

This PDF is a selection from an out-of-print volume from the National Bureau of Economic Research

Volume Title: The Behavior Of Income Shares: Selected Theoretical and Empirical Issues

Volume Author/Editor:

Volume Publisher:

Volume URL: <http://www.nber.org/books/unkn64-1>

Publication Date: 1964

Chapter Title: The Estimation of Produced Income by State and Region

Chapter Author: George H. Borts

Chapter URL: <http://www.nber.org/chapters/c1848>

Chapter pages in book: (p. 317 - 382)

The Estimation of Produced Income by State and Region

GEORGE H. BORTS

BROWN UNIVERSITY

Produced and Received Income

Up to the present, our knowledge of the income generated in states and regions of the United States has been somewhat indirect. The major source of information is the annual series on personal income by states which is published by the National Income Division of the U.S. Department of Commerce. Personal income is composed for the most part of the factor payments received by the residents of a region;¹ it does not measure the factor payments attributable to the resources employed in a region, since the owner of a resource need not reside in the state or region where the resource is employed. Therefore an income concept based on residence may not be useful for the class of analytical problems dealing with the level and growth of income produced in different regions. There is, of course, no certainty of this; a statistical series derived from one income concept may be a useful proxy measure of an unknown series derived from a more appropriate concept. For example, personal income and produced income may in fact yield highly similar measures of the level and growth of economic activity in different states and regions. Richard Easterlin raised this question at the Regional Income Conference in 1955. He concluded that "the difference between the two concepts is significant, even for so comprehensive a measure as total income and for areas as large as census regions and states."²

NOTE: The author wishes to acknowledge with gratitude the extensive cooperation of Ernest J. Engquist, of the U.S. Internal Revenue Service, and Robert E. Graham, Jr., of the National Income Division, U.S. Department of Commerce. They provided unpublished source material which underlies many of the estimates.

Grateful acknowledgment is also due to Mary I. Pett and Morton Ehrlich for their help in the preparation of the estimates. The cost of carrying out this work was supported by a grant from the Ford Foundation.

¹Strictly defined, personal income includes wages and salaries, dividends, interest, rents, proprietor's income, government interest, and government and business transfer payments. Personal income of course falls short of national income, which includes undistributed corporate profits, tax liability, and inventory valuation adjustment, as well as employer's contributions for social insurance; it excludes government interest and business and government transfers.

²See *Regional Income*, Studies in Income and Wealth 21, Princeton for NBER, 1957, p. 28. Easterlin estimated that in 1920 the quantitative difference between

ESTIMATION OF PRODUCED INCOME

His conclusions are based on computations made for the year 1920.

The object of this paper is to present and analyze estimates of produced income by state and region for 1929 and 1953. We shall determine whether produced income provides information which is not embodied in the personal income series that is currently published; whether this information is useful for the analysis of regional problems; and finally what changes in current methods of data collection would be needed to provide current estimates of produced income by state and region.

The analytical concept underlying this work might be called domestic produced income, which is the sum of the factor returns attributable to resources employed in a given region. This is to be distinguished from national income, which is the sum of the returns attributable to factors of production supplied by residents of the region. At the national level our concept differs from national income by the omission of a "rest-of-the-world account," which summarizes the net payments to domestically owned resources employed outside the region minus the payments to domestically employed resources owned by outsiders. The omission of this account means that our domestic income for each region will sum to domestic income for the United States, rather than to total national income. In 1953, the discrepancy between national income and domestic income came to \$1.5 billion.³

The major problem in measuring domestic income for each state is to estimate the returns to resources over and above compensation of employees. Data on compensation of employees by state on a "where-worked" basis were provided by the National Income Division. Accordingly, the focus of this inquiry is the remaining portion which on the average comprises about 30 per cent of total national income. I refer to this remainder as net entrepreneurial income (or NEI) and we can see in what sense this title is appropriate.

income produced and income received was around ± 5 per cent for the census regions.

³All national income data were derived from *National Income*, A Supplement to the *Survey of Current Business*, 1954 edition, Washington, 1954.

Personal income data were derived from *Personal Income by States since 1929*, Washington, 1956. While later editions of the *National Income Supplement* contain revisions of the 1953 data in the above volumes, these were retained as the basic sources, and revisions were not incorporated into our estimates.

ESTIMATION OF PRODUCED INCOME

National income may be written as the sum of the following components:

a. Compensation of employees	68.5
b. Income of unincorporated enterprises, etc.	12.6
c. Corporate income before income taxes	} 12.6
d. Inventory valuation adjustment	
e. Net interest	2.8
f. Rental income of persons	3.5

The percentage following each category shows its portion of the total in 1953.

The 30 per cent remainder is a combination of returns to property and returns to entrepreneurs. The 12.6 per cent attributed to income of unincorporated enterprises is the only part which includes any income paid for personal services. However, even a good part of this category (comprising \$38.6 billion in 1953) represents returns to property. This can be seen in the fact that, of the \$38 billion, \$12.5 billion was generated in agriculture, \$3.0 billion in construction, and \$12.4 billion in wholesale and retail trade. Each of these sectors, perhaps in descending order of importance, requires equity investment by the entrepreneur, and entrepreneurial income, as is well known, is only partly a return for personal services. In the material which follows, no estimate has been made of the portion of the \$38 billion earned by unincorporated enterprises which is a return for personal services by the entrepreneur. The entire amount of income of unincorporated enterprises is included in the total of net entrepreneurial income.

Applications of Data on Produced Income

Data on produced income by state and region are highly useful for analysis of returns to productive factors. As a first approximation, we may regard the split between compensation of employees and net entrepreneurial income as representing the division between returns to labor and to capital in a two-factor analysis of production and distribution. This provides a view of the regional economy which appears useful to analyze regional differences in factor returns as well as the growth and decay of geographic areas. For we have at our disposal a means of interpreting capital

ESTIMATION OF PRODUCED INCOME

accumulation, the growth of wages, and changes in the capital intensity of different sectors of the region's economy. The following applications come to mind:

1. Hanna has analyzed regional differences in wages and salaries per worker.⁴ He finds that such differences may be explained partly by the regional composition of occupations and industries and partly by differences in earnings per worker in the same occupation and industry. Each of these influences is itself partly dependent upon the amount of capital employed and is explained by influences which also affect the return to capital. Perloff found that interindustry differentials in wages per worker are dependent upon the value added per worker which is in excess of the wages and salaries.⁵

Stein and Muth have analyzed regional differentials in wages per worker in specific industries in terms of differentials in the ratio of value added minus wages and salaries to the number of workers.⁶ In these cases the explanatory variable (value added minus wages and salaries) is a gross measure of entrepreneurial income. It will play an important role in the estimation procedures discussed below.

2. Regional differences in the growth of wages and salaries per worker may be regarded as partly due to differences in the growth of the amount of capital employed per worker (thus affecting the marginal physical productivity of labor) and partly due to differences in the change of the prices of goods produced in each region.⁷ Each of these characteristics is in turn an influence on the income produced by capital employed in the region, and may be inferred from a knowledge of the net entrepreneurial income in the region. Thus, knowledge of the income produced by capital and labor and of changes in these components is an important part of the analysis of regional differentials and regional growth.

⁴For an analysis of the influence of occupational and industrial composition on regional earnings differentials, see Frank A. Hanna, "Analysis of Income Differentials: Theory and Practice," in *Regional Income*.

⁵Harvey S. Perloff, "Interrelations of State Income and Industrial Structure," *Review of Economics and Statistics*, May 1957, pp. 162-171.

⁶See Jerome L. Stein, "The Productive Accuracy of the Marginal Productivity Theory of Wages," *Review of Economic Studies*, June 1958. Also see H. S. Perloff, E. S. Dunn, Jr., E. E. Lampard, R. F. Muth, *Regions, Resources and Economic Growth*, Baltimore, 1960, pp. 572-588.

⁷See my paper, "The Equalization of Returns and Regional Economic Growth," *American Economic Review*, June 1960, pp. 319-347. Also, see Muth *et al.*, *Regions, Resources*.

ESTIMATION OF PRODUCED INCOME

3. Still another application has been suggested by Paul Studenski. Knowledge of produced income may be used to evaluate the fiscal capacity of individual regions. This application is explained in his remarks below. A statistical study which explores this use of the data has been completed recently by Mushkin and Rivlin.⁸

Procedures of Estimation

The following procedure was used to estimate net entrepreneurial income in states and regions:

1. The national economy was divided into nine major sectors which originate all of the net entrepreneurial income domestically produced. These are: agriculture; mining; contract construction; manufacturing; wholesale and retail trade; finance, insurance, and real estate; transportation; communications and public utilities; and services. For each sector, a national control total is developed which yields the sector's total net entrepreneurial income generated.

2. Each of the nine sectors is divided into forty-eight state components. It is, of course, impossible on the basis of published data to make a direct allocation of a sector's net entrepreneurial income to each state. Instead, data sources for each sector were examined to find an indicator of net entrepreneurial income. These indicators were then adjusted to the national control totals.

This procedure might appear at first glance to yield imprecise results. In practice, the data sources were frequently available in sufficient detail to allow very good estimates. This was particularly true for those sectors for which federal censuses were available on a statewide breakdown, such that a value added figure might be derived for the sector in each state. Under these circumstances, wages and salaries were deducted from value added to provide a measure of gross entrepreneurial income. The gross entrepreneurial income must be reduced to yield the national control total. The measures employed are described in Appendix B. The concept of value added used in federal censuses is, of course, a grosser magnitude than that employed in national income ac-

⁸ Selma Mushkin and Alice Rivlin, *Fiscal Capacity and Tax Effort*, Staff Report of the Advisory Commission on Intergovernmental Relations, Washington, 1962. This study carries out a state allocation of income reported for federal corporate income tax purposes. The authors use a multiple regression between corporate income subject to state taxation and the factors used in state allocation formulas. The most common factors used are: wages and salaries, sales at origin and destination, and the value of property.

ESTIMATION OF PRODUCED INCOME

counting. The major differences involve the treatment of supplements to wages and salaries, inventory accumulation, capital consumption charges, business transfer payments, indirect business taxes, and the purchase of business services. All of these are included in the Census concept and excluded from the national income concept. To give some idea of the distinction, the Bureau of the Census reported value added minus wages and salaries in manufacturing at \$53.9 billion in 1954, while the National Income Division reported national income originating minus wages and salaries as \$25 billion.

3. The national control totals employed in this study are larger than those shown by the National Income Division (NID). An adjustment was made, which substantially increased the interest income originating in each sector, because the treatment of interest income in national income accounting was not considered to be the most appropriate for use in regional accounts.

Appendix A shows in detail how and why the adjustments were carried out. Stated briefly, we wished to eliminate the distinction made in current practice between interest payments as a business service and as a final factor return. Accordingly, interest income has been adjusted upward by the amount of interest which NID imputes as a receipt to the business sector. The increases are \$1,081 million for 1929 and \$2,096 million for 1953. These increments represent 16.8 and 24.8 per cent of the original total interest income for the respective years.

The national control totals and their components are shown by sector in Tables 1 and 2 below.

4. The allocation of sectoral income to the different states was determined by the availability of published information. In Appendix B there is a full description of the allocation method and the underlying data sources. I shall only indicate here the degree of reliability which can be placed on these data on the basis of the sources and methods employed.

For 1929:

A. Census data were employed to provide an estimate by state of gross entrepreneurial income (i.e., Census value added minus wages and salaries) for the mining, manufacturing, and construction sectors. These were reduced to net entrepreneurial income in two stages. Data from the *Source Books* of the Internal Revenue Service (IRS) provided estimates of the ratio of net to gross

ESTIMATION OF PRODUCED INCOME

TABLE 1
INCOME ORIGINATING BY SECTOR, 1929
(million dollars)

	Agri- culture	Mining	Manufac- turing	Construc- tion	Transport and Public Utilities	Trade	Services	Finance	Total
National income	8,390	2,084	22,233	3,830	9,670	13,455	10,485	12,845	74,912
Compensation of employees	1,706	1,539	16,243	2,540	6,362	9,374	5,538	2,989	55,381
Net entrepreneurial income	6,984	545	5,990	1,290	3,308	4,081	4,947	9,856	37,001
Corporate profits before taxes	6	417	4,848	119	1,945	759	145	1,157	9,396
Rental income	—	—	—	—	—	—	—	5,425	5,425
Income of unincorporated enterprises	6,033	54	565	1,127	229	2,867	2,980	762	14,617
Inventory valuation adjustment	—	6	313	6	11	278	—	—	614
Net interest	945	68	264	38	1,123	177	1,822	2,512	6,949

ESTIMATION OF PRODUCED INCOME

TABLE 2
INCOME ORIGINATING BY SECTOR, 1953
(million dollars)

	Agri- culture	Mining	Manufac- turing	Construc- tion	Transport and Public Utilities	Trade	Services	Finance	Total
National income	17,013	5,551	98,317	15,237	26,326	52,580	29,027	26,679	
Compensation of employees	3,457	4,074	75,052	11,637	19,196	35,055	17,747	7,955	
Net entrepreneurial income	13,556	1,477	23,265	3,600	7,130	17,525	11,280	18,724	96,557
Corporate profits before taxes	74	1,234	21,798	550	5,266	5,156	613	3,572	38,283
Rental income	—	—	—	—	—	—	—	10,596	10,596
Income of unincorporated enterprises	12,560	207	1,172	2,984	828	12,391	7,418	1,079	38,639
Inventory valuation adjustment	—	-44	-625	-16	-66	-408	—	—	-1,159
Net interest	922	60	920	82	1,102	386	3,249	3,477	10,198

ESTIMATION OF PRODUCED INCOME

entrepreneurial income. After the application of these ratios, the state distributions were adjusted to the national control totals.

B. The *IRS Source Books* were used directly to provide estimates of NEI for public utilities and communications and for certain portions of the finance sector.

C. Census data were used to derive estimates of net sales and salaries and wages in wholesale and retail trade. The *IRS Source Book* was used to estimate the net entrepreneurial income as a proportion of these magnitudes.

D. Publications of the Interstate Commerce Commission provided data on the transport sector.

E. Arbitrary allocations were employed in the case of agriculture, services, and the rental income and interest components of the finance sector.

In general, the most reliable state distributions are those provided by Census data, by ICC data, and for agriculture which was distributed according to a measure of farm proprietors' income.

For 1953:

A. Census data were employed to provide an estimate of gross entrepreneurial income for mining and manufacturing. The reduction to a net basis was carried out much the same as for the earlier date.

B. Publications of the Interstate Commerce Commission, the Federal Power Commission, and the Federal Communications Commission were used to estimate net entrepreneurial income for the transport and public utility sector.

C. Census data were used to estimate the value of sales for wholesale and retail trade. The reduction to net entrepreneurial income was carried out by ratios derived from the *IRS Source Book*.

D. The *IRS Source Books* were used to provide estimates of net entrepreneurial income for a portion of the finance sector.

E. Arbitrary allocations were employed for agriculture, construction, services, and the rental income and interest components of the finance sector.

Again the most reliable distributions are those provided by Census sources, by the ICC, FCC, and FPC data, and for agriculture.

Comparisons of Produced and Received Income

Table 3 shows the computed estimates of net entrepreneurial income by state for 1929 and 1953. To provide a comparison, the

ESTIMATION OF PRODUCED INCOME

TABLE 3
NET ENTREPRENEURIAL INCOME BY STATE AND REGION ON A PRODUCED
AND A RECEIVED BASIS, 1929 AND 1953
(million dollars)

<i>States</i>	<i>1929</i>			<i>1953</i>		
	Produced NEI	Received NEI	Ratio of Received to Produced (per cent)	Produced NEI	Received NEI	Ratio of Received to Produced (per cent)
<i>New England</i>	2,433.5	3,157.0	129.73	5,276.1	7,036.2	133.36
Maine	201.2	224.8	111.73	427.9	482.9	112.85
N.H.	108.9	129.5	118.92	265.9	363.6	136.76
Vt.	96.5	100.3	103.94	169.2	217.9	128.76
Mass.	1,301.6	1,729.6	132.88	2,661.9	3,471.6	130.42
R.I.	169.6	243.4	143.51	391.9	528.1	134.74
Conn.	555.7	729.4	131.26	1,359.2	1,972.1	145.09
<i>Middle East</i>	10,143.2	12,560.5	123.83	23,613.7	25,354.9	107.37
N.Y.	5,688.4	7,132.4	125.38	12,211.6	13,129.6	107.52
N.J.	1,356.2	1,498.2	110.47	3,553.5	3,544.6	99.75
Pa.	2,483.5	3,138.8	126.39	6,106.5	6,479.0	106.10
Del.	176.9	160.5	90.73	285.8	511.0	178.81
Md.	438.2	630.6	143.91	1,456.3	1,690.7	116.09
<i>Great Lakes</i>	8,250.4	8,078.1	97.91	22,653.3	19,961.2	88.12
Mich.	1,565.2	1,541.0	98.45	4,744.3	3,814.4	80.40
Ohio	2,049.8	1,962.8	95.76	5,786.7	5,106.4	88.24
Ind.	944.5	727.8	77.06	3,007.4	2,243.6	74.60
Ill.	2,893.3	2,967.1	102.55	6,942.0	6,548.6	94.33
Wis.	797.6	879.4	110.26	2,173.0	2,248.2	103.46
<i>Plains</i>	4,280.1	3,669.7	85.74	9,257.3	9,332.3	100.81
Minn.	810.8	695.8	85.82	1,905.3	1,997.2	104.82
Iowa	865.9	760.0	87.77	1,897.7	1,852.9	97.64
Mo.	1,109.5	982.8	88.58	2,422.8	2,690.6	111.05
N.Dak.	157.8	114.0	72.24	372.0	331.2	89.02
S.Dak.	215.9	168.1	77.86	455.0	425.0	93.40
Nebr.	543.8	456.4	83.93	930.2	909.0	97.72
Kans.	576.4	492.6	85.46	1,274.3	1,126.4	88.40
<i>Southeast</i>	5,597.2	4,709.5	84.14	15,905.9	14,657.1	92.15
Va.	544.5	463.1	85.05	1,583.4	1,452.9	91.76
W.Va.	345.8	269.0	77.79	881.8	622.8	70.63
Ky.	528.2	508.3	96.23	1,340.5	1,235.8	92.19
Tenn.	585.2	461.8	78.91	1,504.7	1,290.8	85.78
N.C.	690.3	506.2	73.33	1,950.6	1,718.7	88.11
S.C.	327.7	210.2	64.14	853.6	777.8	91.11
Ga.	543.2	465.8	85.75	1,667.0	1,491.3	89.46
Fla.	281.2	364.3	129.55	1,667.1	2,376.6	142.56
Ala.	454.0	390.5	86.01	1,316.4	999.9	75.96
Miss.	432.1	357.2	82.67	911.2	778.4	85.42
La.	463.0	403.9	87.24	1,419.6	1,190.1	83.83
Ark.	402.0	309.2	76.92	809.8	722.0	89.16

(continued)

ESTIMATION OF PRODUCED INCOME

TABLE 3 (concluded)

States	1929			1953		
	Produced NEI	Received NEI	Ratio of Received to Produced (per cent)	Produced NEI	Received NEI	Ratio of Received to Produced (per cent)
<i>Southwest</i>	2,526.3	2,065.1	81.74	7,151.2	6,593.7	92.20
Okla.	610.6	510.8	83.66	1,128.5	1,167.7	103.47
Tex.	1,674.6	1,376.0	82.17	5,115.6	4,550.6	88.96
N.Mex.	111.0	82.1	73.96	368.3	325.2	88.30
Ariz.	130.1	96.2	73.94	538.9	550.2	102.10
<i>Rocky Mountain</i>	763.9	662.5	86.73	2,256.7	2,284.1	101.21
Mont.	138.9	103.3	74.37	452.6	456.8	100.92
Idaho	128.7	103.1	80.11	369.0	339.6	92.04
Wyo.	75.5	56.0	74.17	233.7	181.1	77.48
Colo.	285.9	284.8	99.62	826.7	959.6	116.07
Utah	134.9	115.3	85.47	374.7	347.0	92.61
<i>Far West</i>	2,980.5	3,427.3	114.99	10,433.6	12,381.7	118.67
Wash.	443.5	451.1	101.71	1,437.9	1,538.5	107.00
Ore.	262.1	258.4	98.59	958.0	1,065.5	108.17
Nev.	36.5	28.0	76.71	182.3	168.2	92.22
Calif.	2,238.4	2,689.8	120.17	7,828.3	9,609.5	122.75

national net entrepreneurial income is also shown distributed on a received basis. The latter figure has been prepared by expanding the received income by state as shown in *Personal Income by States since 1929*.⁹

On a state-by-state basis, substantial differences appear between produced and received net entrepreneurial income. For 1929, the received exceeds the produced by as much as 43 per cent (Rhode Island) and falls short of it by as much as 28 per cent (North Dakota). For 1953, received exceeds produced by as much as 45 per cent (Connecticut) and falls short of it by as much as 30 per cent (West Virginia).

⁹ The personal income concept includes property income and proprietors' income. These have been adjusted as follows: (1) the receipt of government interest has been eliminated; (2) dividends received have been increased proportionally so that the total now includes undistributed corporate profits, corporate inventory valuation adjustment, and corporate profit tax liability; and (3) imputed interest received now includes the adjustment to total interest income described in Appendix A.

The national total of net entrepreneurial income received is slightly larger than the produced figure because the former still includes income originating in the rest-of-the-world sector. This amounted to \$809 million in 1929 and \$1,480 million in 1953.

ESTIMATION OF PRODUCED INCOME

It is important to point out that there is a considerable degree of stability over time among the states in this regard. There were twenty-five states where produced exceeded received in both years, and thirteen states where produced fell short of received in both years.

The above comparisons are very close to the results which Easterlin achieved for 1920. He computed produced income in a different fashion from the one employed in this study. Indeed, his method cannot be used for later years because it relied upon data which are no longer collected. His method allocates property income to states and regions on the basis of the value of property. The data are found in the *Census of Wealth* which was discontinued.¹⁰ Table 4 permits a comparison between Easterlin's data and the results of Table 3. It shows the excesses

TABLE 4
EXCESS OF INCOME RECEIVED OVER INCOME PRODUCED
FOR CENSUS REGIONS, 1920, 1929, 1953
(per cent)

Region	1920	1929	1953
New England	4	10.4	9.3
Middle Atlantic	5	8.8	2.3
East North Central	-1	-5.8	-3.7
West North Central	-7	-7.5	+0.3
South Atlantic	-6	-4.8	-0.6
East South Central	-5	-8.0	-5.5
West South Central	1	-9.3	-3.6
Mountain	-7	-7.0	-0.1
Pacific	2	6.2	5.6
Average absolute percentage differences	4.2	7.5	3.4

and shortfalls between produced and received total income for 1920 and for the two subsequent years in this study. The transition from net entrepreneurial income in the previous tables to total income below is made simply by adding the compensation of employees on a where-worked basis. Accordingly, the only difference between produced and received total income in my data arise from differences between produced and received NEI. Note that the geographic distribution used below is the Census distribution and not the one employed in the above table. The change was made to conform to Easterlin's computations. With the excep-

¹⁰ See Easterlin's comments on Hochwald's Paper in *Regional Income*, p. 28.

ESTIMATION OF PRODUCED INCOME

tion of the West South Central region, there is a very close correspondence between the behavior of the regions in 1920 and 1929. However, the measurement of produced income in this study seems to yield greater variance. This probably arises from Easterlin's assumption of regionally uniform rates of return on capital. In the present study, as described above, the return to capital is allowed to vary from two causes: variations in gross value added as reported by the census, and variations in the ratio of net to gross value added as estimated from the IRS *Source Book* data.

There are a number of notable differences between behavior in 1953 and the prior years. For one thing, the variance has apparently narrowed, as seen by the decline of the average absolute difference to a level below the other two. In addition, three regions have changed position very markedly, indicating an increase in received relative to produced income. These are the West North Central Region, the South Atlantic Region, and the Mountain Region. This change appears to be part of a pattern under which received income is becoming distributed more equally over time. This will be discussed below.

Table 4 might lead one to think that at present there is not too much difference between produced and received income, that it is not worth worrying about the produced concept when we have the received data readily at hand. However, the small differences shown actually mask much larger percentage differences in the components. Adding the compensation of employees to both numerator and denominator has reduced the apparent difference. Returning to net entrepreneurial income, we see the distribution of differences shown in Table 5.

While there is again a reduction over time in the average absolute magnitude of the differences, it is not as dramatic as the reduction shown previously. The reason is a decline in the relative importance of net entrepreneurial income as a proportion of national income. In 1929, net entrepreneurial income was 41.8 per cent of national income; in 1953, this ratio had declined to 31.4 per cent.

While there are sharp differences between produced and received NEI, it is conceivable that these are nevertheless not large enough to change the relative position of regions with regard to the importance of NEI in the states' income pattern. In fact, this is not borne out by an examination of the data. This will be

ESTIMATION OF PRODUCED INCOME

TABLE 5
EXCESS OF RECEIVED OVER PRODUCED NET ENTREPRENEURIAL
INCOME FOR CENSUS REGIONS, 1929, 1953
(per cent)

Region	1929	1953
New England	23.7	33.4
Middle Atlantic	20.7	7.4
East North Central	-3.2	-11.8
West North Central	-16.9	+0.8
South Atlantic	-6.2	-2.9
East South Central	-14.1	-15.1
West South Central	-17.5	-9.8
Mountain	-20.2	-0.3
Pacific	+6.8	+19.1
Average absolute percentage differences	14.4	11.2

discussed below when we consider the effect of these differences on the distribution of income.

The Distribution of Income

A quick picture of the influence of produced entrepreneurial income on the distribution of income is revealed by the following tabulation. We have computed the per capita received income of all states in 1929 and 1953. We then divide the states into two groups: those where produced income exceeds received income, and the converse case. We may then examine the difference in the mean income of the two groups, as shown in the following tabulation:

	<i>Simple Mean Received</i>			<i>Simple Mean Received</i>		
	1929 No. of States	Income Per Capita (dollars)	Weighted Mean (dollars)	1953 No. of States	Income Per Capita (dollars)	Weighted Mean (dollars)
Produced exceeds received	33	666	532	25	1537	1677
Received exceeds produced	15	943	973	23	2003	2131

We see that where produced income exceeds received, the mean received income is lower than average. It is clear that, in both

ESTIMATION OF PRODUCED INCOME

periods, produced income is more equally distributed per capita than received income. This suggests that the inequality in received income per capita overstates differences among states in the per capita value of their output. It also suggests the possibility that the returns to labor are less equally distributed among states than the produced returns to capital.

TABLE 6
ANALYSIS OF THE DISTRIBUTION OF COMPONENTS OF STATE
INCOME PAYMENTS, 1929 AND 1953

	1929		1953	
	Mean (dollars)	Coefficient of Variation	Mean (dollars)	Coefficient of Variation
Income per capita				
Produced	659	.3370	1735	.2409
Received	639	.3829	1759	.2752
Income per employee				
Produced	1778	.3049	4823	.1831
Received	1724	.3340	4853	.2107
Nonagricultural income per employee				
Produced	2103	.2000	5500	.1073
Received	1963	.2682	5520	.1330
Nonagricultural NEI per employee				
Produced	839	.3037	1632	.1335
Received	695	.4660	1651	.2544
Nonagricultural wages and salaries per employee	1266	.2449	3461	.1196
Nonagricultural produced NEI per private employee	—	—	1942	.1484
Private nonagricultural wages and salaries per private employee	—	—	3496	.1234

In order to analyze this further, we must examine the characteristics of the various components of state income payments. In the following table the means are unweighted, and the coefficient of variation represents the ratio of the unweighted standard deviation to the unweighted mean. Each of the components will be examined in turn, and are shown in Table 6.

INCOME PER CAPITA

This is simply the ratio of total income payments to total population in the state, including members of the armed forces. For both years, it is clear that produced per capita income is more equally distributed than received, the coefficient of variation for

ESTIMATION OF PRODUCED INCOME

produced income being 12 per cent less ($1 - .3370/.3829$) in 1929 and 12.5 per cent less in 1953. It is also clear that both produced and received income have become more equally distributed over time, the coefficient for produced declining by 29 per cent, and that for received declining by 28 per cent.

In order to assess further the differences between the distribution of produced and received income, it is necessary to eliminate influences which account for some of their variation. Accordingly we have computed the next component.

INCOME PER EMPLOYEE

This is the ratio of total income payments to total employment in each state.¹¹ We see that the change from a per capita to a per employee basis reduces the variation. This is to be expected from the work carried out by Hanna.¹² It is explained by the variation in labor force participation among states and the relatively high proportion of the population out of the labor force in low income states. Having eliminated this influence, the previous patterns emerge with equal or greater force. The coefficient of variation for produced income is 9 per cent less in 1929, and 13 per cent less in 1953, than the coefficient for received income. Further, the coefficient for produced income now declines by 40 per cent from 1929 to 1953, while that for received income declines by 37 per cent.

NONAGRICULTURAL INCOME PER EMPLOYEE

A further refinement in the distribution is produced by focusing on nonagricultural income per employee. Because produced in-

¹¹ Total employment for 1929 was taken from the *Census of Population*, which includes full- and part-time workers, as well as the self-employed. The employment data are corrected by estimation to eliminate the self-employed, by eliminating nonagricultural occupational categories in which the self-employed predominate. The self-employed in agriculture are not eliminated. Total employment for 1953 was taken from two sources: nonagricultural employment was derived from the *Monthly Labor Review*, 1956; agricultural employment was derived from *Agricultural Statistics, 1954*, U.S. Department of Agriculture, Washington, 1955. It should be noted that there are two discrepancies between the two definitions of employment. First, the Census definition for 1929 includes military employment, the nonagricultural employment definition for 1953 does not. Thus there is a source of variation in the 1953 income per employee and nonagricultural income per employee which is not removed until we reach wages and salaries per nonagricultural employee. For the 1953 wages and salaries are defined exclusive of military payrolls. Second, nonagricultural employment excludes the self-employed, while they are included in agricultural employment.

¹² Frank A. Hanna, "Age, Labor Force and State Per Capita Incomes," *Review of Economics and Statistics*, February 1955, pp. 63-69.

ESTIMATION OF PRODUCED INCOME

come per worker is lower in agriculture than in almost any other sector, the elimination of this element should reduce the variation in the distribution of the remainder; it will bring out more clearly the difference between produced and received property income in the nonagricultural sphere.¹⁸

Produced nonagricultural income is obtained by subtracting from total produced income compensation of employees and NEI in agriculture. Received nonagricultural income is obtained by subtracting from total received income compensation of employees and income of proprietors in agriculture. No adjustment has been made to either series to subtract the farm realty component of the net rental income of persons. This remains in the estimate of nonagricultural income, although ideally, if a state distribution were available, it could be removed.

As expected, the distribution of nonagricultural income per employee is more equal than the distribution of total income per employee. The removal of the agricultural sector brings out very clearly the greater equality in the distribution of produced income as well as the equalization over time in the distribution of produced and received income. The coefficient of variation of produced income is 25 per cent less in 1929, and 19 per cent less in 1953 than the coefficient for received income. The coefficient of variation for produced income declines by 46 per cent between 1929 and 1953, while the coefficient for received declines by 50 per cent.

NONAGRICULTURAL NEI PER EMPLOYEE

The two major components of nonagricultural income per employee may now be examined, the first of which is nonagricultural NEI per employee. We see that here produced NEI is more equally distributed than received NEI. Further, the greatest difference appears for the later date. The coefficient of variation of produced NEI is 35 per cent less in 1929, and 48 per cent less in 1953, than the coefficient for received NEI. As before, there are marked increases in the equality of distribution between 1929 and 1953. The coefficient of variation of produced NEI declines by 56 per cent, while that for received NEI declines by 46 per cent. For the second date, there is also shown a coefficient of variation for produced nonagricultural NEI per private employee. This is

¹⁸ In 1929, total national income per employee was \$1,807; in agriculture, it was \$790. In 1953 total national income per employee was \$5,243; in agriculture, it was \$1,960.

ESTIMATION OF PRODUCED INCOME

the ratio of NEI to the number of nongovernment nonagricultural workers in each state. The purpose of making this computation is to provide a more direct comparison between NEI, which in fact comes out of the private sector, and the number of each state's employees in the private sector. This calculation was not carried out for 1929 because the census data are less reliable in identifying the number of government employees in each state. Government employment accounted for 10 per cent of the national total of compensation of employees in 1929, and if reliable data were at hand, it would be useful to make the calculation for the prior year. The nonagricultural NEI per private employee shows greater variation. The coefficient of variation is 11 per cent higher than for nonagricultural NEI per employee. It is not immediately clear why the presence of a large percentage of government employees should be associated with higher than average levels of NEI per private employee. For this is what is implied when the removal of government employees increases the variation of the second series. A possible explanation for this is the fact that government employees generate private NEI through their purchases from the private sector. This would be particularly true if their purchases generated NEI in those sectors where there is no obvious production function restraint which might yield a predetermined range of ratios of NEI to employment. For example, the presence of government employees would generate interest and rental payments on housing which could show up as a higher NEI per private employee. Whatever the explanation for the difference, however, the fact remains that the variation in produced NEI has declined over time, whichever way we choose to measure employment.

While it is true that produced NEI is distributed among states differently from received NEI, the possibility remains that these differences are too small to affect the relative position of the states with regard to the amount of NEI generated. In fact, however, this possibility is not borne out by the data. We have computed the produced and received nonagricultural NEI per employee for the two dates in Table 7. There is a substantial difference in the relative position of the regions under the produced and received NEI concepts. If we rank the regions by NEI per employee, then we obtain correlation coefficients of $+ .29$ for both 1929 and 1953 between produced and received series; these low values indicate

ESTIMATION OF PRODUCED INCOME

TABLE 7
PRODUCED AND RECEIVED NONAGRICULTURAL NEI
PER EMPLOYEE, 1929 AND 1953
(dollars)

<i>Region</i>	<i>1929</i>		<i>1953</i>	
	<i>NEI Per Employee</i>		<i>NEI Per Employee</i>	
	Produced	Received	Produced	Received
New England	715	883	1,411	1,909
Middle East	1,149	1,289	1,807	1,944
Great Lakes	861	804	1,754	1,517
Plains	962	576	1,616	1,651
Southeast	662	427	1,504	1,358
Southwest	898	555	1,874	1,704
Rocky Mountain	840	578	1,637	1,673
Far West	874	837	1,734	2,117

the degree to which relative position alters under the two definitions.

NONAGRICULTURAL WAGES AND SALARIES PER EMPLOYEE

The variation in nonagricultural wages and salaries per employee has also declined over time, there being a decline of 51 per cent in its coefficient of variation. This decline becomes 50 per cent if we compute wages and salaries per private employee for the second date in the same manner described above.

It should be noted that the nonagricultural wages and salaries per total employee exclude military payrolls and employment for the second date, but not the first.

It is now possible to compare the equality of distribution of returns to labor (wages and salaries) and to capital (NEI) on a per worker basis. It appears that wages and salaries are distributed more equally than NEI on a per worker basis, although this difference has narrowed considerably. The coefficient of variation of wages and salaries is 19 per cent less in 1929, and 10 per cent less in 1953, than the coefficient for produced NEI. What this means is that the distribution of NEI and wages and salaries has over time come to share approximately the same degree of inequality. However, the above comparisons do not tell us whether the distribution of NEI reinforces or counteracts the inequality of wage income. If the two series were negatively correlated, we could see that inequality in the one series would offset

ESTIMATION OF PRODUCED INCOME

inequality in the other to produce a more equal distribution of income than either series possessed by itself.

In order to investigate this interaction between the two components, it is necessary to examine first the behavior of the shares of national income going into NEI and wages and salaries. We shall then examine the possibility that positive correlation between the two components reinforces the degree of inequality in the distribution of state income.

Income Shares Within Regions

While it is true that the inequality in the distribution of wages and salaries and NEI has declined over time, we do not yet know whether the share of income going to these sectors has altered

TABLE 8
RATIO OF NEI TO WAGES AND SALARIES, 1929 AND 1953

<i>Region</i>	1929		1953	
	Ratio of NEI to Wages and Salaries	Deviations from U.S. Ratio (per cent)	Ratio of NEI to Wages and Salaries	Deviations from U.S. Ratio (per cent)
New England	.5323	-19.5	.4513	-8.7
Middle East	.6113	-7.5	.5242	0.6
Great Lakes	.5589	-15.5	.4748	-8.9
Plains	.7335	+10.9	.5517	5.9
Southeast	.6627	+0.2	.5819	11.6
Southwest	.8194	+23.9	.6503	24.7
Rocky Mountain	.6128	-7.3	.5814	11.6
Far West	.6345	-4.0	.5007	-3.9
U.S.	.6611		.5212	
Average of absolute differences		11.1		9.5

among regions. If the inequality in NEI per worker and in wages and salaries per worker were eliminated entirely, then income shares would be equalized. In view of the reduction in inequality, what effect has there been on income shares? The ratio of NEI to wages and salaries may be seen in Table 8. The numerator is the nonagricultural produced NEI; the denominator is the wages and salaries in the private nonagricultural sector. It can be seen that there is a pattern of distribution of this ratio which has not really altered between the two years. Ranking the two sets of

ESTIMATION OF PRODUCED INCOME

ratios and computing a rank correlation yields a coefficient of +.83. While it is true that the differences from the U.S. average ratio have narrowed over time, they still remain roughly unchanged in the two periods. There appears to be a contradiction between these findings and the earlier results that the distribution of NEI and wages and salaries had both become more equal over time. What must have happened is that the equalization process we have described is an intraregional equalization which has narrowed the extremes of the income distributions. While there is also an interregional equalization process going on, it is not going rapidly enough to equalize the share distribution of wages and salaries and NEI among regions.¹⁴ The preceding remarks are not concerned with whether in fact complete equalization is possible; this will be discussed later in the paper.

The next question is whether the inequality in the distribution of NEI exaggerates or cuts down the inequality in state income produced by wages and salaries. This may be seen through the correlations which have been computed between the two series. Simple regressions have been fitted by least squares between NEI per worker and wages and salaries per worker. The samples of observations consist of the two series in 1929 and 1953. The following regression lines are found:

1929

$$\begin{aligned} \text{Nonagricultural NEI} &= .3342 \times \left[\begin{array}{l} \text{nonagricultural wages} \\ \text{and salaries per} \\ \text{employee} \end{array} \right] + \$378 \\ \text{per employee} & \quad (.1141) \end{aligned}$$

$$r = .3931$$

1953

$$\begin{aligned} \text{Nonagricultural NEI} &= .2890 \times \left[\begin{array}{l} \text{nonagricultural wages} \\ \text{and salaries per} \\ \text{employee} \end{array} \right] + \$632 \\ \text{per employee} & \quad (.0203) \end{aligned}$$

$$r = .5488$$

¹⁴Evidence of this may be seen in that the lowest and highest produced non-agricultural NEI per employee in 1929 and 1953 were the following:

		1929	Ratio L/H	1953	Ratio L/H
Among states:	Low	\$ 514	.229	\$1181	.593
	High	2241		1993	
Among regions:	Low	662	.576	1411	.753
	High	1149		1874	

Similar results hold for wages and salaries per employee.

ESTIMATION OF PRODUCED INCOME

Written under the slope coefficient is the estimate of its standard error.

It can be seen that in each period there is a weak but significantly positive relation between NEI per employee and wages and salaries per employee. The correlation is stronger in the second period, although in the first period wages and salaries appear to have a more direct influence on NEI.¹⁵ In the first period, an increase of one dollar in wages and salaries per employee is accompanied by an increase of 33 cents in NEI per employee. This compares with a sample average ratio in 1929 of 63 cents of NEI for every dollar of wages and salaries. For the second period, an increase of one dollar in wages and salaries per employee is accompanied by an increase of only 29 cents in NEI per employee, compared with a sample average ratio of 47 cents of NEI for every dollar of wages. These results indicate that the distribution of NEI does tend to increase the inequality of state income payments over that already produced by wages and salaries.

Growth of Income Components

We have now completed our analysis of the effects of produced entrepreneurial income on the distribution of income by state and region. However, there are further comparisons with received entrepreneurial income which might be made. While it is true that the distribution of the produced and received entities are dissimilar, the two series may be substitutes for each other in any analysis involving changes over time. In order to check this possibility, we compared the growth over time in the two series (Table 9). The growth is expressed as the ratio (in per cent) of the value at the later date to the value at the earlier date. Growth is computed for nonagricultural NEI, for nonagricultural NEI per employee, and for wages and salaries per employee. It can be seen that the growth of produced and received NEI has roughly the same pattern among regions. The received entity shows a

¹⁵If we eliminate government employment from the 1953 distributions, and take the regression of nonagricultural NEI per private employee on wages and salaries per private employee, we get a correlation coefficient of .3765 and a slope coefficient of .2514. The reduced correlation is due to the increased random dispersion of NEI per employee produced by eliminating government employment. Consequently, there is no reduction in the slope of the correlation. Because of the similar slopes and the higher correlation, it was decided to use the distribution including government employees for the regression described above.

ESTIMATION OF PRODUCED INCOME

TABLE 9
RATIOS OF PRODUCED AND RECEIVED NEI IN 1953 TO THAT IN 1929
(per cent)

Region	NEI Produced (1)	NEI Received (2)	NEI Per Employee Produced (3)	NEI Per Employee Received (4)	Wages and Salaries Per Employee (5)
New England	219.85	227.28	197.48	216.10	265.59
Middle East	235.48	204.02	157.32	150.80	265.55
Great Lakes	286.14	261.18	203.83	188.80	264.06
Plains	231.24	337.46	168.07	286.43	289.87
Southeast	350.16	475.39	227.16	317.96	346.37
Southwest	344.24	464.54	208.76	307.25	317.85
Rocky Mountain	305.35	410.50	195.00	289.35	265.92
Far West	357.24	378.44	198.44	252.84	314.41

higher rate of growth in the regions outside of the Northeast, undoubtedly because of the low levels of received income in these other regions in 1929. Nevertheless the relative position of the regions is roughly unaltered. If we rank the first two columns and compute a correlation coefficient, we obtain a value of $+0.74$. The same conclusion holds when NEI is expressed per employee and the growth rates compared. We see again a much wider dispersion of growth rates of received NEI per employee. Nevertheless, the regional patterns are similar insofar as the relative position of each region is concerned. Ranking columns 3 and 4, we obtain a correlation of $+0.57$. If we compare the growth of NEI per employee with the growth of wages and salaries per employee, both the produced and the received concepts appear related to the wage growth. The rank correlation between the growth of wages per employee (column 5) and the growth of produced NEI per employee is $.55$. The rank correlation between the growth of wages per employee and the growth of received NEI per employee is $+0.88$.

Thus we see that the produced and received NEI, while differently distributed, bear the same relation to each other over time. This brings out a point mentioned at the beginning of this paper. For some purposes, the received NEI concept, which is readily available from NID publications, may serve as a proxy for the produced NEI variable. We now see that these purposes consist of measurements of relative change among regions over long pe-

ESTIMATION OF PRODUCED INCOME

riods of time. However, we have also seen that at any moment of time, the produced and received entities are not alike.

Structure of Regions

Attention will now be turned to the structure of the different regions. We wish to know the relation between the level and changes in produced NEI and the composition of regional activities. This question will be examined in two parts. In the first, we shall identify the rapidly and the slowly growing sectors in each region. In the second, we shall examine the relation at a point in time between NEI and the sectoral structure of the region.

REGIONAL SECTORS

Table 10 shows the growth of produced NEI in each regional sector. The growth is computed as the ratio of NEI in the later period to that in the earlier, expressed as a per cent. Marginal totals permit a comparison with the over-all growth in the region, on the one hand, and with the over-all growth of the national sector, on the other.

As an aid to interpreting these changes, it is useful to consider first the following hypothetical patterns of growth among the regions.

1. Each sector of a region grows at the same rate as its national counterpart. Under these circumstances, the region's growth is determined by the nature of the sectors it contains at the beginning of the period. A region containing a large share of sectors which grow rapidly at the national level will itself grow rapidly, and so on.

2. The sectoral composition of the region remains at the end of the period the same as at the beginning. This means that each sector grows at the regional average, and the growth of the region is completely unrelated to the types of sectors it contains initially.

Neither of these hypothetical patterns describes or even approximates what actually happened. The growth of each region was not dominated by industrial composition acting as a weighting mechanism for national growth patterns. This was determined by computing the growth rate of NEI which each region would enjoy were each sector to grow at the national rate. When these hypothetical regional growth rates were compared with the actual

ESTIMATION OF PRODUCED INCOME

TABLE 10
GROWTH RATES OF PRODUCED NEI, BY REGION AND SECTOR, 1929-53

	Agri- culture	Mining	Manufac- turing	Construc- tion	Trans. and Public Util.	Trade	Services	Finance	Total	Total Nonagri- cultural
New England	172.44	100.00	274.74	176.84	117.11	401.14	169.23	181.82	213.86	219.85
Middle East	178.01	86.15	297.06	187.04	199.56	381.24	197.20	187.95	231.18	235.48
Great Lakes	208.52	174.00	425.73	242.63	234.02	483.48	213.40	165.76	280.81	286.14
Plains	189.85	145.83	325.50	296.26	184.36	300.91	198.18	169.65	215.03	231.24
Southeast	173.44	372.60	468.76	456.10	274.59	483.17	290.71	244.77	282.86	350.16
Southwest	155.21	323.76	1054.50	707.94	216.07	363.38	298.98	225.12	283.54	344.24
Rocky Mountain	277.48	290.32	329.75	522.22	270.00	427.37	279.38	217.39	293.88	305.35
Far West	311.73	435.42	637.62	349.54	218.82	688.26	309.92	201.81	347.45	357.24
United States	194.05	271.01	388.40	279.07	215.54	429.43	229.55	189.98	261.18	276.82

ESTIMATION OF PRODUCED INCOME

growth rates, it appeared that the assumption could not be sustained.¹⁶

It is also clear from the examination of Table 10, that the sectors of each region are not growing at uniform rates within the region, and that the sectoral composition of the regions are apparently undergoing a uniform pattern of change.

If we look at the fastest growing sectors in each region a small group of sectors is identified. These are manufacturing, construction, and trade—all growing at the national level more rapidly than the average of all sectors. Out of twenty-four (eight regions and three sectors) possible cases, these sectors are growing more rapidly than the regional averages in twenty cases. Similarly we find that the slow-growing sectors in each region are agriculture, mining, transport and public utilities, and services and finance—all growing slowly at the national level. Out of forty possible cases, these sectors are growing less rapidly than the regional averages in thirty-eight cases. Thus all eight regions are changing internally, with a shift of composition toward the nationally growing sectors away from the declining sectors.

At the same time, the rate of this shift does not appear to be related to the rate of growth of the region. Within the four most rapidly growing regions, their thirty-two sectors are growing more rapidly than their national counterparts in twenty-seven cases; while within the four slowly growing regions, their thirty-two sectors are growing less rapidly than their national counterparts in twenty-seven cases. Thus the following pattern emerges: the rapidly growing national sectors are expanding in all regions relative to the slowly growing national sectors. At the same time, the rapidly growing sectors slow down sufficiently in certain slowly growing regions to offset their initially greater preponderance in these regions.

REGIONAL COMPOSITION AND SHARE DISTRIBUTION OF INCOME

At any moment in time the total produced NEI in a region may be thought of as influenced by four factors: (1) the composition of private activities requiring the use of capital; (2) the amount of capital invested in each activity; (3) the marginal physical product of capital; and (4) the prices of the products produced by capital.

¹⁶ The hypothetical and actual growth rates of NEI for the eight regions were ranked, and a correlation coefficient of $-.52$ was computed. This indicates that regions with an initial preponderance of rapidly growing sectors in fact grew slower than regions with an initial dependence on slowly growing sectors.

ESTIMATION OF PRODUCED INCOME

We shall ignore any difficulties introduced by varying degrees of monopoly power, although they undoubtedly may influence the distribution of income. Approximately the same list of influences operates on wage payments in a region, except that we would list under (2) the amount of labor employed in each activity, and under (3) the marginal physical product of labor.

The object of analysis is to remove and isolate the effects of the above influences on the regional distribution of income. This is an important goal of inquiry in order to understand the meaning and consequences of the equalization process described above. We should like to know whether there is an economic process at work which will eventually eliminate all differences in income distribution among regions, and if not, what differences are likely to remain permanently. It seems clear, on theoretical grounds, that even if all differences were eliminated in wage payments per employee, and in NEI per unit of capital, the share of income going to wages and NEI would still vary among regions. The reason is that all regions are not likely to contain the same composition of activities. Some activities use more capital per worker than others even when they all face the same factor prices. Consequently, the regions with a heavy composition of capital-using sectors will produce more NEI per dollar of wages than other regions.

In order to produce evidence for or against this proposition, we have computed hypothetical values of produced NEI for each region in 1953. These hypothetical values were computed in two ways. First, it was assumed that each regional sector yields the same ratio of NEI to wages and salaries as the national sector. Second, it was assumed that each regional sector yields the same ratio of NEI per worker as the national sector.

We may compare the two hypothetical values by writing the following definitions: Within a given sector let $NEI \equiv C \times P \times MP_C$, where C is the physical quantity of capital, P the price of output, and MP_C the marginal physical productivity of capital. In addition, let wages and salaries $\equiv L \times P \times MP_L$, where L is the number of workers, P the price of output, and MP_L the marginal product of labor. The ratio of NEI to wages and salaries within sector j may then be written:

$$a_j: \quad \frac{NEI}{\text{wages and salaries}} = \frac{C \times MP_C}{L \times MP_L}$$

ESTIMATION OF PRODUCED INCOME

In addition, the NEI per worker within sector j may be written:

$$b_j: \quad \frac{\text{NEI}}{\text{worker}} = \frac{C \times MP_C \times P}{L}$$

Assume for the moment that all regional components of the sector share the same production function, that production is carried on subject to constant returns to scale, and that each regional component faces the same factor and output prices. Then the a_j term would be identical among regions within sector j , and likewise the b_j term would be identical among regions within sector j . Assume, in addition, that wages and salaries per worker are the same among all sectors of a given region. Then the hypothetical NEI computed from the a_j terms would be the same as those computed from the b_j terms. Under these assumptions, the regions would differ in total NEI only through the composition of capital-using activities. Therefore, the hypothetical and actual NEI would be the same for each region.

In fact, these assumptions are not satisfied, as the following computations reveal. The tabulation below shows: (a) the produced NEI in each region; (b) the hypothetical NEI based on the assumption of uniformity in the ratio of NEI to wages; and (c) the hypothetical NEI based on the assumption of uniformity in the ratio of NEI per worker. All three concepts are expressed in dollars per private nonagricultural employee. For comparison, column (d) shows the region's nonagricultural wages and salaries per private employee. In comparing columns (a), (b), and (c), bear in mind that they are formed from common sets of weights for each region.

	(a)	(b)	(c)	(d)
New England	1,595	1,846	1,928	3,534
Middle East	2,036	2,137	2,024	3,883
Great Lakes	1,951	1,941	1,846	4,109
Plains	1,894	1,835	2,018	3,433
Southeast	1,781	1,623	1,884	3,061
Southwest	2,240	1,870	2,023	3,444
Rocky Mountain	2,063	1,890	2,013	3,550
Far West	2,087	2,225	2,009	4,169

They differ in the terms which are weighted to form the respective sums. Thus, the actual NEI per employee (a) for a region may be written:

ESTIMATION OF PRODUCED INCOME

$$\begin{aligned} \frac{\text{NEI}}{L} &= \frac{1}{L} \sum_j \left(\frac{\text{NEI}_j}{L_j} \right) L_j \\ &= \frac{1}{L} \sum_j \left[\left(\frac{\text{NEI}_j}{\text{wages and salaries}_j} \right) (\text{wages \& salaries})_j \right] \end{aligned}$$

where the subscript j represents one of nine sectors.

The hypothetical NEI per employee (b) based on wages may be written:

$$\frac{\text{NEI}^b}{L} = \frac{1}{L} \sum_j \left[(\text{wages and salaries})_j \left(\frac{\text{NEI}}{\text{wages and salaries}} \right)_j \right].$$

The weights consist of the wages and salaries in each of j sectors; the j^{th} weighted term consists of the ratio of NEI to wages and salaries, which is the same for the j^{th} sector in all regions.

The hypothetical NEI per employee (c) based on employment may be written:

$$\frac{\text{NEI}^c}{L} = \frac{1}{L} \sum_j \left[L_j \left(\frac{\text{NEI}}{L} \right)_j \right].$$

The weights consist of the L_j , employment in each sector; the j^{th} weighted term consists of the ratio NEI/worker which is the same for the j^{th} sector in all regions.

Returning to the tabulation above, we see that the hypothetical NEI series each reproduce the ranking of the actual NEI series with a fair degree of similarity. The rank correlation between columns (a) and (b) is $+.55$; between (a) and (c) it is $+.52$. Despite this correspondence, the two hypothetical series are quite unlike each other, with a rank correlation between them of $+.19$. A possible explanation of this lack of correspondence is the variation among regions in the level of wages and salaries per private employee shown in column (d). The hypothetical NEI based on wages apparently exceeds that based on employment in high-wage states and falls short of that based on employment in low-wage states.¹⁷

We have seen that a portion of the inequality in the distri-

¹⁷For this reason it is not meaningful to use the above relations to conclude that high-wage regions are or are not capital intensive. On the basis of series (b) they appear highly capital intensive. The rank correlation between columns (b) and (d) is $+.95$. However, on the basis of column (c), they do not appear to be capital intensive: the rank correlation between columns (c) and (d) is $-.07$.

ESTIMATION OF PRODUCED INCOME

bution of NEI per employee is due to differences in the sectoral composition of capital-using activities among the regions. To this extent, these differences may well be permanent. We must now investigate the influence of industrial composition upon the shares of income. The following tabulation shows: (a) the ratio of produced NEI to private wages and salaries; (b) the ratio of hypothetical NEI (based on wages) to private wages and salaries; and (c) the ratio of hypothetical NEI (based on employment) to private wages and salaries.

	(a)	(b)	(c)
New England	.4409	.5102	.5329
Middle East	.5243	.5503	.5212
Great Lakes	.4748	.4724	.4444
Plains	.5517	.5345	.5878
Southeast	.5818	.5302	.6155
Southwest	.6504	.5430	.5874
Rocky Mountain	.5811	.5324	.5670
Far West	.5006	.5337	.4819

Here we see a sharp difference in the correspondence between the actual ratios (a) and the hypothetical ratios (b) and (c). The rank correlation between columns (a) and (b) is $+.48$, while that between columns (a) and (c) is $+.74$. Apparently the assumption of regional uniformity of the ratio of NEI per employee within each sector brings us closer to the actual distribution which has occurred.¹⁸

¹⁸ It would be a mistake to infer from these findings that the capital-to-labor ratio is a constant among regions within each sector. In fact, the reverse is closer to the truth. Let us assume a production function which is homogeneous of the first degree such that the marginal physical products of capital (C) and labor (L) are each dependent on the ratio of capital to labor. Let P stand for price, MP for marginal product, and assume only one sector represented in each region. The ratio of NEI per worker may then be written as

$$\frac{\text{NEI}}{L} = \frac{P \times MP_C \times C}{L} = P \times F(C/L).$$

The ratio of NEI per dollar of wages may be written as

$$\frac{\text{NEI}}{\text{wages}} = \frac{P \times MP_C \times C}{P \times MP_1 \times L} = h(C/L).$$

If the ratio of NEI to wages is not a constant among regions within each sector, C/L must vary among regions, within each sector. The possibility that the ratio of NEI to L is constant does not imply C/L constant, for the price term may vary to offset variations in C/L .

Returns to Capital and Labor

We are now in a position to compare the hypothetical indexes for 1953 prepared here with the regression shown earlier between NEI per employee and wages and salaries per employee. It will be recalled that this regression was not a particularly good fit, having a correlation coefficient of $+0.5488$. The most likely reason for the poor fit is the difference in sectoral composition of regions in capital intensity.

The regression may be regarded as the embodiment of the hypothesis that all regions are alike in their sectoral composition of capital-using activities. The regions differ in the amounts of capital employed per worker within each sector, and in prices of outputs produced. These differences in prices and capital-labor ratios yield the relation between NEI per employee and wage payments per employee.¹⁹ If the major differences among regions were the sectoral composition of capital-using activities, we would not expect a relation between wage levels and NEI per employee.

The existence of fairly large residuals from the fitted regression may be regarded as evidence that the last assumption is not satisfied. There are differences among the regions in the sectoral composition of activities. Using the 1953 regression equation shown previously, we computed the residuals for the eight regions. These residuals are the differences between the actual NEI per employee and the values predicted by the equation. A positive residual indicates that the actual NEI was above the estimate. Our

¹⁹ Write the NEI per worker and wages and salaries per worker in terms of their definitions under the marginal productivity theory:

$$\frac{\text{NEI}}{L} = \frac{P \times MP_C \times C}{L}$$

$$\frac{\text{wages and salaries}}{L} = \frac{P \times MP_L \times L}{L}$$

We immediately see the presence of a price term in both expressions. Therefore regional variation in prices will yield the above correlation. We also see the terms $MP_C \times C/L$ and MP_L . The relations between these terms depends upon the nature of the production function specified. For example, under a Cobb-Douglas production function, with constant returns to scale, the two terms bear a constant ratio to each other. With less restrictive production functions, they will not have a constant ratio, but ordinarily will be positively related. In fact, the following restriction may be imposed and is easily perceived, although it will not be proved here. Assume the production function is homogeneous of the first degree. Then the two terms will be positively related if a 1 per cent increase in the ratio of labor to capital produces a less than 1 per cent increase in the marginal physical productivity of capital.

ESTIMATION OF PRODUCED INCOME

explanation leads us to expect that the positive residuals would occur in regions with a more capital-intensive composition of industry, and the negative residuals in regions with less capital-intensive sectors. The following tabulation provides the information necessary to evaluate these explanations. Column (a) shows the residuals from regression; columns (b) and (c) show the hypothetical values of NEI per worker, (b) constructed under the assumption of constancy in the ratio of NEI per dollar of wages in each sector, and (c) under the assumption of constancy in the ratio of NEI per employee in each sector.

	(a)	(b)	(c)
New England	\$ -236	\$1,846	\$1,928
Middle East	+52	2,137	2,024
Great Lakes	+51	1,941	1,846
Plains	+13	1,835	2,018
Southeast	-19	1,623	1,884
Southwest	+258	1,870	2,023
Rocky Mountain	-11	1,890	2,013
Far West	-96	2,225	2,009

If we compare column (a) with columns (b) and (c), we see that the rank correlation between (a) and (b) is $-.07$, and between (a) and (c) $+.79$. On the basis of the size of these coefficients, I would conclude that the explanation receives strong support from the hypothetical series based on employment and no support from the hypothetical series based on wages. The residuals from the regression appear to be explained by the sectoral composition of the regions with regard to capital-using activities. However, the measure of capital intensity needed to support such an explanation is provided by the second hypothetical series. That is, capital intensity must be measured by the ratio NEI per worker.

Usefulness of Estimates of Produced Income

The previous sections have described the estimation of produced net entrepreneurial income, the comparison of produced with received NEI, the influence of produced NEI on the distribution of state income, and the components of the regional distribution of NEI and its growth.

It is necessary to return now to the questions posed at the beginning of the paper. Is it worthwhile for the National Income

ESTIMATION OF PRODUCED INCOME

Division to estimate produced NEI by state and region on a continuous basis? Should this be done frequently or only for census years? What changes in data collection methods would be required to expedite the construction of this series? In particular, is it necessary to provide a closer link between the income data of the Internal Revenue Service, which is collected on a company basis, and the data of the Bureau of the Census, which is collected on an establishment basis?

I think that there is a great deal to be said in favor of the preparation and publication of a produced NEI series by state and region. As indicated in the previous sections, the produced NEI series is not distributed in the same fashion as the received series. Its distribution is determined by the amount of capital and the return on capital employed in each state. In turn, these elements are influenced by the patterns of growth and decline in each state. It is true that the received and produced NEI appear to change in a similar fashion over long periods of time. But we do not know whether they would follow similar patterns during shorter periods or during business fluctuations. The information on produced NEI is useful for what it tells us of the productivity of resources employed in the region.

There are no clear grounds on which to decide the frequency with which such series should be produced. In the absence of information on short-run fluctuations of produced state NEI, we do not know whether the received NEI is a suitable proxy. On a priori grounds, I would think that produced NEI would fluctuate in a different fashion from received NEI over a business cycle since business fluctuations will be transmitted to some regions through sectors which do not influence immediately the received NEI of the region. The fact that received exceeds produced NEI in some regions means that received income is sensitive to fluctuations of produced income in other regions.

Other than the few speculative remarks made immediately above, there does not appear to be any ground on which the user of data can indicate the frequency with which such data should appear. The decision would appear to rest on what changes in data collection methods are needed to expedite construction of a produced income series, and whether such a series be prepared annually, like the received series.

The answers to these questions can be given in two parts.

ESTIMATION OF PRODUCED INCOME

First, are there refinements in the present study, which a government agency could undertake? Second, how can census data which appear infrequently be linked up with annual data such as those provided by the Internal Revenue Service?

It seems clear that refinements in the present study are called for in those areas where arbitrary allocations of produced NEI were made. As mentioned above, and detailed in Appendix B, the most important of these are services, the rental and interest components of the finance sector, and construction. In addition, it would be highly desirable to investigate on a current basis the characteristics of the income of unincorporated enterprises in order to impute the income which is earned by the provision of personal services by the entrepreneur. An attack on the problem of unincorporated enterprises, in general, and the services sector, in particular, could be made by a finer processing of personal income tax returns in order to obtain a breakdown by region and industry of the income earned by unincorporated enterprise, with perhaps a splitting out of the components of the income statement to identify interest and trading profits.

Refinements also may be called for in dealing with those sectors where the Census identifies the value of sales in a region, but does not provide a measure of gross entrepreneurial income. This problem arose with wholesale and retail trade. Again it might be tackled through improved information on the income of unincorporated enterprise.

The second question is that of tying Census information, which appears infrequently, with current information such as that produced by the IRS in order to develop short-run estimates which could then be corrected with the appearance of new Censuses. However, this poses questions which have not been dealt with previously. First of all, IRS information, while it appears annually, is not really current. Secondly, the use of IRS information raises the problem of the residence of the corporation or individual filing the return. In certain sectors of the economy, the return is likely to be filed in the region where business is transacted. This would be particularly true in agriculture, trade, and services—sectors in which unincorporated enterprise is likely to be important. Construction also has a high proportion of unincorporated enterprises, but we find in this sector that firms are likely to carry on business in areas outside the area of residence of the firm.

ESTIMATION OF PRODUCED INCOME

The residence problem becomes particularly acute for large firms operating in many states. In our use of IRS *Source Book* data, we tried to avoid the more serious errors which this would produce by dealing only with the larger states as individual units, and treating the smaller states as a residual to be characterized by an average. In addition, we tried wherever possible to use sources other than the IRS to identify the size of the industry in the state, relying on the *Source Book* to provide a ratio by which such a measure of size could be reduced to an estimate of NEI. There is, of course, no way of knowing how much error exists in the present study because of the residence problem.

It has been suggested that the measurement of produced NEI requires a link-up between census and Internal Revenue data to solve the residence problem. Under such a program, census returns would be identified with company tax returns, which would then permit a regional breakdown of the company's NEI.²⁰ If at the same time, the NEI could be related to over-all measures of the company's activities, then a procedure could be worked out to provide annual estimates of regional NEI for the company until the next census was taken. This type of activity should certainly be encouraged. One of its by-products would be an estimate of the error in using the returns of resident corporations as an indicator of the total produced NEI in a sector of a region, or as an indicator of the ratio of net to gross entrepreneurial income. The chief limitation of this procedure is that it is restricted to sectors where we are well on the way to getting good estimates of NEI, namely mining and manufacturing. For these are the two sectors where we are likely to be provided with data on gross entrepreneurial income in future Censuses. This procedure can, however, do very little to illuminate problems in the services sector. While it is true that the Census does cover receipts and payrolls for the services sector, it was not possible to derive here a meaningful estimate of other costs which would allow the derivation of state estimates of NEI. This is the reason for the eventual resort to pro-ration, as described in Appendix B. It would seem that the progress of greater refinement in the estimation of produced income lies in the identification of the industrial and regional components of the income of unincorporated enterprise. For this is the wide

²⁰Such a program is under way at the U.S. Bureau of the Census under the direction of Julius Shiskin.

ESTIMATION OF PRODUCED INCOME

unknown area which could be opened to exploration through detailed processing of IRS personal tax return data. Once the information in the personal returns is opened up, it would then be possible to attack the sectors such as trade, construction, and services, where unincorporated income is so important.

Finally, we must say a word about rental income and the interest income components of the finance and services sectors. A more accurate breakdown of rental income by functional and regional source would be desirable. The farm realty component of rental income should be identified on a state basis and returned to the agricultural sector. In addition, for nonagricultural rents, the rent on commercial, industrial, and residential property should be identified by state.

The interest income component of the finance sector represents the net interest payments by individuals and firms in this sector after imputation of the interest received by this sector from non-financial sectors as a manager of capital. The latter aspect is discussed below in Appendix A. The chief source of interest originating in the finance sector is interest paid on real estate mortgages by real estate firms including private householders. The regional origin of these payments should be identified more accurately than we have done in this study. Again a possible source is the finer processing of itemized deductions in personal income tax returns.

The interest component of the services sector is very largely composed of private household interest on personal debt. Some objection has been voiced to including this payment as a part of the national income. It might be regarded, for example, as payment for a consumer service rather than an ultimate income payment for the use of capital. This objection might be expanded in a regional income study. For consumer interest reveals not the production of income in a region but the pattern of household expenditure. I feel this is too narrow a construction to place on consumer interest. It is a payment for the use of capital; and it would require a stretching of the ordinary economic meaning of utility to argue that this is a less useful employment for capital than others. As a consequence, the chief problem in the treatment of consumer interest is to identify its geographic origin. I feel that this task could be accomplished better than it has been here. There are data on new and outstanding consumer debt contracts. If these could be extended to a geographic breakdown,

ESTIMATION OF PRODUCED INCOME

then an identification of the regional sources of consumer interest might be made.

Appendix A *The Treatment of Interest Payments as a* *Final Return to Resources*

As indicated in the text, the national control totals have been adjusted upward to reflect a different treatment of interest income from that used by the National Income Division.

In order to explain the procedure followed in this paper, it is necessary to review the method currently employed by the NID to measure interest income. Due to inadequate data, the interest income is measured as a residual of total private interest payments (payments by business, individuals, and foreigners to U.S. sectors) less receipts by businesses and foreigners.²¹ Although this simple definition would appear to allow unambiguous measurement, several difficulties arise. Interest income may in fact be produced, but never leave the private business sector in the form of payments to individuals. There are two reasons for this. First, interest payments received by insurance companies and certain financial intermediaries may be reinvested for their clients without actually having been paid out to them. Second, interest payments received by financial intermediaries may be used to pay their operating expenses and may be paid out in the form of dividends or may be retained.

In order to adjust the data for these deficiencies, the NID has correctly introduced processes of imputation.²² The effect of these is to treat the interest correctly, in the sense that it is shown as originating in the nonfinancial sector. This produces the same result as would occur if the nonfinancial sector made interest payments directly to households, and the households then hired the financial sector as portfolio managers.

²¹ The NID employs the following identity:

Interest payments are made by (a) business, (b) foreigners to U.S. sectors, (c) individuals, and (d) government. Interest is received by (e) business, (f) foreigners from U.S. sectors, (g) individuals and (h) government.

By definition, the interest paid by (a)–(d) is equivalent to the interest received by (e)–(h). The interest component of national income is defined as (g) interest received by individuals and (h) interest received by government minus (d) interest paid by government. This definition follows from the concept of interest as a contractual payment for the use of capital used in current production which is ultimately controlled by individuals or the government. For a discussion of these definitions, see *National Income*, 1954 ed., pp. 97–98.

²² See *ibid.*, pp. 99–102.

ESTIMATION OF PRODUCED INCOME

The procedures described above do not pose real difficulties for the conversion of national income totals into regional components. The difficulties arise because the NID treats some interest payments as a business expense, and therefore not part of the value added of the nonfinancial sector.²³

If interest payments are regarded as a business service much as transport charges, then the value added of the nonfinancial sector is reduced by the amount of interest in the same way that it is reduced by a transport charge. On the other hand, interest might be regarded as an ultimate income payment, with the financial intermediary acting as a cloak for an underlying group of property holders. In this case the value added of the nonfinancial sector is not reduced, as interest is truly a factor cost. In either of the above cases, the value added of the financial sector is largely equal to its receipts of interest payments. Thus the two treatments imply a different total national income. The NID would have shown an additional \$1,485 million of net interest income in 1950 if it had adhered entirely to the second concept.

The NID has, in fact, chosen a compromise between the two views of interest. They have regarded the financial sector as the cloak for household portfolios in proportion to household ownership of the liabilities of certain financial intermediaries. Of the \$2,994 million of interest paid in 1950 by commercial and Federal Reserve banks, \$1,205 million are allocated to households on the basis of their ownership of funds "by use of which financial intermediaries obtained property income." In similar fashion, \$1,485 million are imputed to businesses, and consequently are subtracted from gross interest payments to arrive at net interest income. Thus, the \$1,485 million is regarded as the portion of business interest payments which represent a service charge by financial institutions to the nonfinancial sector. This amount is therefore subtracted from the value added of the nonfinancial sector.²⁴

²³ A thorough discussion of interest as an intermediate or final payment will be found in *A Critique of the United States Income and Product Accounts*, Studies in Income and Wealth, 22, Princeton for NBER, 1958. See papers and discussion by G. Jaszi, R. Easterlin, and C. Warburton.

²⁴ A different procedure was chosen by Simon Kuznets although for the same purpose. He regarded short-term interest payments by the nonfinancial sector as the "service to business" portion of interest. This portion is then deducted from gross interest payments to arrive at the net interest income. Consistent with this, Kuznets regarded the net long-term interest payments of the nonfinancial sector as payments to households. See his *National Income and Its Composition, 1919-1938*, New York, NBER, 1941, pp. 408-409.

ESTIMATION OF PRODUCED INCOME

The procedure which I have followed in this paper is to treat all interest payments as part of value added. This implies adding back to the net interest income the NID portion of imputed interest received by the business sector. There are two reasons for taking this position. First, in a regional allocation of produced income, it is impossible to determine which firms are predominantly employing their own funds, which have borrowed in the long-term bond market, and which in the short-term market. Since we cannot determine the regional location of these characteristics, it is impossible to carry out the imputation of interest received even if we wished to. Second, and more important, there are strong grounds for treating all interest payments alike, no matter what the institutional arrangements under which they arise. It appears arbitrary and inconsistent to reduce the value added of any sector or firm because of the method of financing which it employs.

The procedure followed in this paper increases the net interest income by \$1,081 million in 1929 and by \$2,096 million in 1953. These increments represent 16.8 and 24.8 per cent, respectively, of the total interest income in those years.

The sectoral allocation of these increments was carried out in two steps. First, making use of the IRS Statistics of Income, the net interest paid by corporations in each nonfinancial sector was computed. Where this interest exceeded the NID figure for interest income generated in the sector, the IRS figure was employed. On this basis we were able to account for \$679 million out of \$1,081 million that we wish to add for 1929.

Second, the remainder, or \$402 million in 1929, was attributed to the nonfinancial unincorporated enterprises in each sector and to the finance sector. The share of the residue going to the financial sector was determined by the relative importance of firms in this sector in the distribution of imputed interest received.²⁵ The remainder, or the share going to the proprietorships and partnerships, was allocated to the various sectors according to their relative share of income generated by unincorporated enterprise. Tables 11 and 12 show the original NID determination of interest income in each sector, the Kuznets figures for 1929, the IRS corporate net interest by nonfinancial sector, the adjustment of the remainder to the financial sector and to proprietorships, and finally the interest income figure included in the national

²⁵ See *National Income*, 1954 ed., p. 102, Exh. 6.

ESTIMATION OF PRODUCED INCOME

control totals. Note that the national control totals exclude the interest originating in the rest of the world. This came to \$577 million in 1929 and \$333 million in 1953. Also note that most of the interest originating in the services sector arises from personal

TABLE 11
DEVELOPMENT OF INTEREST INCOME BY SECTOR, 1929
(million dollars)

Sector	NID	IRS		Finan. Sector Adjust.	Proprietor- ship Adjustment	Final Figure
		Corporate Returns	Kuznets			
Agriculture	833	20.9	436	—	112	945
Mining	32	66.4	45	—	2	68
Manufacturing	-81	253.4	209	—	11	264
Construction	16	17.4	13	—	21	38
Transport and public utilities	953	1,118.7	970	—	4	1,123
Wholesale and retail trade	80	123.9	56	—	53	177
Services	1,675	92.1	87	—	55	1,822
Finance	2,360	—	2,266	152	—	2,512
Total domestic interest	5,868					6,949

TABLE 12
DEVELOPMENT OF INTEREST INCOME BY SECTOR, 1953
(million dollars)

Sector	NID	IRS		Finan. Sector Adjust.	Proprietorship Adjustment	Final Figure
		Corporate Returns	Kuznets			
Agriculture	730	17.6	—	—	192	922
Mining	16	55.7	—	—	4	60
Manufacturing	-74	902.5	—	—	18	920
Construction	44	38.6	—	—	38	82
Transport and public utilities	979	1,093.1	—	—	9	1,102
Wholesale and retail trade	156	248.1	—	—	138	386
Services	3,069	91.3	—	—	89	3,249
Finance	3,182	—	—	295	—	3,477
Total domestic interest	8,102					10,198

debt of households. For this reason the IRS figure and the proprietorship adjustment were both added to the original NID figure to yield the entry in the last column. The entries in the final figure column are carried into the interest originating columns of Tables 11 and 12 in the text showing net entrepreneurial income by sector.

ESTIMATION OF PRODUCED INCOME

Appendix B

Sources of Data and Methods of Allocating Sectoral Income to the States and Regions

In the following description of allocation methods, reference is made to the *Source Book of Corporate Income Tax Returns* which is maintained by the U.S. Internal Revenue Service. This provides data for 1929 on a state basis. For 1954, we were not able to use the *Source Book*. However, the IRS supplied a sample study of the returns of the 10,000 largest corporations for 1957. Profit rates and estimates of the ratio of net to gross entrepreneurial income were derived from these sources for sectors and states. In all cases, the estimates of NEI which these sources yielded were then adjusted to national control totals. In the description which follows, both types of Internal Revenue Service information are referred to as the *Source Book*.

AGRICULTURE

Net entrepreneurial income in agriculture was allocated according to the states' share of farm proprietor's income as shown in *Personal Income by States since 1929*. This series appears in the main to be on a produced basis already. While it does include certain government payments to farmers, no attempt was made to eliminate this component prior to carrying out the allocation.

MINING

Net entrepreneurial income in mining was allocated to the states in three steps.

First, the U.S. Censuses for 1929 and 1954 were used to develop by state the gross value added minus wages and salaries for each sector of the mining industry.²⁶ Henceforth the gross value added minus wages and salaries as reported by the Census will be referred to as the gross entrepreneurial income.

Second, the gross entrepreneurial income was reduced to an estimate of national income through the use of data on a state basis from the *Source Book*. The reduction was carried out individually for the major mineral-producing states and on an average basis

²⁶ *Fifteenth Census of the United States, Mines and Quarries, 1929*, U.S. Bureau of Census, Washington, 1933. *Census of Mineral Industries, 1954*, Volume II, U.S. Bureau of Census, Washington, 1956.

ESTIMATION OF PRODUCED INCOME

for the remainder. It was based on separate experience in metal mining, anthracite, bituminous coal, and oil and gas. The reduction factor in each case was an estimate of the ratio of net to gross entrepreneurial income. This ratio was formed from the income statement entries shown in the *IRS Source Book*.

Third, a final adjustment to the national control total of entrepreneurial income was carried out on a proportional basis.

MANUFACTURING

Net entrepreneurial income in manufacturing was allocated in three steps similar to those used for mining.

First, the Census of Manufactures for 1929 and 1954²⁷ was used to provide an estimate of gross entrepreneurial income by state for each two-digit industry group. Note that manufactured gas was not included with manufacturing in the first year, but incorporated into the public utility sector.

Second, the gross entrepreneurial income was reduced to an estimate of net entrepreneurial income through *IRS Source Book* data. The reduction was carried out for individual industries and states.

Third, a final adjustment to the national control total was carried out on a proportional basis.

CONSTRUCTION

Two different methods were used to allocate net entrepreneurial income in construction.

In the first one, for the year 1929, the Census of Construction was used to derive state estimates of gross entrepreneurial income.²⁸ This was reduced individually for the largest states by a net-to-gross ratio derived from the *Source Book*. For the other states, the reduction was on an average basis. The total was then adjusted to the national control proportionately to each state's share of the reduced entrepreneurial income.

In the second one, for the year 1953, net entrepreneurial income in construction was directly allocated on the basis of a state distri-

²⁷ *Fifteenth Census of the United States, Manufacturers, 1929*, Volume III, Reports by States, U.S. Bureau of the Census, 1933; *Census of Manufacturers, 1954*, Volumes II and III, Statistics by States, U.S. Bureau of Census, 1956.

²⁸ *Fifteenth Census of the United States, 1930*, Construction Industry, Reports by States, U.S. Bureau of Census, 1933.

ESTIMATION OF PRODUCED INCOME

bution of engineering construction contracts awarded in 1952, 1953, and 1954.²⁹ There is no recent Census of Construction to allow an allocation similar to that carried out for the earlier year.

TRANSPORTATION AND PUBLIC UTILITIES

A number of different methods were employed for the various industries in this sector.

Railways

The publications of the Interstate Commerce Commission were used for railway income.³⁰ For each region of the country, we derived the net entrepreneurial income of steam and electric railways of all classes. The regional income was then allocated to the states within the region according to the type and proportion of track mileage in the state. That is, the income of switching companies was allocated according to the state's proportion of the mileage of switching companies, and so on.

Pipe Lines

Again publications of the ICC were used for this industry.³¹ For 1929 and 1953, the net entrepreneurial income was allocated to the regions in which the respective companies operated. It was then allocated to the states on the basis of an estimate of the state distribution of pipe-line mileage.

Air Lines

No allocation was made of air-line net entrepreneurial income. It amounted to \$107 million in 1953, or 3.6 per cent of the national total in the transport sector. In 1929, it was negligible.

Highway Transport

Two different methods were employed to estimate NEI for this sector. For 1929, the *Source Book of Corporate Income Tax Returns* was employed to provide the NEI on a state basis. This was then adjusted to the national control total. For 1953, a pub-

²⁹ These series, as prepared by the *Engineering News Record*, are reported in the *Statistical Abstract of the United States*, for 1953, 1954, and 1955.

³⁰ *Statistics of Railways in the United States*, for the years ending December 31, 1929 and 1953, U.S. Interstate Commerce Commission; *Selected Financial and Operating Statistics from Annual Reports of Electric Railways*, 1953, U.S. ICC.

³¹ *Statistics of Railways, 1929*; *Statistics of Oil Pipe Line Companies, 1953*, U.S. Interstate Commerce Commission.

ESTIMATION OF PRODUCED INCOME

lication of the Interstate Commerce Commission was employed.⁸² The estimate of net entrepreneurial income was furnished on a regional basis. The income within the region was allocated to the states by using the mileage of the federal-aid highway system within each state. The latter figure was taken from the *Statistical Abstract of the U.S.* The allocation was then adjusted to the national control total.

Water Transportation

For 1929 and 1953, the state allocation of NEI for this sector was made by using the *Source Book of Corporate Tax Returns*. The totals were then adjusted to the national control totals.

COMMUNICATIONS AND PUBLIC UTILITIES

Telephones

Two methods were employed. For 1929, the *Source Book* was employed for the allocation. For 1953, a publication of the FCC was used.⁸³ Where it could be determined that a company operated in a single state, the company was assigned to that state. The remainder were allocated on the basis of the number of telephones in each state, and by a process of elimination all companies were assigned. In the case of Bell System companies, the total net revenue of the American Telephone and Telegraph Company was added back on a proportionate basis.

Radio Broadcasting and Television

Allocations were made from the *Source Book*.

Utilities, Electric and Gas, and Public Services

Electric utilities were allocated through the *Source Book* for 1929. For 1953, a publication of the Federal Power Commission was employed.⁸⁴ This provided information by company and state.

Gas utilities were allocated through the manufactured gas entry of the Census of Manufactures in 1929 although included in the

⁸² *Statistics of Class 1 Motor Carriers, 1953*, U.S. Interstate Commerce Commission.

⁸³ *Statistics of the Communications Industry in the United States, 1953*, U.S. Federal Communications Commission.

⁸⁴ *Statistics of Electric Utilities in the United States, 1953*, Federal Power Commission.

ESTIMATION OF PRODUCED INCOME

public utility total. For 1953, the gas utilities were handled in the same fashion as the electric.

WHOLESALE AND RETAIL TRADE

For 1929, the Census of Business was used to provide the value of retail and wholesale sales in each state.³⁶

Salaries and wages were also provided by this source. An estimate of cost of goods sold was then derived from the *Source Book* in conjunction with the above data. The *Source Book* data were then used to develop the value of net entrepreneurial income. This method has been mentioned previously when *Source Book* data are used in conjunction with the Census estimate of gross entrepreneurial income. It is somewhat more complicated in this case, because the *Source Book* is also used to estimate the cost of goods sold. In the other cases, the following procedure is used:

Let GEI, gross entrepreneurial income, stand for the difference between value added and wages and salaries as shown in the Census.

Then we must find an α such that α GEI is the net entrepreneurial income. Using IRS categories, our α is estimated by the following ratio:

$$\alpha = 1 - \left[\frac{G + H}{A + B - E - F - K} \right]$$

where A = gross sales, B = gross profits from other operations, E = cost of goods sold, F = compensation of officers, K = miscellaneous deductions, G = taxes paid other than income tax, and H = depreciation and depletion.

α may be interpreted as the estimated ratio of net to gross entrepreneurial income, where the net is the NID concept and the gross is the Census concept.

In the case of trade, it was necessary to use the *Source Book* first to estimate the gross entrepreneurial income.

Let X = net sales as reported in the census, and Y = salaries and wages, excluding proprietors, as reported in the census.

Then estimate

$$Z = \text{cost of goods sold} = \left[\frac{E + K}{A + B} - \frac{Y}{X} \right] \cdot X.$$

³⁶ *Fifteenth Census of the United States: 1930*, Volume II, Wholesale Distribution, State Reports, Volume I, Retail Distribution, State Reports, U.S. Bureau of Census, 1934.

ESTIMATION OF PRODUCED INCOME

Our estimate of gross entrepreneurial income is then $X - Y - Z$, and we apply the ratio to this expression to obtain NEI.

For 1953, a similar procedure is followed. The value of sales by state is given in the Census.⁸⁶ In this year, however, salaries and wages are not provided. Accordingly, *Source Book* data were used to provide an estimate of the ratio of net entrepreneurial income to sales. This ratio was then applied to derive an estimate of NEI. For 1929, we distinguished retail from wholesale trade, but did not split either sector. For 1953, the retail and wholesale sectors were each broken into components: food trade, eating and drinking, etc.

SERVICES

Allocation of the services sector was carried out in a more arbitrary fashion than the other sectors shown. *Source Book* data were not found useful in this case because of the small importance of corporate income in the services total. It will be recalled from Tables 1 and 2 that most of the NEI in services is accounted for either by unincorporated enterprises or by household interest payments. While there are a number of possible reasons for altering the NID treatment of household interest, it was finally decided to retain the existing usage. In the absence of a satisfactory breakdown by state for this sector, the NEI of services was allocated on a proportional basis to the nonagricultural proprietary income as shown in *Personal Income by States Since 1929*.

FINANCE, INSURANCE, AND REAL ESTATE

The NEI was allocated in two stages. The corporate profits and unincorporated income of firms in this sector were allocated according to the corporate profit distribution of the *Source Book*. The interest and rental income were allocated according to the estimated value of tenant-occupied buildings. This distribution follows an allocation supplied by the NID. The underlying distribution of housing value comes from the Census of Housing. While it would appear arbitrary to allocate interest payments in this sector in the same fashion as rental payments, there are two reasons which suggest this procedure. Information from the NID reveals that most of the net interest generated by this sector represents interest payments by personal landlords. Thus a possible

⁸⁶ *Census of Business, 1954*, U.S. Bureau of Census, 1954.

ESTIMATION OF PRODUCED INCOME

allocator is the state distribution of value of all real estate. Since this allocator is not available for the two study years, it was decided to allocate on the basis of the value of tenant-occupied buildings.

SUMMARY

Table 13 shows the relation between the estimates of gross entrepreneurial income after adjustment by *Source Book* information on the net-to-gross ratio and the actual national control totals for the sectors where such estimates are made. In the case of the finance sector, estimates were made only for the sum of corporate profits and income of unincorporated enterprise.

TABLE 13
ADJUSTED GROSS AND NET ENTREPRENEURIAL INCOME, 1929 AND 1953
(million dollars)

<i>Sector</i>	1953		1929	
	Adjusted GEI	NEI	Adjusted GEI	NEI
Mining	3,245	1,477	880	545
Manufacturing	24,527	23,265	7,986	5,990
Construction	—	—	1,123	1,290
Transport and public utilities	6,299	7,130	2,847	3,308
Trade	12,050	17,525	1,965	4,081
Finance	4,854	4,651	1,206	1,919

Most of the estimates are within 20 per cent of the national control totals. In those cases where the errors are larger, it is explained by the likelihood that the ratio of net to gross entrepreneurial income as reported in the IRS data are unrepresentative of the whole population. This would be true in the case of trade where the IRS data were used to estimate the ratios of net entrepreneurial income to sales, or used to estimate the cost of goods sold. The errors would arise because the IRS data represent the corporate sector only in 1929, and represent only the largest part of the corporate sector for the later years.

Another explanation is possible in those cases where *Source Book* data were used to provide an estimate of the over-all size of an industry—for example, public utilities in 1929. It is possible that the net entrepreneurial income is understated at the very start. In this industry, on the basis of the NEI definition I have used, the

ESTIMATION OF PRODUCED INCOME

Statistics of Income reveals a figure of \$2,402 million, which is below the \$3,308 million used in this study.

C O M M E N T

DANIEL CREAMER, National Industrial Conference Board

Despite the fact that George Borts' estimates of income produced by states are central to his paper, it seems to me that too little attention is given to the details of the derivation and the limitations of the estimates. Without a full understanding of the weaknesses of the estimates, one cannot judge whether the uses made of them are defensible and the results valid. For this reason, I have restricted my comments to the estimating procedures.

The heart of the problem is the estimation of property income by the state in which it is produced. The official estimates of personal income by state are by the state of residence of the recipient. However, the wage and salary component, being based on establishment data, is, in the first instance, estimated on a "where-produced" basis. It is transformed onto a "where-received" basis by correcting for interstate commuting. On the other hand, the property income component of personal income by state has two major defects for Borts' purposes. It excludes retained corporate profits, and individuals' receipts of distributed property income are estimated on a where-received basis. Thus, much the larger part of labor income is already available on a where-produced basis, but estimates of property income on this basis must be developed. The newly developed estimates account for about 30 per cent of his national control total, which is net domestic income produced, slightly modified to exclude imputed interest payments of the nonfinancial business sectors entered in the national accounts as an offset for financial services.

Borts develops the property income estimates for two benchmarks, 1929 and 1953. His national control total is divided into nine industrial sectors and each sector control total is allocated to the forty-eight states. The quality of the estimates then depends on the quality of his state allocation procedures.

Borts concludes that: "In general, the most reliable state distributions are those provided by Census data, ICC data, and for agriculture which was distributed according to a measure of farm proprietors' income." As a basis for judging how reliable the

ESTIMATION OF PRODUCED INCOME

most reliable sector estimates are, I have concentrated on the agricultural sector and on manufacturing which is based on Census data.

The factor returns to capital—interest, net rent, and net profit before income tax—Borts calls net entrepreneurial income (NEI). The control total for the agricultural sector is allocated among the states by the relative state distribution of farm proprietors' income as shown in the official personal income estimates by state. Borts notes that this treatment ignores the consideration that some part of NEI in farm proprietors' income is actually a factor return to the farm proprietors' labor service. Perhaps more serious for his interstate and interregional comparisons is the large regional variation in the percentage of his NEI that must be a property return. This can be inferred from the large regional range in the ratio of physical farm capital to gross farm income in constant prices as estimated by Alvin Tostlebe.¹

The estimate for the manufacturing sector is carried out in three stages. Remember that the objective is to derive some factors for allocating NEI by states for 1929 and 1953. For the 1929 estimate, Borts starts with a state distribution of value added for all manufacturing from the U.S. Census of Manufactures for 1929. This, of course, is much grosser than NEI. The first adjustment to approximate NEI is to subtract from Census value added wages and salaries reported by Census. The remainder Borts calls gross entrepreneurial income—GEI. This exceeds NEI, the factor returns to capital, by the inclusion of inventory accumulation, supplements to wages and salaries, capital consumption, taxes other than those on income, and purchases from enterprises other than materials, supplies, containers, fuel, purchased energy, and contract work. Borts sought for a reduction ratio, a separate one for each state, that would purge these items from GEI and leave NEI. He found such a ratio in the *Source Book* tabulations of the *Statistics of Income*.

The denominator of this ratio in terms of *Statistics of Income* entries must equal or closely approximate GEI from the Census of Manufactures. Borts states that this equivalence can be achieved by subtracting from the sum of gross sales and gross profits from operations (1) the cost of goods sold, (2) compensation of officers,

¹ *Capital in Agriculture: Its Formation and Financing since 1870*, Princeton for NBER, 1957, pp. 108-109.

ESTIMATION OF PRODUCED INCOME

and (3) miscellaneous deductions. The subtraction of this last item, as I read the evidence, introduces a significant error into the ratio. With the minor exception of repairs, miscellaneous deductions are not composed of expenditures for materials, supplies, containers, fuels, purchased energy, and contract work. Much the largest part relates to expenditures for business services, including rental on property, business transfer payments, and supplements to wages and salaries, such as they were in 1929. Such expenditures, conceptually, are part of gross entrepreneurial income.

Miscellaneous deductions, moreover, are not trivial in amount. For all corporate manufacturing in the forty-eight states in 1929, they represent 19 per cent of the sum of the cost of goods sold and compensation of officers; in mining, 26 per cent; and in contract construction, 29 per cent.

In the numerator of his reduction ratio, Borts enters only two items, taxes other than income taxes and depreciation and depletion. If my characterization of miscellaneous deductions is correct, these also should be part of the numerator. Moreover, it is a misconception to include depletion in the numerator. The NEI control total includes the estimate of net profit before income taxes prepared by the National Income Division. This estimate is gross of depletion. Therefore the reduction ratio should be so constructed as to yield NEI gross of depletion. Borts' ratio produces NEI net of depletion.

A statistical test supports this criticism of the Borts reduction ratio. The test consists simply of comparing GEI for total manufacturing according to Borts' specifications of the use of IRS data and according to my specifications with GEI based on the 1929 Census of Manufactures. Census value added less wages and salaries for corporations only (based on the data in *Historical Statistics*) amounted to \$15.1 billion. The comparable total based on IRS data for 1929 and Borts' specifications is only \$6.6 billion. If my specifications are used, the total is \$16.8 billion, only 11 per cent larger than the Census-derived total. The direction of this difference is expected since IRS data are company based and therefore include some nonmanufacturing operations, which is not the case with the establishment-based data of the Census.

If GEI for all firms in manufacturing based on Census data is \$16.3 billion in 1929 and the NEI control total is \$6.0 billion (Borts' Table 1), the perfect reduction percentage is 63. Ac-

ESTIMATION OF PRODUCED INCOME

According to Borts' prescription, his reduction percentage is 40 and, according to my prescription, 76. In short, the level of his reduction ratio is very wide of the mark nationally. My computations suggest that his ratio would account for only 57 per cent of his control total. However, a more careful use of the available data would produce a much closer approximation to the required ratio. I am unable to perceive why its performance would be more accurate at the state level, even if we assume there are acceptable state data for the construction of the reduction ratio.

What are the state data? Borts relies on the state tabulations of data from corporate income tax returns presented in the *Source Book*. From *Statistics of Income, 1929*² we learn that:

the data for States and minor civil divisions, although compiled from returns filed in each locality, do not represent what may be called the geographical distribution of income, there being no way of ascertaining from the income-tax returns the amount of income originating in the respective States as income reported by a corporation in one State may have been derived from sources in other States . . . a corporation files its income-tax return in the collection district in which its principal place of business or the principal office or agency is situated, excepting closely affiliated concerns filing a consolidated return. In the latter case the consolidated return is frequently filed in a State other than the State in which the principal place of business or principal office or agency of the subsidiary is located.

Borts is aware of this deficiency, but expresses his concern only in the last few pages devoted to a discussion of improving the estimates. That is, no mention of this deficiency is made in the technical appendix describing the estimates nor in the introductory pages of the paper where the derivation of the estimates is briefly described. At that early point, it seems to me, it would have been helpful to discuss this difficulty and to speculate on the direction and extent of bias created by the discrepancy between the state in which a corporate income tax return is filed and the state in which the manufacturing activity is located.

My own guess is that this data defect understates NEI produced in the older manufacturing states. My reasoning and assumptions are as follows: (1) The companies that have processing operations in more than one state are the larger firms. (2) The

² *Statistics of Income for 1929*, Washington, 1931, p. 3.

larger firms have a higher capital-output ratio than smaller firms. (3) Therefore, Borts' reduction ratio, which includes depreciation in the numerator, is too high and NEI too low in states in which the principal offices of companies with multistate operations are located. (4) The latter states, I assume, are the older manufacturing centers in the New England, Middle Atlantic, and Great Lake states.

If this reasoning is correct, the differences Borts finds in these states between NEI received and produced is overstated.

Thus far we have been concerned with the estimates of NEI for manufacturing by states for 1929. I have suggested that the formulation of the reduction ratio used to convert GEI to NEI is much too crude and that this defect is compounded by the use of state corporate income tax tabulations based on the state of the principal office.

The estimates for the manufacturing sector in 1953, also subject to these "data defects," suffer from additional deficiencies—the data used relate not to 1953 but to other years. For example, the initial allocation of the national control total for 1953 among the states is based on the state distribution of GEI from the Census of Manufactures for 1954. That, of course, was a recession year. And we know from Borts' earlier researches that there are regional variations in cyclical movements. One would not expect the state distribution of manufacturing in a recession year (even a relatively mild recession) to be an accurate proxy for the state distribution at the peak level of 1953.

Even less acceptable are the data for the reduction ratios by states. Because of the limited uses of state tabulations of corporate income tax returns, the Internal Revenue Service prepares state tabulations only at infrequent intervals and primarily for administrative purposes. Closest in point of time to 1953 were the state tabulations of a sample of large corporations for 1957. Borts reports a sample of 10,000 companies for all industries—the number classified as manufacturing is not given. The reduction ratios then have a large company bias, which further accentuates the basic defect of these state tabulations, and they relate not to 1953 but to 1957 when the fixed-capital-to-output ratio for all manufacturing had risen by nearly 10 per cent.

Now I come to my main point. Borts states that his estimates for manufacturing are among his most reliable. For the reasons

just developed, I have grave doubts whether his estimates for the manufacturing sector attain a level of accuracy that can sustain the analytic burden he places on them. If this is true for manufacturing, it applies with even greater force to those sectors regarded by Borts as less reliably estimated.

This concentration on the negative aspects does not do full justice to the paper. We are indebted to Borts for showing us in a practical way what the difficulties are in preparing estimates of income produced by states and for showing us some of the imaginative analytical uses to which such estimates could be put once their margin of error is reduced to more tolerable limits.

WERNER Z. HIRSCH, University of California, Los Angeles

There can be no doubt that George Borts has presented us with a pioneering study in an area in which few economists before him have had the courage to rove. It opens a host of new questions and challenges at a time when economists, inside and outside government, are becoming increasingly aware of the usefulness of knowledge about regional economic activity. In his careful manner, Borts has kept the ratio of heroic assumptions to painstaking labor as low as possible and has achieved for the first time comprehensive estimates of produced income for forty-eight states in 1929 and 1953.

I will first attempt to raise a few questions about the methodology and data employed and suggest some possible answers. Thereafter, I will explore short-run applications of information on produced income to supplement Borts' presentation of its application to long-run situations.

I

Profit rates and the ratio of net to gross entrepreneurial income for sectors and states were estimated by Borts with the aid of the *Source Book of Corporate Income Tax Return* of the U.S. Internal Revenue Service. The use of these data can be justified on the grounds that at present no better ones are available. However, since these data occupy such a pivotal position in the income computations, an awareness of their main shortcomings is essential. Borts mentions the fact that they are based on corporation reports. Before they are applied to all legal forms of organization, adjustments using sole proprietorship and partnership data, meager as

ESTIMATION OF PRODUCED INCOME

they are, could improve the estimates of net entrepreneurial income.

Secondly, the "miscellaneous deductions" category of the Internal Revenue Service used by Borts in his equation in Appendix B is designed precisely for tax purposes. It would have been desirable to modify the data to make them more consistent with the economic definition given them in this paper. For example, depreciation claimed on the tax return may not be the same as depreciation charged in accounting for profits to stockholders. Net entrepreneurial income may thus be understated.

In addition to these issues, the 1929 and 1953 data are not entirely comparable. While the IRS *Source Book* offered reasonably complete data for 1929, no such data are available for 1953. Instead, Borts uses an IRS sample of returns of the 10,000 largest corporations for 1957, which raises a number of questions. What is the nature of the bias introduced by this procedure? Specifically, what bias is introduced by using 1957 relationships for 1954? Also, what bias is introduced by using the 10,000 largest corporations instead of all corporations?

II

A corollary question pertains to the growth analysis. For example, the claim is made that "the received and produced NEI appear to change in a similar fashion over long periods of time." The basis for this assertion is a comparison of rather poor and only partially comparable entrepreneurial income data for two years—1929 and 1953. Much of the growth discussion appears somewhat tenuous because of the paucity of data, general statistical difficulties with time series data, and absence of statistical significance tests. Borts' enthusiasm appears to run away with him here.

III

One of the most interesting pieces of information offered by Borts is his Table 3, which shows net entrepreneurial income data by states on both a produced and received basis for 1929 and 1953. While the absolute data are intriguing, the ratios between received and produced NEI are even more so. In 1929 the ratio was highest for Maryland and lowest for South Carolina, i.e., 144 versus 64. The New England states exhibited the highest ratio. They were followed by the Middle Eastern states. The Plains,

ESTIMATION OF PRODUCED INCOME

Southeast, Southwest, and Rocky Mountain states had ratios below 100.

By 1953 the picture had changed greatly. Delaware had taken the place of Maryland, and West Virginia that of South Carolina. The ratios were 179 and 71, respectively. The ratios of the New England, Plains, Southeast, Southwest, Rocky Mountain, and Far West states had increased over 1929. Those for the Middle Eastern and Great Lakes states had declined.

Two major questions suggest themselves: On the assumption that the data are by and large accurate, what can explain the differences between the ratios of different states in either year, and what can account for the changes in the ratios of a given state from 1929 to 1953? Borts makes little effort to provide an answer to either question; and yet until good explanations are offered, further doubt is cast on the quality of the estimates.

A number of hypotheses suggest themselves as possible explanations—for example, older states have had more time to establish a substantial resource base and, therefore, their produced income should exceed that of newer ones. The data do not appear to support this hypothesis. While the ratios in the New England states are high, those in the Southeast are low, and both regions are about equally old.

Other hypotheses are that industrial structure can affect the ratio and that the age distribution of population has a major bearing. As to the latter hypothesis, Florida, Arizona, and California should have about similar ratios. All three states have attracted many retired persons with means. Received income should exceed produced income. It does so, but the differences between the ratios of the three states are major: 130, 74, and 120 in 1929, and 143, 102, and 123 in 1953, respectively.

Turning next to changes over time, no ready explanation suggests itself for the doubling in Delaware's ratio from 91 to 179, within a span of fourteen years. Why did the New York ratio drop during this period from 125 to 108 and that of Maryland from 144 to 116? On the other hand, why was only the ratio of Massachusetts virtually the same in 1929 and 1953?

A comparison of ratios over time may be more instructive if data are expressed on a per capita basis. In this manner, the general effect of population changes can be isolated.

Borts offers sound and at the same time challenging proposals

ESTIMATION OF PRODUCED INCOME

to increase the availability of relevant data. Whether the Internal Revenue Service can be a major source for further data depends on the presence of the required information on the tax returns, a sufficiently large budget, and lead-time to build up the analytical resources necessary to plan and produce such data. For example, the sole proprietorship return for 1960 does not include information on interest income. In addition, a finer functional and regional breakdown would require a substantial increase in the size of the sample presently drawn by the Internal Revenue Service.

The Census link study opens the way for obtaining much improved data. However, it must be realized that this study, which attempts to link U.S. Census and Internal Revenue Service data, is merely in a pilot stage. The present main objective is to show industry subdivisions of the corporation data, and even in this connection only tentative findings can be expected. Ultimately, it can prove an important data source.

IV

I would like to turn next to a brief examination of the application for impact analysis of produced income estimates by states in general and the Borts paper in particular. Borts' main interest in produced income data appears to stem from his concern with long-run growth comparisons. But short-run impact analysis also often prefers produced income to received income data. It usually inquires into the impact various autonomous forces have on returns to resources employed in a state, rather than on returns attributable to factors supplied by residents of a given state. For example, a state government faced with prevalently low incomes might want to estimate the potential impact of alternative development policies. Its main criterion for evaluating the desirability of alternatives would be income to resources employed in the state.

To study such issues, state input-output accounts, centered around commodity and service flows rather than payment transactions, can be constructed. In this manner, the effect of autonomous forces on the state's resources and their returns can be appraised.

Borts' work can provide basic information for the development of the household row of such a state input-output transaction matrix. For many purposes, however, further disaggregation of the nine industry sectors is necessary. Especially, more detail is

ESTIMATION OF PRODUCED INCOME

needed for the manufacturing, services, and trade sectors. Impact analysis points to the need for up-to-date information, which however is unlikely to be produced from Internal Revenue Service data. For many years to come, they will tend to be about two years late. Even Census data will not be ready much earlier.

V

In conclusion, I hope that my remarks in no way detract from the contribution made by George Borts. He deserves our gratitude for having opened up a significant new area of income analysis.

ROBERT E. GRAHAM, JR., National Income Division, U.S. Department of Commerce

George Borts' effort is a path-breaking one. The state estimates of income produced which he has presented here constitute the first such measure to be developed in a comprehensive and systematic fashion, and it is obvious that much imagination and statistical ingenuity have been marshaled to meet problems that stem basically from a lack of essential data. However, the measure which Borts has prepared does not appear to provide "a means of interpreting capital accumulation . . . and changes in the capital intensity of different sectors of the region's economy"; nor does it permit an examination of the respective roles played by the stock of capital and the rate of return on such capital employed in each state as determinants of the geographic distribution of the returns to property. The real contributions of this paper are that it focuses attention on the difficulties inherent in measuring monetary returns to capital on a geographic basis and outlines the dimensions of the problem.

Daniel Creamer and Werner Hirsch have commented extensively on the statistical aspects of the income produced measure, and I shall make only two points in this regard. First, in large degree the estimates reflect the geographic distribution of the volume of business activity as measured by sales, value added, miles of track, number of telephones, etc., with only rough adjustments for geographic differences in profit ratios. Secondly, there is a lack of comparability over time as illustrated by the construction industry. For 1929, net entrepreneurial income was estimated by applying profit ratios derived from corporate returns to value added less wages. For 1953, the value of contract awards by states was

ESTIMATION OF PRODUCED INCOME

used to allocate the national total. Quite apart from any errors in the estimates for each individual year, two instances of lack of comparability stand out: (1) The distribution of value added (underlying 1929) reflects construction activity by the state of the home office of the company, while contract awards (underlying 1953) measure construction activity by the state of the location of the work. (2) The 1929 state estimates reflect profit differentials among the states as derived from IRS returns, while the 1953 distribution assumes equal profit ratios state by state.

On balance, the lack of temporal comparability, the absence of profit differentials in the estimates for a number of industries, and the potential error in the industries which the author terms "good" would seem to combine so as to blunt, if not actually distort, the over-all measure of NEI.

Borts' presentation would have been strengthened had more consideration been given the concept of income produced on a geographic basis. For example, what is the meaning of corporate profits in relation to their geographic origin? Do profits originate where a company's capital equipment is located, where its sales are made, or where entrepreneurial decisions are formulated? Take the case of a stock life insurance company with headquarters in one state, solicitors writing insurance in each of the fifty states; and the company's premium income invested in company-managed real estate or loans in a half dozen states. Where do the profits of this corporation originate? Or consider an integrated petroleum company with oil wells in one state, pipelines crossing several states to its refineries concentrated elsewhere, wholesale bulk plants in a number of states, and leased filling stations scattered even more widely. Does the "value-added" approach form the basis of the profits measure that is sought and so yield estimates which mirror state differences in the return to capital, or does it merely reflect the company's accounting practices?

It seems to me that much thinking along definitional lines remains to be done in order to formulate a satisfactory set of concepts before we get into the measurement phase of the geographic distribution of income produced. A primary consideration in such thinking should be the needs which the measure is intended to serve. Certain uses may permit the adoption of specific conventions in the measurement of property returns. For example, in revenue estimation or the analysis of fiscal capacity by states, the

ESTIMATION OF PRODUCED INCOME

generally accepted formulae now in use in determining corporate state tax liability may be entirely acceptable as a means of allocating property returns. Similarly, other conventions, though lacking the theoretical basis, may well cut through the difficulties of statistical measurement and, at the same time, yield a useful measure of net entrepreneurial income produced.

REPLY by George H. Borts

In this section I shall examine alternative methods of estimating net entrepreneurial income. New estimates have been made for the manufacturing sector and the resulting changes incorporated into total NEI. One set of changes was investigated at the suggestion of Daniel Creamer for the reasons given in his comments above. The second set of changes was made in response to the appearance of new data in the 1958 Census of Manufactures. These data were made available after the first draft of this paper was written.

Comments by Daniel Creamer

Creamer questioned the validity of the formula shown in Appendix B, which was designed to convert gross to net entrepreneurial income by using regional data available in the Internal Revenue *Source Book*. The formula was written:

$$\frac{\text{NEI}}{\text{GEI}} = 1 - \left[\frac{G + H}{A + B - E - F - K} \right].$$

(For definition of the terms, see Appendix B.)

Creamer argues that the denominator of the expression is too small, by virtue of the subtraction of miscellaneous deductions. In 1929, for all manufacturing, the denominator I used would come to \$6.6 billion for gross entrepreneurial income; if miscellaneous deductions were added back in, the estimate would be \$16.8 billion. The actual census figure for GEI was \$16.7 billion. Creamer does not object to the procedure used to arrive at net entrepreneurial income from Internal Revenue sources. Both his procedure and mine yield an estimate of NEI of \$4 billion, compared with the National Income Division control total of \$5.99 billion. The crux of Creamer's objection is that the reduction formula I use places too much emphasis on depreciation and therefore

penalizes regions where depreciation is likely to play an important role. The formula Creamer prefers is

$$\frac{\text{NEI}}{\text{GEI}} = 1 - \left[\frac{G + H + K}{A + B - E - F} \right].$$

I have attempted to evaluate at the national level the importance of Creamer's very reasonable suggestion. I recomputed the reduction formulae for each manufacturing industry sector for 1929 and compared it with two other formulae, all of which are shown in Table A. Column 1 shows the national average reduction ratios based on Creamer's formula; column 2 shows the national average reduction ratios used in my study. Column 3 shows the national average reduction ratios implied by proceeding directly from Census GEI to the NEI measured by the National Income Division. Bear in mind that my study uses regional formulae which when averaged equal those shown in column 2. Also note that the ratios in column 2 have been adjusted equiproportionately for the shortfall of GEI which my procedure implies.

Asterisks are used in columns 1 and 2 to show which of the estimates is closer to the figure in column 3. It can be seen that Creamer's proposal, while reasonable, does not necessarily improve the estimate of the ratio of gross to net entrepreneurial income.

A second method of evaluating Creamer's proposal is to compute the net entrepreneurial income using the reduction formula he suggests. In order to carry out such a test thoroughly, it would be necessary to recompute the reduction formulae for each region. However, as a first approximation, I used the national ratios in column 1 of Table A and applied them to the manufacturing gross entrepreneurial income of each state. As a check I also used the national ratios in column 3 of Table A. The results are summarized by region in Table B. Column 1 shows the value of manufacturing NEI as derived from the reduction formulae in column 1 of Table A. Column 2 shows the manufacturing NEI derived from my study. Column 3 shows the manufacturing NEI derived from the ratios in column 3 in Table A. Also shown in Table B are the effects of these changes on total NEI in the regions. The total NEI of the regions were corrected by addition or subtraction for the changes in manufacturing NEI implied in columns 1 and 3. Columns 4 and 6 show the ratio of the total received NEI to the corrected total produced NEI.

ESTIMATION OF PRODUCED INCOME

TABLE A
RATIO OF GROSS TO NET ENTREPRENEURIAL INCOME, 1929

	Creamer (1)	Borts (2)	Census NID (3)
Food products, beverages, tobacco	.309*	.367	.229
Textiles and textile products	.219	.291*	.266
Leather and leather products	.248	.354*	.323
Rubber and related products	.203	.293*	.254
Lumber and wood products	.243	.234*	.230
Paper, pulp, and products	.405	.334*	.305
Printing and publishing	.328*	.394	.271
Chemicals and allied substances	.402*	.324	.536
Stone, clay, and glass	.339*	.326	.341
Metal, metal prod., machinery, and transport equip.	.431*	.382	.416

TABLE B
NET ENTREPRENEURIAL INCOME FOR MANUFACTURING, 1929

Region	1929 Manufacturing NEI (million dollars)			1929 Ratio of Received to Produced Total NEI		
	Creamer (1)	Borts (2)	Census- NID (3)	Creamer (4)	Borts (5)	Census- NID (6)
New England	539.3	552.7	532.5	130.4	129.7	130.8
Middle East	2,055.5	2,067.7	1,989.4	124.1	123.8	125.4
Great Lakes	1,909.8	1,769.6	1,930.8	96.3	97.9	96.0
Plains	367.6	413.4	383.3	86.7	85.7	86.3
Southeast	589.0	651.7	625.2	85.4	84.1	84.5
Southwest	113.0	111.0	107.6	81.7	81.7	81.9
Rocky Mountain	55.5	63.2	59.7	87.6	86.7	87.1
Far West	356.5	359.3	356.8	115.0	115.0	115.0

If we examine columns 1, 2, and 3, we see that Creamer's procedure penalizes the following regions: New England, Middle East, Plains, Southeast, Rocky Mountain, and Far West. It favors the Great Lakes and Southwest regions. Thus it is not correct to say that my procedure favors newer as opposed to older regions.

If we examine columns 4, 5, and 6, we see that the changes in manufacturing NEI are not by themselves strong enough to offset the original regional patterns of divergences between received and produced income. This is, of course, an incomplete test of Creamer's proposal, for it is not applied to nonmanufacturing

ESTIMATION OF PRODUCED INCOME

sectors. If it were, there would undoubtedly be additional changes in the patterns of produced NEI. Nevertheless enough has been done to indicate that, while Creamer's suggestion would lead to different results, they would not necessarily alter the basic findings of this study.

To determine the possibility that changes in NEI in other sectors might alter the regional patterns, the following computation was performed. The percentage change from column 2 to 1 in Table B was applied to the total produced NEI of the region. That is, I assumed that the percentage change implied by column 1 would apply to NEI in all categories. The ratio of received to adjusted produced NEI was then computed. These are shown in Table C.

TABLE C
RATIO OF RECEIVED TO PRODUCED NEI, 1929

<i>Region</i>	Manufacturing NEI Ratios of Column 1 to Column 2 (1)	<i>Ratio of Received to Produced Total NEI</i>	
		Borts (2)	Adjusted (3)
New England	.976	129.7	132.9
Middle East	.994	123.8	124.6
Great Lakes	1.079	97.9	90.8
Plains	.889	85.7	96.4
Southeast	.904	84.1	93.1
Southwest	1.018	81.7	80.3
Rocky Mountain	.878	86.7	98.8
Far West	.992	115.0	115.9

The only region experiencing a significant alteration of position is the Rocky Mountain region. The relation of received to produced income remains roughly the same for the other regions.

New Data in 1958 Census of Manufactures

A special Census tabulation for 1957 permits finer approximations to net entrepreneurial income than those made previously.¹ The new data consist of state estimates for 1957 of supplementary employment costs, expenditures for maintenance and repairs, insurance premiums, rental payments, property taxes paid, and depreciation

¹ *Supplementary Employment Costs, Cost of Maintenance and Repair, Insurance, Rent, Taxes, and Depreciation and Book Value of Depreciable Assets: 1957; Industry and Industry Groups, State by Industry Groups, 1958 Census of Manufactures.* This report is also published as Chapter IX, Volume I, *Summary Statistics of the 1958 Census of Manufactures.*

ESTIMATION OF PRODUCED INCOME

and depletion charges. With the exception of maintenance and repairs, all of the above items should be subtracted from gross entrepreneurial income in order to approach net entrepreneurial income. Only that portion of maintenance and repairs should be subtracted which represents purchases from other firms. I have estimated the subtractable portion to be the amount charged for maintenance and repair over and above that paid to the firms' own employees.² Table D shows the magnitudes of gross entrepreneurial income, net entrepreneurial income, and the relevant cost items.

TABLE D
U.S. TOTALS OF GROSS AND NET ENTREPRENEURIAL INCOME, 1957
(million dollars)

Value added in manufacturing, Census		147,928
Payrolls		-76,379
Gross entrepreneurial income		71,549
Maintenance and repair	4,472	
Insurance	667	
Rental payments	1,411	
Property taxes	1,450	
Depreciation	7,295	
Supplements to payrolls	5,974	
	21,269	-21,269
Census approximation to NEI		50,280
National income originating in manufacturing, NID		112,517
Compensation of employees		-87,671
		24,846
Discrepancy		+25,434
		50,280

It may be seen that, without the new data, the Census GEI of \$71.5 billion is over \$50 billion greater than the NEI of \$24.8 billion. The new data permit the allocation of \$21.3 billion, so that the discrepancy is reduced to \$25 billion. In the absence of additional information, reduction formulae must again be used. An alternative, not explored here, is to blow up the totals of the cost items, so that they equal the amounts shown in the *IRS Statistics of Income*.

A check of the new data was carried out through a crude

²In 1957 total maintenance and repair in manufacturing is shown as \$9 billion; while \$4.5 billion is paid to employees of the same firm. Thus \$4.5 billion are assumed to be purchases from other firms.

ESTIMATION OF PRODUCED INCOME

reduction formula. The resulting distribution of NEI was then compared with the state manufacturing NEI prepared in my study. There are many reasons why the two series should not agree, so that the purpose of comparison is to give only a rough idea of the changes the new data imply.

The reduction formula employed is the following: For each state, the Census approximation to NEI was computed. The state entries were then reduced proportionately so that they totaled \$23,265 billion, the NEI in 1953. No attempt was made to correct for state industry mix, although the data permit such correction. Undoubtedly such corrections will be made in later studies. The distribution of manufacturing NEI is shown in Table E. Column 1 shows the estimates made with the new data; column 2 shows the estimates made in the original study.

TABLE E
MANUFACTURING NET ENTREPRENEURIAL INCOME, 1953
(million dollars)

Region	Census (1)	Borts (2)	Ratio of Col. 1 to Col. 2 (3)
New England	1501.9	1518.5	.989
Middle East	6259.5	6142.3	1.019
Great Lakes	6876.3	7533.7	.913
Plains	1507.3	1345.5	1.120
Southeast	3444.9	3055.0	1.128
Southwest	1115.7	1170.5	.953
Rocky Mountain	285.8	208.4	1.371
Far West	2274.5	2291.0	.993

It can be seen that the new data do depart somewhat from the earlier estimates. While NEI is not reduced anywhere by more than 8 per cent, it is increased by 37 per cent for the Rocky Mountain area. It is curious that Creamer's ratios penalize the Rocky Mountain area, while the above data reward it quite heavily. Again referring back to a comment of Creamer's, there is no indication from this comparison that my method penalizes older areas and rewards newer areas. The same conclusion holds when the above changes are added to change the produced income for each region. Table F shows the original ratios of received to produced income, and those which are derived from the above changes in manufacturing.

ESTIMATION OF PRODUCED INCOME

TABLE F
RATIOS OF RECEIVED TO PRODUCED INCOME, 1953

Region	Census (1)	Borts (2)
New England	133.8	133.4
Middle East	106.8	107.4
Great Lakes	90.7	88.1
Plains	99.1	100.8
Southeast	90.0	92.1
Southwest	92.9	92.2
Rocky Mountain	97.9	101.2
Far West	118.9	118.7

It is to be hoped that further refinements of GEI will be made possible in the future. This will require additional special studies by the Census and some attempt at reconciliation of Census and NID estimates of national income generated in manufacturing. Presently available data do not permit such a reconciliation.

