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METHODS AND PROBLEMS IN THE MEASUREMENT OF
ECONOMIC CHANGES IN STATES*

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I

This paper will deal primarily with methods and problems of measurement of economic change within a state of the United States of America. However, it will go into the details of only one of the measures of economic change, the measurement of income produced in Arkansas by industrial origin. This topic will be taken up in the second part of this paper.

Two of the other basic measures or indicators of long-run economic change within a given area are data on the number of persons gainfully employed, and the percentage employed in each particular industry. W. Paul Brann, Bureau of Business Research, University of Arkansas, has prepared estimates of these measures for census years from 1910 to 1940. They will be extended forward to 1950 and backward to at least 1880.

The two measures, income by industrial origin and the percentage of persons employed by industry, provide a clear picture of the economic structure of a state at given moments in time. New theoretical tools--or at least new uses of old tools--and additional data sought out on the basis of these tools are required if we are to follow the processes of economic change and gain further insight into their causes.

One familiar tool is the measurement of physical productivity. Several excellent studies of changes in agricultural productivity for this area are available. A new method in macroeconomic analysis is the statement of sources and uses of funds. V. Q. Alvis has made the first local efforts toward developing such a statement for Arkansas. He is also working on the application of the balance of payments concept to interstate trade, another hopeful development.

Thought must also be given to the development of the terms of trade for Arkansas. This concept has been used to advantage by Colin Clark, the Australian statistician, in his studies of economic progress. The "terms of trade" simply refers to the prices at which a country (region) buys as compared to those at which it sells. What determines the terms of trade? It is certainly evident that the list of elements important in the determination of the terms of trade between countries would be considerably different from those that are important in determining the terms of trade between an area such as Arkansas and the rest of the United States. It is probable that the relative importance of the items which appear on both lists differ. Werner Hochwald of Washington University has emphasized that the "export" industry or industries of a region are strategic in that region's economy. May I suggest that if the income elasticity of demand for this "export" is low, if pure competition prevails in this industry, and if productivity is increasing, the terms of trade will probably be running strongly against this region.

All of these--the percentage of gainfully employed by industry, changes in physical productivity, sources and uses of funds, balance of payments, and terms of trade--should be helpful in the formulation of a complete statement of the causes and processes of economic change in a given region.

II

Estimates of income in each state of our country by industrial origin have been made by the Department of Commerce since 1929. Maurice Leven of the National Bureau of Economic Research has constructed estimates of income in the various states for 1919, 1920, and 1921. The Department of Commerce estimates for the United States as a whole start in 1929, but those of the National Bureau of Economic Research go back to 1909.

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One object of my research is the construction of estimates of the net income of Arkansas industries from 1909 to 1929. This will provide a series of income estimates which can be spliced to adjusted Department of Commerce estimates to provide a continuous series from 1909. Such a series will be a valuable aid in studying changes in the structure of the Arkansas economy.

Before reviewing the methods used by the Department of Commerce and the National Bureau of Economic Research, and the content of their estimates, I will define the principal concepts, show the relationship between these concepts, and demonstrate that the aggregate net income--i.e., the earnings of the factors of production which arise from the current production of goods and services--can be estimated in two ways.

We can start either by adding the earnings of the productive factors employed in an industry, or with the sales of an industry. Let us start with the largest aggregate--sales. For example, data for the total sales of the manufacturing industries are available in the Census of Manufactures. The term used in the census for sales is "value of products." This is defined as "the selling value, at factory, of all products shipped or delivered." In the manufacturing industries, however, these sales include large elements of duplication because of sales between firms in different manufacturing industries. Interfirm sales must be deducted to arrive at value added by manufacturing. The items deducted in the Census from value of products to leave value added are: cost of materials, supplies, containers, fuel, and purchased electric energy. Value added is greater than net income because this list omits several important expenses, other than factor payments, such as capital consumption allowances, insurance, rent, selling expenses, and indirect business tax and nontax payments. If we could deduct the items just mentioned from value added the remainder would be net income from manufacturing.

This aggregate, net income, can in no way be estimated from Census information alone. Nevertheless, there is no conceptual barrier to stating the relationship between value added, as defined by the Bureau of the Census, and net income. If all expenses, except factor earnings, which were not previously deducted in calculating value added are now deducted from value added, the remainder is net income. Incidentally, once all of the expense items which are deducted from value of product to arrive at net income are known and the physical quantities of each item purchased are also known, we have the basis for the type of "input-output" analysis being developed by Wassily Leontief of Harvard.

The Department of Commerce and the National Bureau of Economic Research built up net income in each industry by adding the earnings of the factors of production which arise from the current production of goods and services. The items added by the National Bureau are: wages, salaries, entrepreneurial withdrawals, dividends, interest, entrepreneurial income, net savings of entrepreneurs, and net savings of corporations. The procedures of the National Bureau and the Department of Commerce are similar. Detailed statements of the procedures of both agencies have been published.¹

The components of factor income for each industry, when added, give the net income for the industry. The "difference" between net income and value added can be easily calculated by subtracting net income from value added.² When this "difference" is added to net income along with the other expenses enumerated by the Bureau of Census, the sum is value of product. The following table summarizes the relations which have been stated:

¹The description of the procedures, methods, and terminology of the Department of Commerce is published in the *National Income Supplement to the Survey of Current Business*, (Bureau of Foreign and Domestic Commerce, United States Department of Commerce, July 1947); that of the National Bureau is found in Simon Kuznets', *National Income and its Composition*, 1919-1938, 2 Vols., (National Bureau of Economic Research, 1941) The latter contains an extended treatment of the theoretical and practical problems involved in the construction and interpretation of National Income and its components.

²It should be noted that these two aggregates are independently determined.

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Read Down	VALUE OF PRODUCT	Read Up =
-	Cost of materials, supplies, containers, fuel, and purchased electric energy	+
=	VALUE ADDED	=
-	Such items as capital consumption allowances, insurance, rent, selling expenses, and indirect business tax and nontax payments	+
=	NET INCOME	=
	Wages	+
	Salaries	+
	Dividends	+
	Interest, etc.	+

The net income of each industry in the United States has been estimated by the National Bureau for the period 1909-1938. State income estimates are not available before 1929 except for 1919, 1920, and 1921 as stated above. The value added by manufacturing is available for 1909, 1914, 1919, and every second year thereafter to 1939 for both the United States and Arkansas. On the basis of the value added in manufacturing in Arkansas it is possible to construct estimates of net income from manufactures for the state for census years.

In preparing estimates of net income from manufactures in Arkansas the following procedure was used. The relationship between net income (National Bureau) and value added (Census)--which aggregates, it will be recalled, come from independent sources--proved to be stable when tested for the United States. It was then assumed that the relationship between net income and value added in Arkansas would also be stable. However, the percentage relationship between net income and value added in Arkansas is not the same as it is for the United States because of local differences in various costs. The Department of Commerce estimates of income³ from manufactures in Arkansas and the United States were calculated as percentages of the corresponding value added in manufacturing. This calculation indicated that income from manufactures in Arkansas as a percentage of value added was on the average almost three per cent higher than the corresponding figure for the United States. The percentage relationship between net income from manufactures and value added by manufacturing for the United States for 1929 and prior census years back to 1909 was adjusted on this basis in order to have an estimated relationship for Arkansas for years in which no estimate of net income is available. This estimated relationship for Arkansas was then applied to value added from manufacturing in Arkansas for the corresponding census years in order to estimate net income from manufacturing in Arkansas back to 1909.

The procedure for estimating net income in the other industries, with the exception of agriculture, is similar. It may be possible, however, to estimate net income from manufacturing and the other industries in Arkansas by adding factor earnings. This is essentially the method used by the Department of Commerce for estimating income by industrial origin by states for the period 1929-1949. However, several types of data, such as those given in the *Statistics of*

³The Department of Commerce estimates of income in the various industries in Arkansas consist of: wages and salaries, entrepreneurial income, property income, and other income. Other income includes public assistance, veterans' pensions, social insurance benefits, and other government transfer payments. Property income includes dividends, interest, net rents and royalties. Income received (Department of Commerce) is not identical with net income for various reasons such as: (1) property income is shown on a "where received" basis; (2) other income is composed largely of transfer payments which are not a part of net income; (3) corporate profits before income taxes are not included in the Department of Commerce income series. However, wages and salaries, and entrepreneurial income are included in both concepts and comprise the bulk of both income received and net income.

Income, published by the Bureau of Internal Revenue, are not available for the individual states. Furthermore, the National Bureau of Economic Research employed a staff of workers for several years in preparing its estimates. Such an undertaking for a state is obviously beyond the capacity of any individual. Even if it were undertaken its success would be doubtful.

The method of estimating income suggested in this paper has several advantages. First, estimates can be made with limited resources; second, these estimates are sufficiently accurate for the purpose of revealing the important changes in the economy of a state in so far as this is possible for income statistics; third, precautions are taken to insure that secular changes, cyclical fluctuations, and cost structures peculiar to an area are not removed; fourth, these estimates may be readily compared with estimates of the United States, or for other states, when such estimates are made.

For agriculture, detailed estimates of income from both home consumption and cash sales, and expenses, can be made for each year back to 1909. A study made by the Department of Agriculture to supply data for the purchasing power parity concept contains complete details for agricultural income back to 1924. The coverage for the years 1909-1923 is about 75 per cent complete--that is, about 75 per cent of the farm income in Arkansas has been estimated by the United States Department of Agriculture. My estimates for the remainder of farm income are now being prepared and will be completed within a few weeks. It is hoped that estimates of net income for all the industries in Arkansas from 1909-1929 will be completed by next fall.