological Change and Studies of the Future.* Rand Corporation Paper, P-3365. Santa Monica, California, Rand Corporation, 1966. 24 pp.

Kennedy, Charles, and Thirlwall, A. P. "Surveys in Applied Economics: Technical Progress." *The Economic Journal,* March 1972.

Presents as an appendix of this survey article an authoritative bibliography of works bearing on the title theme.

Kreps, Juanita, and Laws, Ralph. *Automation and the Older Worker.* An annotated bibliography prepared for the Committee on Employment and Retirement of the National Council on the Aging. New York, N.Y., The National Council on the Aging, 1963. 49 pp.

The authors present titles on the effect of technological advance on job opportunities for all workers; data on age-related differences in the capacities of workers; policy implications of automation as related to employment; and background material pertaining to automation and to older workers.

Kussow, Omar, and Dunwiddie, William. *Instructional Materials on Productivity and Automation: An Annotated Bibliography, A Descriptive List of Films.* Madison, Center for Productivity Motivation, University of Wisconsin, 1965. 14 pp.

Presents an annotated list of titles designed chiefly for classroom use. Also contains a list of relevant films.

Manpower Report of the President (including a Report on Manpower Requirements, Resources, Utilization, and Training by the U.S. Department of Labor). Washington, U.S. Government Printing Office. 19 .

Issued annually since 1963, the *Manpower Report* deals primarily with manpower requirements, resources, utilization, and training. Developments in productivity and related subjects are usually also discussed.

New Literature on Automation. Amsterdam, Stitching The Netherlands Studiecentrum voor Informatica. Monthly. 1960 to date.

A periodical presenting listings of current publications on computer technology, information theory, the consequences of automation, and related subjects. Listings are annotated.

United Nations. *Industrialization and Productivity.* Bulletin. New York, United Nations, 1958 to date.

Published at irregular intervals, this series presents articles on problems of industrial development in technologically less advanced countries.

U.S. Department of Labor, Bureau of Labor Statistics. *BLS Publications on Productivity and Technology.* 1972. 16 pp.

Contains citations of articles and reports from 1960 to 1971.

U.S. Department of Labor, Bureau of Labor Statistics. *Monthly Labor Review.* Washington, U.S. Government Printing Office.

Regularly publishes original articles on concepts, trends, and the sources of productivity, as well as on

other subjects relating to productivity and technological change. Lists new publications on productivity each month under "Book Reviews and Notes–Other Publications–Productivity and Technological Change."

U.S. Department of Labor, Bureau of Labor Statistics. *Productivity: A Bibliography,* BLS Bulletin 1226, 1958. 182 pp. (Out of print but available at many libraries that are depositories for Government publications.)

An annotated bibliography of books and references on productivity published through June 1957.

Presents annotated citations of measures of productivity by industry and economic sector; studies of productivity at the plant level; international comparisons of productivity, factors affecting productivity; the relation of productivity to the economy as a whole, and to wages and prices; and productivity and labor-management relations. Also contains a list of bibliographies and of doctoral dissertations and theses on the subject. Period covered generally extends from 1953 to mid-1957, but some references dating from prior to 1953 are included.

U.S. Department of Labor, Bureau of Labor Statistics. *Productivity: A Bibliography,* BLS Bulletin 1514, 1966. 129 pp.

Presents annotated citations of books, reports, and articles on productivity concepts and measurements; factors affecting productivity; productivity levels and trends in various economic sectors; international productivity comparisons; the relation of productivity to the economy; and a list of bibliographies. Period covered extends from mid-1957 to 1964.

U.S. Department of Labor, Library. *The Shorter Workweek; Selected References,* N.S. No. 5, 1965. 15 pp.

Lists titles on real wages, hours, leisure preference, and pertinent legislation.

Author Index

(Authors of theses and dissertations are not included.)

Adams, Dale W. 3.136
Adams, W. J. 3.221
Adelman, Edwin 2.001, 2.067
Ahmad, Syed 3.222
Aigner, D. J. 1.001
Alburo, Florian A. 2.002
Aliber, Robert Z. 4.067
Almon, Clopper, Jr. 6.001
Alterman, Jack 1.002, 5.001, 6.002, 6.003, 6.004
Ammer, Dean S. 5.003
Anderson, W.H.L. 1.004
Anton, Frank R. 4.001
Ardolini, Charles W. 2.001, 2.003, 2.067
Argy, V. 4.002
Arnfield, R. V. 3.102
Aronson, Robert L. 5.004
Arrow, Kenneth J. 3.223
Arvidsson, G. 3.224
Atkinson, Anthony B. 3.103
Auer, L. 2.004, 2.005
Ayres, Robert V. 3.104

Baerwaldt, Nancy 3.026
Bagrit, Sir Leon 3.105
Baldwin, Robert E. 6.005
Ball, Claiborne M. 2.006, 2.007, 2.008
Ball, Robert 2.009, 3.106, 5.089
Banerji, Ranadev 3.218
Baranson, Jack 3.107
Bardwell, George E. 5.006
Barkin, Solomon 5.007
Barnes, Irston R. 4.003
Bartsch, W. H. 3.001
Bateman, Fred 2.010
Bauer, L.L. 5.008
Bauer, Raymond A. 5.009
Becker, Gary S. 3.002
Becker, S. W. 3.071, 3.225
Beckmann, Martin J. 1.005
Behman, Sara 2.011
Bell, F.W. 2.012
Beller, Irving 4.004, 4.005
Ben-Porath, Yoram 3.003
Bennett, E. C. 3.108
Berglas, Eitan 1.006
Bergson, Abram 2.013
Berri, L. 6.006
Bertram, Gordon W. 3.004
Besen, S. M. 3.005
Bhatt, V. V. 6.023
Bhattacharyya, M. A. 6.007
Bjeda, K. 3.006
Black, Guy 3.232
Blackett, P. M. S. 6.008
Blakeman, L. T. 4.006
Blase, M. G. 3.138
Blaug, Mark 2.114, 3.007
Bliss, Charles A. 4.007
Blitzer, C. R. 6.009
Bloom, Gordon F. 4.008
Blyth, C.A. 6.010
Bock, Betty 3.072, 3.073, 3.074
Bodkin, Ronald G. 4.009
Bonwick, George J. 5.010
Borch, Karl 1.007
Bossler, W. 2.014
Bottomley, A. 4.010, 4.049
Bowen, Howard R. 5.011
Bowles, S. S. 3.008
Bowman, Mary Jean 3.009, 3.010
Braae, G. P. 1.008
Brady, Dorothy 2.015
Brand, Horst 4.011
Bright, James R. 3.109
Briscoe, G. 1.009
Bronfenbrenner, Martin 4.012
Brooks, George W. 3.110
Brown, Lester R. 3.111, 3.112
Brown, Murray 1.010, 3.113
Brown, R. H. 3.226
Brubaker, E. R. 1.011
Bruton, Henry J. 6.011, 6.012
Buck, P. B. 5.012
Buckingham, G. L. 4.052
Burck, Gilbert 2.016
Burns, Leland S. 3.061

Bush, George P. 3.114
Butler, Gavan 3.218
Butterworth, Jack 3.075
Bynum, Alice L. 2.017

Caplan, Stanley H. 3.121
Capron, William M. 3.115
Carey, John L. 2.019, 2.020, 2.021, 2.022
Carroll, Jean 3.227
Carter, Anne P. 3.116, 3.117
Chambers, E.J. 6.013
Chandler, John H. 4.014, 4.015
Chang, W. W. 3.118
Chao, Kang 3.067, 6.014
Chien, W. 4.043
Childs, Rex E. 2.023
Christensen, Eric 5.015
Christensen, L. R. 1.012, 1.013
Christian, James W. 6.015
Chu, S. F. 1.001
Clark, Colin 6.016
Cleaver, Joe M. 2.024
Close, Guy C., Jr. 4.016
Cohn, Edward A. 2.025
Colm, Gerhard 6.017
Colyer, D. 3.138
Comanor, William S. 3.229
Cooper, Joseph D. 3.230
Cordtz, Dan 2.026
Cornwall, John 6.018
Cottrell, Fred 5.016
Cox, R. W. 5.010
Creamer, Daniel 1.058
Critchlow, Robert V. 3.120
Crossman, E. R. F. W. 3.121, 5.017
Cukor, Gy 6.019

Dacy, Douglas C. 2.027
Dahmen, Erik 3.077
Dalrymple, Dana G. 3.122
Daly, D. J. 2.028, 2.029
Daniels, Mark R. 1.014
David, Paul A. 1.015, 3.123, 6.020, 6.021
Davidson, J. R. 1.050
Davis, Lance E. 6.022
Davis, Louis E. 3.121
Davis, Vincent 3.231
Dawson, John 2.030
Day, R. H. 5.018
Deakin, B. M. 1.016
Delagrave, Pierre M. 4.018
de Leeuw, Frank 1.017
Delehanty, George E. 5.019
Denison, Edward F. 1.018, 2.031, 2.032, 2.033
Diamond, Peter A. 1.019, 1.020
Diaz, Alejandro, Carlos F. 1.021
Diebold, John 3.078, 3.125
Divatia, V. V. 6.023
Diwan, R. K. 3.126
Doctors, Samuel I. 3.127
Doll, John P. 1.022
Domangue, Dennis A. 5.020
Domar, Evsey D. 1.023
Dorner, Peter 3.136, 5.021
Douty, H. M. 4.019, 4.020
Dovring, Folke 1.044, 2.034, 3.079
Dowie, J. A. 2.035
Dragonnette, Joseph E. 2.036, 2.037, 2.038
Dubin, Robert 3.080
Du Boff, Richard B. 1.024
Duncan, James H. 2.039
Dunlop, John T. 4.021

Earl, Victor 3.128
Eisgruber, L. M. 3.090
Elliott, Mable 5.023
Eltis, W. A. 6.024, 6.025
Enarson, Harold L. 3.011
Engerman, Stanley L. 1.030, 3.012
Enke, Stephen 6.026
Erlich, Alexander 6.027
Etherington, D. M. 3.033
Evan, E. W. 3.129
Evan, William M. 3.232

Fabricant, Solomon 1.025, 3.130
Farkas, Jack 3.073, 3.074
Fehd, Carolyn S. 2.040, 2.041, 2.042, 2.043
Feinstein, C. H. 1.027
Feldstein, M. S. 3.013
Feller, Irwin 3.233
Fellner, William 3.195, 6.028
Fenske, Russell W. 1.028
Ferguson, C. E. 1.029
Ferguson, Walter 3.131
Ferkiss, Victor C. 3.132
Ferris, John W., Jr. 2.044
Finn, Joseph T. 2.009
Fleishman, Edwin A. 6.016
Fleming, M. C. 2.045, 2.046, 3.081
Fogel, Robert W. 1.030
Ford, Gordon W. 3.133
Foster, Howard G. 5.022
Fox, Harland 4.022
Freedman, Audrey 5.023, 5.024, 5.025, 5.026

Freeman, Christopher 3.134
Freeman, R. E. 4.023
Friedrichs, Gunter 5.027
Froomkin, Joseph 5.045
Fryer, John L. 5.028
Fuchs, Victor R. 1.031, 1.032, 2.047, 2.048, 5.029
Fulco, Lawrence J. 2.063, 2.064, 3.135
Furuya, K. 1.123

Gaathon, A. L. 1.033
Gaevskaia, V. 5.030
Galatin, Malcolm 1.034
Gale, Hazen F. 2.044, 2.049, 2.050, 2.051, 2.052, 2.059
Gamble, William K. 3.136
Geiger, Theodore 6.017
Geisel, John M. 1.035
George, K. D. 1.036, 2.053, 2.054
Gintis, Herbert 3.014
Glejser, Herbert 4.024
Goddard, Frederick O. 6.029
Gold, Bela 1.037, 3.137
Goldberg, Joseph P. 5.031
Golding, John 4.039
Goldsmith, Maurice 3.234
Golov, A. 1.038
Goodwin, L.B. 3.138
Gordon, D. F. 6.013
Gordon, Robert J. 1.039
Gouverneur, J. 1.040, 1.041
Green, H. A. J. 1.042
Greenberg, Leon 5.032, 5.033
Gregory, Peter 4.062
Griliches, Zvi 1.043, 1.056, 3.235
Grossling, William 1.044
Guha, A. 6.030
Gupta, S. 1.045
Gwartney, J. D. 4.030

Haase, Peter E. 5.034
Haldi, John 2.055
Halevi, N. 1.061
Hall, R. E. 1.046
Hamada, K. 1.047
Hamberg, Daniel 6.031
Hamer, P. 6.010
Hamilton, Mary T. 4.061
Hammerman, Herbert 5.025
Hansen, W. Lee 3.015
Harbison, Frederick R. 6.032
Harmston, Floyd K. 4.031
Harris, E. Marjorie 4.032
Hartley, K. 3.016
Hartman, Paul T. 4.033
Hattery, Lowell H. 3.114
Havelock, Ronald G. 3.236
Hayami, Y. 2.056, 3.082
Headley, J. C. 2.057
Heilbroner, Robert L. 3.140
Helfgott, Roy B. 5.035
Hemley, D. D. 4.046
Henneberger, John E. 2.058, 2.059, 2.060
Herman, Arthur S. 2.061, 3.106, 5.036
Herman, Shelby W. 2.062, 2.063, 2.064, 2.074, 2.081
Heskett, J. L. 1.048
Hicks, John 6.033
Higgs, R. 3.237
Hildebrand, George H. 1.049
Hilgert, Ronald J. 2.065
Hill, T. P. 6.034
Hino, Hiroyuki 4.031
Hirsh, Werner Z. 3.141
Hirshleifer, Jack 3.238
Hodgson, James D. 4.080, 6.066
Hogg, H.C. 1.050
Hohenstein, Jeffrey 2.067
Holmes, R. A. 6.035
Homans, George C. 3.080
Horvitz, Wayne L. 4.034
Hou, Chia-Chu 6.056
Hubbard, Norman S. 5.037
Huffstutler, Clyde 2.067
Hugh-Jones, E. M. 3.142
Hultgren, Thor 4.035
Hunt, E. H. 1.051, 4.036
Hunter, Maxwell W. 3.143

Intriligator, Michael D. 1.053
Irgens, O. M. 3.146
Isaac, Julius E. 4.038
Isenson, Raymond S. 3.147

Jackman, Patrick C. 2.068, 4.014, 4.015
Jacks, Frederick G. 2.069
Jaffe, A. J. 5.045
Jantsch, Erich 3.148
Jaynes, Philip W. 2.037
Jehring, J.J. 2.070, 3.084, 3.149, 3.150
Johnston, R. E. 3.239
Jones, Ken 4.039
Jorgenson, Dale W. 1.012, 1.013, 1.043, 1.055, 1.056

Kahn, Elizabeth 4.045
Kalachek, Edward D. 3.172
Kaldor, Nicholas 3.151
Kamerschen, David R. 4.040

Kamien, M. I. 3.240
Kaneda, Hiromita 3.152, 3.153
Kaplan, Norman M. 6.036
Kelly, Terence F. 2.020, 2.021
Kendrick, John W. 1.057, 1.058, 2.071, 2.072
Kennedy, Kieran A. 6.037
Kennedy, R. V. 1.059
Ketterling, Virgil H. 2.058, 2.073, 5.046
Keyes, J. Stephen 5.023
Keys, B. A. 2.028
Kiker, B. F. 3.017, 3.018
Kim, S. 1.060
Kim, Y. C. 6.038
Kindleberger, Charles P. 6.039, 6.040
Kleiman, E. 1.061
Kleiman, Herbert S. 3.241
Klotz, Benjamin P. 1.062, 1.063, 1.064, 2.074, 5.047
Knauerhase, R. 3.154
Knight, Kenneth E. 3.242
Knudsen, John W. 1.065
Konopa, Leonard J. 2.075
Koo, Anthony Y. C. 2.076
Kovalick, Peter N. 1.066
Kreinin, Mordechai E. 3.019
Kuh, Edwin 1.067, 4.041
Kumar, Dharma 3.155
Kurihara, Kenneth K. 6.041
Kutscher, Ronald E. 1.002
Kuznets, Simon 3.020, 6.042, 6.043

Lal, Brij Bhushan 6.044
Lamson, Robert D. 4.042
Lancaster, Kelvin 3.156
Laner, Stephen 3.121
La Tourette, J.E.1.068, 1.069
Lau, J.J. 1.124
Lave, Lester B. 3.157
Lawler, Edward E. 4.084
Lawrence, Paul R. 5.048
Lee, Tieh-sheng 6.056
Leibenstein, Harvey 3.085, 3.086
Leonard, William N. 3.243
Lessowski, Witold 1.070
Levenson, Irving F. 3.021
Levhari, D. 1.061, 1.071, 3.022
Levine, Morton 5.049
Lin, Leon 3.217
Li-Tien, F. 4.043
Liu, Ta-Chung 1.049
Lomax, K. S. 2.077
Lou, L. J. 1.072
Lovejoy, Robert J. 5.050
Lovell, C. A. Knox 3.158
Lucas, R. E., Jr. 1.073
Lydall, H. 3.159
Lyon, Richard W. 2.022, 3.106

Macut, John J. 3.160, 3.161
Maddala, G. S. 2.078
Maddison, Angus 2.079
Mahar, James F. 5.006
Makdisi, S. A. 6.045
Mandelstamm, Allan B. 5.051
Mangum, Garth L. 5.011
Mann, Floyd C. 3.080
Mansfield, Edwin 3.162, 3.244, 3.245
Mark, Jerome A. 2.080, 2.081, 2.082, 4.044, 4.045
Markuson, Barbara Evans 3.164
Marquis, Donald B. 3.250
Marsden, Keith 3.163
Maruhnic, Joan 6.032
Masters, Stanley H. 1.074
Mathewson, Stanley B. 3.023
Mauer, J.J. 4.046
Mazel, Joseph L. 4.047
McAdams, A.K. 3.246
McCarthy, M. D. 1.075
McCloskey, S. N. 2.083, 3.165
McKersie, Robert B. 3.094
Mehta, P.C. 6.056
Melman, Seymour 3.087, 3.166
Melvin, J. R. 3.167
Merhaw, Meir 3.168
Merrett, S. 3.024
Metcalfe, J. S. 3.247
Migliore, Henry R. 3.025
Miller, Delbert C. 3.080
Miller, Stanley F. 2.084, 2.085
Minami, R. 6.046
Minasian, Jora R. 3.248
Mishan, E.J. 3.169
Mitchell, Edward J. 4.048
Moes, J.E., 4.049
Morgan, James N. 3.026
Morse, Dean 3.170
Moss, Bennett R. 1.077
Moss, Fred T. 2.086, 2.087
Moss, M. 1.078
Moundalexis, John 1.066
Mueller, Dennis C. 3.249
Mueller, Eva 5.052
Mullen, James H. 3.088
Muller, Charlotte 1.079
Murphy, N. B. 2.012

Murray, Roland V. 2.008
Musgrave, P. W. 3.027
Myers, John G. 4.050
Myers, R. G. 3.010
Myers, Sumner 3.250
Myslicki, Chester 2.038, 2.088

Nadiri, M. Ishaq 1.080
Nair, Kusum 6.057
Nance, Harold W. 1.081
Naqui, K. A. 1.094
Neef, Arthur 4.051
Neher, Phillip A. 6.047
Nelkin, Dorothy 3.251
Nelson, Richard R. 2.090, 3.029, 3.171, 3.172, 6.048
Nesvera, Vaclav 1.082
Nevile, J.W. 1.083
Nicholson, R.J. 1.084
Nishikawa, Shunsaku 1.085
Noda, Nobuo 3.089
Nordhaus, William D. 3.173, 3.252
North, Dick T.B. 4.052
North, Douglas C. 1.086
Novikov, H. 3.030
Nowshirrani, V. F. 6.049
Nudds, D. 4.010

O'Brien, P. 1.009
O'Carroll, Lloyd T. 3.174
Okishio, N. 1.087
Olken, Hyman 3.175
Owen, Wyn F. 6.057

Pack, Howard 3.179
Paelinck, Jean 1.089
Pandit, N. H. 3.032
Parker, William N. 1.090
Patrick, G. F. 3.090
Paukert, Liba 5.078
Peck, Merton J. 3.172
Pejovich, S. 5.063
Perlo, Victor 2.092
Phelps, Edmund S. 3.029
Phelps-Brown, E. H. 4.056
Phillips, Almarin 3.180
Philpot, G. 1.091
Phipps, Anthony J. 4.057
Piakash, Piem 2.093
Pierce, W. S. 3.137
Piore, M. 5.064
Pitchford, J. D. 4.058
Porter, R. C. 3.181
Prasow, Paul 3.194
Pratten, C. 2.094
Price, J. E. 3.033

Quinn, James B. 3.182, 3.183

Rader, T. 1.093
Raimon, Robert L. 3.034, 3.035
Raines, Frederick Q. 4.059
Ramachandra, N. 6.056
Rankine, L. B. 1.050
Rapping, Leonard 3.036
Read, L. M. 4.060
Rees, Albert 4.061
Reiss, F. J. 3.187
Remery, R. 2.095
Renten, Henry 2.096
Resnick, Jane R. 6.032
Reynolds, Lloyd G. 4.062
Rezler, Julius 5.065
Rhodes, James V. 1.022
Riche, Martha Farnsworth 2.009, 2.097
Riche, Richard W. 5.025, 5.066, 5.067
Rimlinger, G. V. 3.091
Robertson, D.J. 4.063, 4.064
Robinson, Derek 4.065
Robinson, Joan 1.094
Roman, Zoltan 1.095
Rosegger, G. 3.137
Rosen, Ned A. 3.092
Rosenberg, Jerry M. 3.037
Rosenberg, Nathan 3.184
Rosenbloom, Richard S. 3.185
Rothberg, Herman J. 2.085, 5.068
Rudelius, W. 3.256
Ruff, L. E. 3.257
Rumiantsev, A. 3.258
Ruttan, V. W. 2.056, 3.082
Rymes, Thomas K. 1.096, 1.097

Sahota, G. S. 1.098, 1.099
Sales, Stephen M. 3.093
Salkin, Jay S. 1.100
Salter, W. E. G. 3.186
Samuelson, Paul A. 1.071, 1.101, 3.259
Sapolsky, Harvey M. 3.260
Sato, Ryuzo 1.005
Sawney, P. K. 1.102
Schmookler, Jacob 3.261
Schon, Donald A. 3.262
Schroeder, Gertrude 3.038
Schuh, G. Edward 6.057
Schultz, Robert S. 6.058
Schultz, Theodore W. 3.039, 3.040

Schwartz, N. 3.240
Schwartzman, David 1.103, 3.050
Scott, J. T., Jr. 3.187
Scott, W. H. 5.069
Scrupski, Stephen E. 3.188
Scully, Gerald W. 3.051
Sellers, Walter E., Jr. 3.052
Sen, A. K. 3.053
Seward, T. 1.016
Shanks, Michael 3.263
Shaw, L. H. 1.104
Sheeks, Robert B. 3.271
Shell, Karl 3.264
Shepard, Herbert A. 3.265
Shepard, Jon M. 5.070
Sherrard, William R. 1.105
Shirai, Takamasa 5.071
Shirom, Arie 5.072
Shrivastav, Omkar S. 4.066
Shultz, George P. 3.094, 4.067
Siegel, B. N. 5.073
Siegel, Irving H. 5.074
Silberman, Charles E. 5.075
Silbertson, A. 2.094
Singer, H. W. 3.055
Sirageldin, Ismail 3.026
Sirota, David 3.095
Smith, A. D. 5.076
Smyth, D. J. 1.009
Solo, Robert A. 1.106
Somel. K. 1.124
Southard, Leland 2.098
Spatz, Laura H. 2.099
Spence, E. J. 2.028
Spencer, Daniel L. 3.189
Sreedharan, V. P. 1.120
Stafford, Frank 3.071
Steedman, I. 1.045
Steiner, George A. 3.190
Stephenson, Samuel S. 1.107
Stettner, Nora 4.068
Stieber, Jack 5.078
Stiglitz, Joseph 3.103, 6.059
Stoikov, Vladimir 3.035, 3.056
Strassman, W. Paul 2.100, 3.191
Strazheim, Mahlon R. 2.101
Striner, Herbert E. 5.079
Sturm, Herman M. 3.192, 3.193
Sultan, Paul 3.194
Sutermeister, Robert A. 3.057
Suzuki, T. 1.123
Sveikauskas, Leo 3.058
Taylor, Lester D. 6.062
Temin, Peter 1.108, 3.059
Terreblanche, S. J. 3.060
Thompson, E. J. 6.060
Thompson, F. M. L. 3.198
Thorbecke, Erik 6.061
Thornton, J. 1.109
Thurow, Lester C. 1.110, 6.062
Tjibe, B. Khing 3.061
Tlusty, Zdenek 1.111
Todaro, Michael 3.179
Topham, Tony 4.070
Touraine, Alain 5.081
Towers, B. 4.071, 4.074
Turner, Marjorie S. 4.073

Ulman, Lloyd 4.075, 5.082
Usher, Dan 1.117
Uzawa, Hirofumi 6.059

Van de Klundert, Th. 3.123
Van Dussen, P. E. 1.118
Van Horn, Thomas R. 2.051
Vanek, Jarasslow 6.067, 6.068
Vatter, H. G. 3.209
Vepa, Ram K. 3.098
Verma, P. 3.268
Vernon, Raymond 3.210
Vilenskii, M. 3.211

Waldorf, William H. 2.025, 2.052, 2.112
Walker, James F. 2.096
Walter, D. 2.029
Walton, F. T. 5.086
Walton, Gary M. 3.099, 3.212
Warner, Aaron W. 3.170, 3.213
Watanabe, Tsunehiko 1.119
Waud, R. N. 3.063
Wedderburn, Dorothy 5.087
Wein, Harold H. 1.120
Weinberg, Edgar 3.064, 3.215, 5.026, 5.088, 5.089
Weiss, Jeffrey 5.090
Welch, F. 3.065
West, Jerry G. 1.022
Westfield, F.M. 3.214
Whistler, T. L. 3.225
Whittingham, T. G. 4.071, 4.074
Wilburn, Jean Alexander 2.048
Wiles, R.C. 4.081
Will, R. E. 3.209
Willacy, Hazel M. 3.067
Williams, Bruce R. 3.269

Williams, Roger 4.082
Wilson, Andrew H. 3.270
Wise, David 4.083
Wohlmuth, Karl 1.121
Wolek, Francis W. 3.185
Wolfbein, Seymour L. 3.216
Wolfe, J. N. 5.091
Wood, G. L. 3.256
Wood, Ian 4.084
Woodhall, Maureen 2.114
Woroniak, Alexander 3.189
Worthington, Paula 1.079
Worton, David A. 1.122
Wu, Yuan-li 3.271
Wysong, John W. 3.066

Yamada, Saburo 1.085
Yeh, M. H. 3.217
Yoshihara, K. 1.123
Yotopoulos, P.A. 1.072, 1.124
Yudelman, Montague 3.218

Zeisel, Rose N. 3.219, 3.220
Ziegler, Martin 2.082, 2.115
Zudak, L. S. 4.085

Subject Index

(Theses and dissertations are not included.)

Agriculture. See Farm

Air transportation, 2.036, 2.038, 2.101

Aircraft, 3.180

Aluminum, 2.024, 2.073

Armed Forces, 3.231

Asia, 3.111, 3.203, 3.204, 6.056

Australia
- capital productivity, 1.083
- earnings, 4.038
- economic growth, 1.059
- productivity measures, 2.035

Automation. See Technological change

Automobiles. See Motor vehicles and equipment

Banking, 2.012, 3.121

Bituminous coal, 2.078. See also Coal; Mining

Canada
- capital productivity, 1.068
- costs, 4.013
- costs, guideposts, 4.001
- economic growth, 6.013, 6.035
- invention and innovation, 3.270
- labor productivity, 1.122
- price stability, 4.013
- productivity measures
  - international comparisons, 2.004, 2.005, 2.018, 2.028, 2.029
  - mining, 2.030
- technological change
  - employment, 5.014
  - farm, 3.217
  - manpower adjustment programs, 5.013

Capacity utilization (see also Economies of scale)
- in manufacturing, 1.017
- United Kingdom, 1.009, 1.019, 1.084

Capital, 1.030, 1.069, 1.082, 1.086
- economic growth, 6.007, 6.018, 6.022, 6.033
- farm, 3.090
- invention and innovation, 3.264
- measurement, 1.039
- metalworking industry, 1.003
- United Kingdom, 1.027

Capital formation. See Capital and Capital Productivity

Capital productivity, 1.047, 1.093, 1.101
- Australia, 1.083
- Canada, 1.068
- capital, 1.069, 1.082, 1.086, 1.121
- construction, hospitals, 1.079
- developing countries, 1.021
- economic growth, 1.006
- energy inputs, 1.024
- input-output studies, 1.002, 1.054
- measurement, 1.012, 1.096
- organizational factors, 1.087
- Poland, 1.070
- production functions, 1.046, 1.071, 1.094
- retail trade, United Kingdom, 1.036
- sources of growth, 1.011, 1.043, 1.073
- technological change, 1.020, 1.042, 1.053, 1.055, 1.120
- United Kingdom, 1.036, 1.084

Capital stock. See Capital and Capital productivity

Cement industry, India, 1.102

Chemical industry, 5.044

China, 3.076, 3.271, 6.014

Coal (see also Bituminous coal; Mining), 2.106, 3.200

Colombia, 2.090

Communications industry, 3.115, 3.124

Company productivity, 1.058, 1.092, 1.105, 1.107
- employment, 5.047
- growth projections, 1.062, 1.064
- production function, 1.063

Computers, 3.101, 3.176, 5.002, 5.036, 5.077
international comparisons, 5.069

Concentration, industrial. See Economics of scale; Organizational factors

Concrete products, 2.065

Construction. See also Construction, foreign countries
hospitals, capital productivity, 1.079
labor requirements
college housing, 2.084, 2.085
highways, 2.007
hospitals and nursing homes, 2.009, 2.097
schools, 2.096
selected types, 2.006
sewer works, 2.008
single-family homes, 2.011
technological change, 3.215
trade unions, 5.051

Construction, foreign countries
developing countries, 2.100
Ireland, 2.045
Japan, 1.123
Northern Ireland, 2.046
United Kingdom, 1.008

Corrugated and solid fiber box industry, 2.040, 2.042

Costs (see also Costs, foreign countries), 4.010, 4.011, 4.040, 4.058, 4.073, 4.081, 4.084, 4.085
employment, 4.009, 4.050, 4.061
farm, 4.023
fringe benefits, 4.022
improvement programs, 4.016
income shares, 4.003, 4.004, 4.005
iron and steel industries, 4.083
manufacturing industries, 4.014, 4.015, 4.045, 4.051
measurement, 4.037
price stability, 4.008, 4.024
profits, 4.035, 4.041

Costs, foreign countries
Australia, 4.038
Canada, 4.001, 4.013
developing countries, 4.049, 4.066
United Kingdom, 4.025, 4.028, 4.072

Czechoslovakia, 5.078

Dairy farming, 2.010, 2.089

Developing countries, 1.021, 1.040, 1.041, 2.100, 3.107, 3.122, 3.136, 3.151, 3.163, 3.168, 3.179, 3.189, 3.191, 4.049, 4.066, 6.005, 6.024

Earnings (see also Costs; Costs, foreign countries), 4.043
education, 3.002, 3.003, 3.015, 3.024
employment, 4.055
farm, 4.036
international comparisons, 4.002, 4.018, 4.048, 4.056
social variables, 4.030, 4.046
technological change, 4.031

Economic growth (see also Economic growth, foreign countries)
capital, 1.006, 6.007, 6.022, 6.033
education, contribution of, 3.004, 3.006, 3.031, 3.060
farm, 6.049, 6.050, 6.057, 6.061
food distribution, 6.052
improvement programs, 6.053
income shares, 6.026
international comparisons, 6.038, 6.042, 6.043, 6.051, 6.054, 6.055
invention and innovation, 3.261
measurement, 6.034
organizational factors, 5.015
production function, 6.062
projections, 6.001, 6.002, 6.003, 6.004, 6.006, 6.019, 6.048, 6.063, 6.064
quality of life, 6.017, 6.066
research and development, 3.243, 3.269
social variables, 6.032
sources of, 6.016, 6.058, 6.060
technological change, 6.020, 6.021, 6.025, 6.028, 6.029, 6.067, 6.068

Economic growth, foreign countries
Asia, 6.056
Australia, 1.059
Canada, 6.013, 6.035
China, 6.014
Europe, 6.018, 6.040
developing countries, 6.005, 6.024
France, 6.039
India, 6.023, 6.044, 6.049
Ireland, 6.037
Japan, 6.041, 6.046
Syria, 6.045
United Kingdom, 3.129, 6.008
USSR, 6.006, 6.009, 6.027, 6.036

Economies of scale (see also Capacity utilization), 3.072, 3.073, 3.074, 3.081
banking, 2.012
construction, 2.045
electric power, 1.034
farm, 1.026, 1.100, 3.079, 3.153
India, 2.093
research and development, 3.221
technological change, 3.126, 3.142

Education, 3.005, 3.007, 3.009, 3.011, 3.014, 3.016, 3.017, 3.018, 3.022, 3.024, 3.040, 3.050, 3.055, 3.062, 3.065
cost-benefit analysis, 3.010, 3.012, 3.032, 3.039
earnings, 3.002, 3.003, 3.015, 3.024
economic growth, 3.004, 3.006, 3.031, 3.060
international comparisons, 3.006, 3.056
production functions, 3.036, 3.051
productivity measures, 2.114
technological change, 3.027, 3.037, 5.057, 5.063, 5.077, 5.088

Electrical equipment, 3.241

Electric power industry, 1.034, 3.115

Electric utilities. See Electric power industry; Gas and electric utilities

Electronic components, 3.176, 3.188

Emigration. See Migration

Employment, 5.032, 5.046
company productivity, 5.047
costs, 4.009, 4.041, 4.050, 4.061, 4.066
earnings, 4.055
farm, 5.008, 5.018, 5.021
guideposts, 5.074
hours of work, 5.022
international comparisons, 5.086
labor productivity, 5.037, 5.071
manpower requirements, 5.001
service industries, 5.029
technological change (see also Technological change, employment)
chemicals, 5.044
computers, 5.002, 5.036, 5.069
Czechoslovakia, 5.078
footwear, 5.039
gray iron foundries, 5.003
insurance, 5.023, 5.024
leather, 5.039
manufacturing, 5.091
railroads, 5.014, 5.016
shipping, 5.010, 5.012, 5.031
sugar, 5.020
textiles, 5.043, 5.076

Energy inputs, 1.024, 1.108

Europe
economic growth, 6.018, 6.040
productivity measures, 2.031, 2.032, 2.033, 2.039 2.077, 2.091, 2.103

Exports. See International trade

Farm
capital, 3.090
costs, 4.023
economic growth, 6.049, 6.050, 6.057, 6.061
economies of scale, 1.026, 1.100, 3.079, 3.153
employment, 5.008, 5.018, 5.021
income shares, 5.021
input measures, 2.057
invention and innovation, 3.235
labor productivity, 1.015, 1.044, 1.051, 4.036, 5.050
labor utilization, 3.033, 3.052, 3.067, 5.030
management, 3.090
organizational factors, 3.082
production function, 1.022, 1.050
productivity measurement, 1.072, 1.104, 1.117
productivity measures, 2.004, 2.005, 2.056, 2.057, 2.107
sources of growth, 1.090
technological change, 3.112, 3.131, 3.135, 3.136 3.138, 3.152, 3.187, 3.198
Asia, 3.111
Canada, 3.217
developing countries, 3.122, 3.136
economic growth, 6.057
employment, 5.008, 5.018
India, 3.155
international comparisons, 3.218
total factor productivity, India, 1.098, 1.124

Food, 2.049
distribution, 2.051, 2.052, 2.112. 6.052
processing, 2.025, 2.098

Footwear, 2.086, 2.087, 5.039

Forecasting. See Projections; Technological forecasting

Foundries (see also Gray iron foundries), 2.014

France, 5.043, 6.039

Fringe benefits, 4.022

Gas and electric utilities (see also Electric power industry) 2.037, 5.066, 5.067

Germany, 3.027, 3.154

Government, Federal
manpower adjustment policies, 5.068
post office, 2.055
productivity measurement, 1.066, 1.112, 1.113
productivity measures, 2.072

Government, municipal, 2.026

Gray iron foundries, 2.019, 2.022, 5.003

Growth. See Economic growth

Guideposts. See Wage-price guideposts.

Health services, 3.192, 3.193, 3.227, 5.090

Hosiery, 2.017

Hospitals, 1.079, 2.009, 2.070, 2.097

Hours of work, 3.021, 3.067, 5.022, 5.055

Household appliances, 2.059, 2.095

Hungary, 1.095

Immigration, See Migration

Imports. See International trade

Improvement programs, 3.069, 3.070, 3.078, 3.084, 3.094, 4.016, 4.047, 6.053, 6.058
- health services, 3.096
- international comparisons, 4.053
- Japan, 3.068, 3.098
- United Kingdom, 3.075

Income shares, 4.003, 4.004, 4.005, 4.043, 4.047, 4.076
- economic growth, 6.026
- farm, 5.021
- technological change, 4.031

Incomes policy. See Wage-price guideposts

India
- cement industry, 1.102
- economic growth, 6.023, 6.044, 6.049
- farming, 1.072, 1.098, 1.124, 3.155
- productivity measures, 2.093

Input-output studies, 1.002, 1.054, 1.111, 1.119, 5.001
- food, 2.049
- projections, 6.002, 6.003, 6.004, 6.064
- technological change, 3.116, 3.117, 3.217
- United Kingdom, 1.045

Insurance industry, 3.256, 5.023, 5.024

International comparisons. See section under specific subject heading

International trade, 2.111, 3.210, 4.080, 6.011
- international comparisons, 2.076

Invention and innovation (see also Invention and innovation, by industry), 1.030, 3.222, 3.223, 3.234, 3.236, 3.238, 3.240, 3.251, 3.252, 3.253, 3.255, 3.262, 3.263
- Armed Forces, 3.231
- Canada, 3.270
- capital, 3.264
- economic growth, 3.261
- manpower, 3.259
- organizational factors, 3.225, 3.232, 3.240, 3.256, 3.260, 3.265
- social variables, 3.226, 3.233, 3.237, 3.242
- United Kingdom, 3.247, 3.268

Invention and innovation, by industry
- electrical equipment, 3.241
- farm, 3.235
- health services, 3.227
- industry studies, 3.250
- insurance, 3.256
- pharmaceuticals, 3.230
- railroads, 3.245
- steel, 3.246
- textiles, 3.228

Iran, 3.001

Ireland, 2.045, 6.037

Iron and steel, 3.137, 3.165
- international comparisons, 2.068, 2.083, 2.103 2.105, 3.027, 4.083

Israel, 1.033, 3.087

Italy, 5.050

Japan, 1.123, 3.068, 3.083, 3.089, 3.098, 6.041, 6.046
- farm, 3.082, 3.153

Labor productivity, 1.067, 1.111, 5.071
- farm, 1.015, 1.051, 4.036, 5.050
- input-output studies, 1.045
- international comparisons, 4.048
- lumber industry, 1.105
- manufacturing, 5.037
- measurement, 1.065, 1.114, 1.115, 1.116
  - Canada, 1.122
  - construction, single-family homes, 1.008
  - farm, 1.044
  - Hungary, 1.095
  - international comparisons, 1.052
  - office work, 1.076, 1.081
  - supervisory work, 1.035
  - USSR, 1.038
- production scheduling, 1.004
- transportation, 1.016

underdeveloped countries, 1.040
underemployment, 1.074

Labor quality. See Education; Occupational structure

Labor requirements. See Construction, labor requirements

Labor utilization, 3.023, 3.025, 3.026, 3.028, 3.053, 3.057, 3.059, 3.061, 3.064
farm, 3.033, 3.052, 3.066, 5.030
hours of work, 3.021, 3.067
immigration, 3.020
international comparisons, 3.019
Iran, 3.001
occupations, 3.034, 3.035, 3.058
production functions, 3.008, 3.013, 3.063
technological change, 3.218
underemployment, 1.074
USSR, 3.030, 3.038, 3.054

Lead and zinc, 3.206

Leather, 5.039

Libraries, 3.164

Longshore, 4.033, 4.034

Lumber, 1.105

Machine tools, 3.100, 3.129, 3.160, 3.161

Management, 3.080, 3.087, 3.088, 3.090, 3.092, 3.093, 3.094, 3.095

Man-hours. See Hours of work

Man-made fibers, 2.099

Manpower (see also Employment; Manpower requirements), 3.218, 3.259

Manpower adjustment programs, 5.005, 5.013, 5.015, 5.025, 5.026, 5.049, 5.066, 5.067, 5.068, 5.076

Manpower requirements, 3.194, 5.001, 5.083

Manufacturing
capacity utilization, 1.017
capital-output ratios, 2.092
costs, 4.014, 4.015, 4.045, 4.051
economic growth, 6.038, 6.039
employment, 5.091
international trade, 2.111
invention and innovation, 3.268
labor productivity, 5.037
occupational structure, 5.019
production function, 1.029, 1.049, 1.060, 1.118
productivity measures, 2.028, 2.115
wage-price guideposts, 4.059

Measurement. See under specific subject heading

Metal mining, 2.015

Metalworking, 1.003

Mexico, 3.079

Migration, 3.010, 3.020

Mining (see also Metal mining), 2.030, 3.202

Motor vehicles and equipment, 2.067, 2.088, 2.094, 5.005

New Zealand, 5.016, 6.010

Nonelectrical machinery, 3.174

Northern Ireland, 2.046

Occupational structure, 3.034, 3.035, 3.058, 3.081
health services, 5.090
international comparisons, 4.048
manufacturing, 5.019
technological change, 3.121, 5.006, 5.055, 5.062, 5.088, 5.089
underdeveloped countries, 1.041
USSR, 5.042

Office work, 1.076, 1.081

Organizational factors, 3.085
capital productivity, 1.087
China, 3.076
costs, 4.040
economic growth, 5.015, 6.008
farm, 3.082
health and welfare programs, 3.091
invention and innovation, 3.225, 3.232, 3.240, 3.256, 3.260, 3.265
price stability, 4.021
savings and loan associations, 3.071
Sweden, 3.077
technological change, 3.086
United Kingdom, 3.097

Petroleum, 2.015

Petroleum pipelines, 2.043

Pharmaceuticals, 3.176, 3.229, 3.230

Philippines, 2.002

Plant productivity. See Company productivity

Plastics, 3.176

Poland, 1.070

Poultry processing, 2.023

Price indexes, 1.077, 1.123

Prices (see also Costs), 4.057, 4.076
farm, 4.023
international comparisons, 4.024
services, 4.042
wage-price guideposts, 4.059

Price stability, 4.008, 4.009, 4.021, 4.080
Canada, 4.013
international comparisons, 4.024

Printing and publishing, 3.108, 3.114, 3.120

Production function, 1.001, 1.010, 1.075
capital, 1.046, 1.071, 1.094
company productivity, 1.063
economic growth, 6.028, 6.048, 6.059, 6.062
farm, 1.022, 1.050, 1.100
international comparisons, 4.048
manufacturing, 1.049, 1.060, 1.118
research and development, 3.248
technological change, 1.005, 1.011, 1.029, 1.033, 3.103, 3.113, 3.123, 3.158
transportation, 1.016

Production indexes, 1.023, 1.078

Production scheduling, 1.004

Productivity bargaining, 4.068
international comparisons, 4.054
longshore industry, 4,033, 4.034
United Kingdom, 4.006, 4.017, 4.020, 4.026, 4.027, 4.029, 4.032, 4.039, 4.052, 4.064, 4.069, 4.070, 4.071, 4.074, 4.075

Productivity improvement programs. See Improvement programs

Productivity measurement
capital productivity, 1.012, 1.096
construction, 2.027
farm, 1.072, 1.104, 1.117
government, 1.066, 1.112, 1.113
international comparisons, 1.085, 1.088, 2.104
Israel, 1.033
labor productivity, 1.008, 1.065, 1.114, 1.115, 1.116
Canada, 1.122
farm, 1.044
Hungary, 1.095
international comparisons, 1.052
supervisory work, 1.035
USSR, 1.038
office work, 1.076, 1.081
prices, 4.042
service industries, 1.031, 1.032, 2.016
total factor productivity, 1.007, 1.037, 1.097
trade, 1.048, 1.103

Productivity measures (see also Productivity measures, foreign countries), 2.015, 2.063, 2.064, 2.071, 2.080, 2.081, 2.082, 2.092, 2.102, 2.110, 2.113
air transportation, 2.036, 2.038, 2.101
aluminum, 2.024, 2.073
coal, 2.078, 2.106
concrete products, 2.065
construction, 2.006, 2.027
college housing, 2.084, 2.085
highways, 2.007
hospitals and nursing homes, 2.009, 2.097
schools, 2.096
sewer works, 2.008
single-family homes, 2.011, 2.045
corrugated and solid fiber boxes, 2.040, 2.042
dairy farming, 2.010, 2.089
education, 2.114
farm, 2.004, 2.005, 2.034, 2.056, 2.057, 2.107
food, 2.049
distribution, 2.051, 2.052, 2.112
processing, 2.025, 2.098
footwear, 2.086, 2.087
foundries (see also gray iron foundries, this section), 2.014
gas and electric utilities, 2.037
government, 2.026, 2.055, 2.072
gray iron foundries, 2.019, 2.022
hosiery, 2.017
hospitals, 2.070
household appliances, 2.059, 2.095
international comparisons (see also specific industry, this section), 2.079, 2.104, 2.108
iron and steel, 2.068, 2.105
man-made fibers, 2.099
manufacturing, 2.111, 2.115
motor vehicles and equipment, 2.067, 2.088, 2.094
petroleum, 2.015
petroleum pipelines, 2.043
poultry processing, 2.023
radio and television sets, 2.058, 2.060
railroads, 2.062, 2.074
retail trade, 2.053, 2.054, 2.075

selected industries, 2.003, 2.041, 2.050, 2.061, 2.109
service industries, 2.016, 2.047, 2.048
soft drinks, 2.001
steel (see also iron and steel, this section), 2.020, 2.021, 2.069
sugar, 2.044

Productivity measures, foreign countries
Australia, 2.035
Canada, 2.004, 2.005, 2.018, 2.028, 2.029, 2 030
Colombia, 2.090
developing countries, 2.100
Europe, 2.031, 2.032, 2.033, 2.039, 2.077, 2.091, 2.103
India, 2.093
Ireland, 2.045
Philippines, 2.002
United Kingdom, 2.076, 2.083, 2.114
USSR, 2.013

Profits, 4.035, 4.076, 4.082

Projections, 1.062, 1.064, 6.001, 6.002, 6.003, 6.004, 6.006, 6.019, 6.048, 6.064, 6.065

Puerto Rico, 4.062

Quality of life, 1.106, 3.144, 4.080, 5.058, 5.070, 6.017, 6.066

Radio and television sets, 2.058, 2.060

Railroads
economic growth, 6.021
invention and innovation, 3.245
productivity measures, 2.062, 2.074
technological change, 5.014, 5.016, 5.049, 5.076

Research and development (see also Invention and innovation), 3.221, 3.224, 3.229, 3.257
China, 3.271
economic growth, 3.243, 3.267, 3.269
government-financed, 3.127, 3.190
measurement, 3.244, 3.248, 3.249, 3.258
technological change, 3.172, 3.195, 3.205

Retail trade, 1.036, 2.053, 2.054, 2.075

Savings and loan associations, 3.071

Scientific instruments, 3.176

Science and technology (see also Technology transfer), 3.119, 3.167, 3.171, 3.254, 3.266
international comparisons, 3.177, 3.205, 3.270

Service industries, 1.031, 1.032, 2.047, 2.048, 4.042, 5.029

Shipbuilding, 3.036

Shipping, 3.099, 3.154, 3.212, 3.213, 5.010, 5.012, 5.031

Skill levels. See Occupational structure

Soft drinks, 2.001

Sources of growth (see also Capital productivity; Labor productivity; Technological change; Organizational factors; and Research and development), 1.025, 1.056, 1.065, 1.089, 2.015, 3.173, 6.058, 6.060
capital, 1.043, 1.073
economic growth, 6.016
Europe, 2.032, 2.033, 2.039
farm, 1.090
international comparisons, 6.054, 6.055
mining, 1.099
New Zealand, 6.010
Puerto Rico, 4.062
shipping, 3.099
USSR, 1.011, 1.109

South Africa, 1.118

Steel (see also Iron and steel), 2.020, 2.021, 2.069, 3.246, 5.076

Sugar, 2.044, 5.020

Sweden, 3.077

Syria, 6.045

Technological change (see also Technological change, by industry), 3.116, 3.117, 3.118, 3.141, 3.162, 3.167, 3.172, 3.173, 3.181, 3.184, 3.186, 3.207, 4.079, 5.009, 5.059, 5.082
capital productivity, 1.006, 1.020, 1.042, 1.053, 1.055, 1.120
consumption, 3.156
diffusion, 2.002, 3.197, 3.225, 3.227, 3.228, 3.235, 3.239, 3.246, 3.247
earnings, 4.031
economic growth, 6.020, 6.021, 6.025, 6.028, 6.029, 6.067, 6.068
economic variables, 3.133, 3.136, 3.142, 3.144, 3.145, 3.149, 3.150, 3.199, 3.209, 3.211, 3.216
economies of scale, 3.126, 3.214
education, 3.027, 3.031, 3.037, 3.062, 5.057, 5.063, 5.077, 5.088

employment, 5.006, 5.011, 5.017, 5.033, 5.034, 5.038, 5.052, 5.053, 5.054, 5.055, 5.065, 5.073, 5.075, 5.079, 5.080, 5.084, 5.085, 5.088
international comparisons, 5.040, 5.041, 5.045, 5.061, 5.078
improvement programs, 3.078
income shares, 4.031
international comparisons, 3.125, 3.171,3.176, 3.178, 3.182, 3.196
international trade, 3.210
labor utilization, 3.218
manpower adjustment programs, 5.004, 5.027, 5.035, 5.048, 5.052, 5.056, 5.060, 5.062, 5.064, 5.072, 5.081
international comparisons, 5.007, 5.013, 5.015, 5.028, 5.056, 5.087
manpower requirements, 3.194
measurement, 1.019, 3.130, 3.134, 3.152, 3.157, 3.159
occupational structure, 3.121, 5.042, 5.089
organizational factors, 3.086
production function, 3.103, 3.113, 3.123
quality of life, 5.058, 5.070
research and development, 3.172, 3.195, 3.205
social variables, 3.105, 3.110, 3.111, 3.112, 3.122, 3.132, 3.133, 3.140, 3.143, 3.144, 3.145, 3.149, 3.150, 3.166, 3.169, 3.170, 3.201, 3.209, 3.216

Technological change, by industry
aircraft, 3.180
chemicals, 5.044
coal, 3.200
communications, 3.115, 3.124
computers, 3.101, 3.106, 5.002, 5.036, 5.069
construction, 3.215
electricity, 3.115
electronic components, 3.188
farm, 3.131, 3.135, 3.138, 3.152, 3.155, 3.187, 3.198, 3.217, 3.218, 5.008, 5.018, 6.057
footwear, 3.039
gas and electric utilities, 5.066, 5.067
gray iron foundries, 5.002
government, 5.068
health services, 3.192, 3.193
insurance, 5.023, 5.024
iron and steel, 3.027, 3.137, 3.165
lead and zinc, 3.206
leather, 5.039
libraries, 3.164
machine tools, 3.100, 3.160, 3.161
manufacturing, 1.029, 3.158
mining, 3.202
motor vehicles, 5.005
nonelectrical machinery, 3.174
printing and publishing, 3.108, 3.114, 3.120
railroads, 5.014, 5.016, 5.049, 5.076
shipping, 3.154, 3.212, 3.213, 5.010, 5.012, 5.031
steel, 5.076
sugar, 5.020
telephones, 5.025, 5.026, 5.076
textiles, 3.219, 3.220, 5.043, 5.076
transportation, 1.016, 3.115

Technological forecasting, 3.102, 3.104, 3.109, 3.128, 3.147, 3.148, 3.175, 3.183

Technological innovation. See Invention and innovation

Technological invention. See Invention and innovation

Technology transfer (see also Technology transfer, foreign countries), 3.119, 3.127, 3.146, 3.185, 3.190, 3.197, 3.208

Technology transfer, foreign countries
Asia, 3.203, 3.204
developing countries, 3.107, 3.151, 3.163, 3.168, 3.179, 3.189, 3.191
Japan, 3.083, 3.089

Telephones, 5.025, 5.026, 5.076

Textiles
invention and innovation, 3.228, 3.247
productivity measures, 2.015
technological change, 3.219, 3.220, 5.043, 5.076
technology transfer, 3.146

Thailand, 1.117

Total factor productivity (see also Total factor productivity, foreign countries), 1.013, 1.025, 1.028, 1.056, 1.057, 1.089, 1.106, 1.110, 1.119
company productivity, 1.058, 1.092, 1.107
elasticity of substitution, 1.091
farm, 1.022
input-output studies, 1.111
measurement, 1.007, 1.018, 1.028, 1.037, 1.080, 1.085, 1.097, 4.060
production function, 1.001, 1.010, 1.075
technological change, 1.005, 1.019

Total factor productivity, foreign countries
Canada, 6.035
developing countries, 1.014, 1.041
India, 1.098, 1.102, 1.124
Israel, 1.033
Latin America, 6.012
USSR, 6.036

Trade, 1.048

Trade unions, 3.110, 5.051

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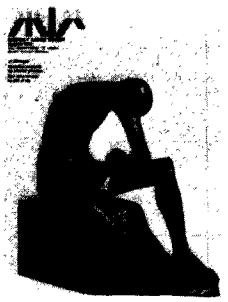

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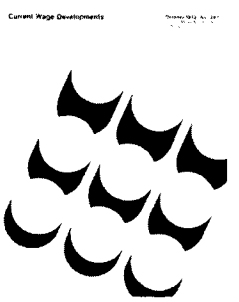

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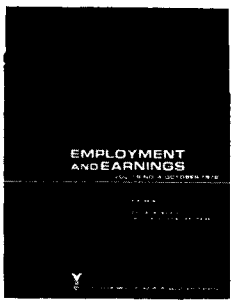

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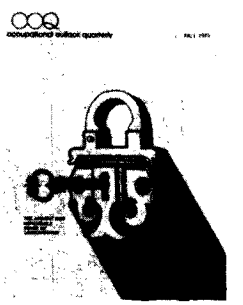

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Transportation, 1.016, 3.115

Unions, See Trade unions

United Kingdom
capacity utilization, 1.009, 1.019, 1.084
capital, 1.027
capital productivity, 1.036, 1.084
costs, guideposts, 4.025, 4.028, 4.072
earnings, 4.036
economic growth, 3.129, 6.008
education, 2.114
improvement programs, 3.075
invention and innovation, 3.268
iron and steel, 3.027, 3.165
labor productivity, 1.015, 1.045, 1.051
organizational factors, 3.097
productivity bargaining, 4.006, 4.017, 4.020, 4.026, 4.027, 4.029, 4.032, 4.039, 4.052, 4.064, 4.069, 4.070, 4.071, 4.074, 4.075
productivity measures, 2.076, 2.083, 2.114
technological change, 3.165, 5.015, 5.016, 5.076

USSR
capital, 1.121
economic growth, 6.006, 6.009, 6.027, 6.036
labor productivity, 1.038
labor utilization, 3.030, 3.038, 3.054, 5.030
productivity measures, 2.013
research and development, 3.258
sources of growth, 1.011, 1.109
technological change, 3.211, 5.042

Wages. See Earnings; Costs

Wage-price guideposts, 4.007, 4.012, 4.019, 4.021, 4.060, 4.067, 4.077, 4.078
employment, 5.074
international comparisons, 4.063
manufacturing, 4.059
measurement, 4.044
United Kingdom, 4.025, 4.028, 4.065, 4.072

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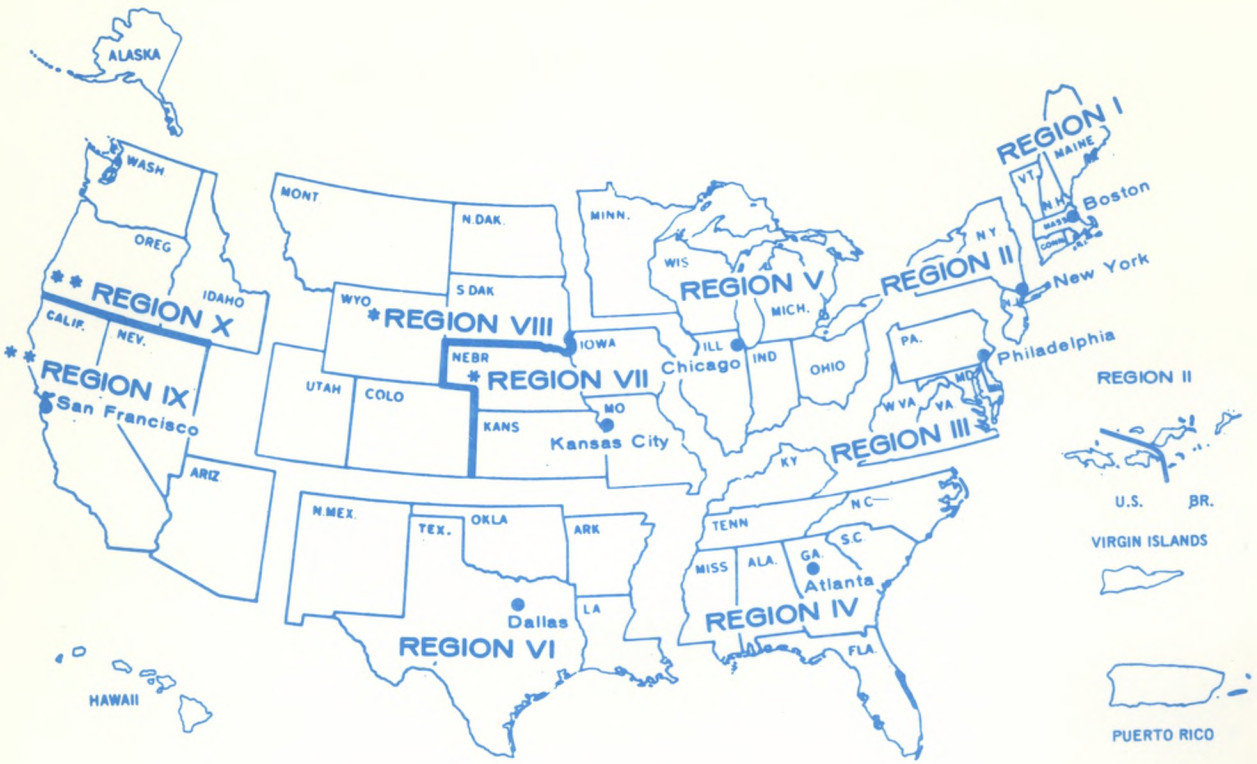

Region I
1603 JFK Federal Building
Government Center
Boston, Mass. 02203
Phone: 223-6762 (Area Code 617)

Region II
1515 Broadway
New York, N.Y. 10036
Phone: 971-5405 (Area Code 212)

Region III
P. O. Box 13309
Philadelphia, Pa. 19101
Phone: 597-1154 (Area Code 215)

Region IV
Suite 540
1371 Peachtree St., NE.
Atlanta, Ga. 30309
Phone: 526-5418 (Area Code 404)

Region V
8th Floor, 300 South Wacker Drive
Chicago, Ill. 60606
Phone: 353-1880 (Area Code 312)

Region VI
1100 Commerce St., Rm. 6B7
Dallas, Tex. 75202
Phone: 749-3516 (Area Code 214)

Regions VII and VIII *
Federal Office Building
911 Walnut St., 15th Floor
Kansas City, Mo. 64106
Phone: 374-2481 (Area Code 816)

Regions IX and X **
450 Golden Gate Ave.
Box 36017
San Francisco, Calif. 94102
Phone: 556-4678 (Area Code 415)

* Regions VII and VIII are serviced by Kansas City.
** Regions IX and X are serviced by San Francisco.

U.S. DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS
WASHINGTON, D. C. 20212