The Analysis of Factor Shares by Industry

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A 13th century theologian who succeeded in measuring the head of a pin would not have found the information helpful without knowledge of the area of an angel's foot. And an economist who measures income shares by industry is not much better off until he resolves an almost equally metaphysical question—namely, what it is he has measured. The problem arises from the fact that, unlike information on the aggregate shares of capital and labor in the economy as a whole, data on factor shares for individual industries are of little intrinsic interest.

From the standpoint of income distribution, it matters little whether property holders or wage recipients derive their income from one industrial activity or another. Estimates of factor shares by industry are useful only indirectly. More specifically, the significance of measures of property income by industry lies primarily in their role either as indicators of capital inputs or as measures of the rewards to capital, expressed as rates of return. The use of estimates of property income to measure profitability is too familiar to warrant discussion at this point, but the implications of using these estimates to measure interindustry differences in capital inputs have not been adequately explored. Consequently, while this paper is mainly concerned with measurement problems, it first focuses on the above question.

Differences Among Industries in the Relation of Property Income to Output

Differences among industries in the ratio of earnings to output stem from two sources: variations in the production function and variations in rates of return. To what extent, then, can property income be taken as a measure of capital inputs? While the income that accrues to capital is, by definition, the value of the services of capital at market prices, for most analytical problems the desired measure of capital inputs is an estimate of the services of capital valued at their replacement cost. The extent, therefore, to which property income can be used for interindustry comparisons of capital-labor or capital-output ratios depends on the degree to which rates of return on replacement cost vary among industries. Assuming that the rewards for superior entrepreneurship are in-

cluded in the compensation for managerial services, economic theory offers three possible reasons for differences in these rates of return. First, they may result from the presence of monopoly; second, from risk aversion (or risk preference) in conjunction with differences in risk between industries; and third, from temporary disequilibriums.

To date, attempts to establish a clear empirical relation between profit rates and monopoly have not met with much success,[1] so that one must at least tentatively conclude that in the American economy monopoly has not generated large and persistent differences among industries in rates of return. The role of the second factor, risk aversion, is still obscure and there is currently no evidence to support or confute a hypothesis about its influence. The third factor, that of temporary disequilibrium, is likely to be important. However, this source of variation in rates of return is, presumably, largely eliminated if returns are averaged over a period long enough to smooth out the effects of short-run fluctuations in output and of the lag in adjustment of supply to long-run shifts in demand. Our assumption is that when income is averaged over a period sufficiently long to smooth out the effects of temporary disequilibriums, there is a strong tendency to equality in rates of return to capital, when capital is valued at the replacement cost of its services. Thus, variations among industries in the ratio of average income to average output become useful measures of differences in the capital intensiveness of production. The critical question from the standpoint of measurement is the minimum duration of the period over which income must be averaged, for the choice of too long an interval may conceal significant changes in the production function.

A comparison of ratios of income to output with ratios of balance sheet values of capital to output appears in Table 1. For this table, gross income (without subtracting depreciation charges

[1] See, for example, Joe S. Bain, "Relation of Profit Rate to Industry Concentration: American Manufacturing, 1936–1940," *Quarterly Journal of Economics*, August 1951. Bain found no steady relation between the degree of concentration of production in a few producers and profit rates, though for one sample of forty-two industries he observed a higher profit rate for industries in which 70 per cent or more of the value of product was contributed by eight producers. In my own study, "The Analysis of Stability and Change in Market Shares" (*Journal of Political Economy*, February 1963), it was found that stability in market shares (another and perhaps more direct test of monopoly power than the concentration ratio) showed no clear relation to industry profit rates.

but after income taxes),[2] was averaged for the eight-year period, 1947–54 (and adjusted for changes in the price level). The relevant output was measured by the average of output for 1948 and 1953. When the income-to-output ratios using these measures are compared with ratios of capital assets to output for 1948 and 1953, there is obviously a strong relation between the two types of ratios. However, important differences in the ranking of industries on the basis of the two types of ratios arise, and the Spearman coefficient of rank correlation for the income-to-output and the 1948 asset-to-output ratios was only .702. Using the 1953 asset-to-output ratios, the Spearman coefficient was .695. Thus, despite the positive effect on the correlation coefficient resulting from the presence of common components in the denominators of the two sets of ratios, one set of ranks explained not quite one-half the variance in the ranks of the other set.[3]

The most important reason for differences in ranks based on income-to-output and asset-to-output ratios is that balance sheet values vary in relation to the replacement cost of tangible assets. It is only relative to *replacement* cost that returns can be expected to move, in the long run, towards equality. Because of the way in which book values are arrived at, these values are higher compared to replacement cost in industries with more rapid technological change.

Balance sheet values are conglomerate in the sense that, even if deflated for changes in the price level, they are composed of heterogeneous valuations. This stems from the fact that assets are acquired at more than one point in time and, hence, their book values reflect prices set under differing technologies. Since there is no evidence of a secular rise in rates of return, gains in technology appear to be translated into increases in real wages, leaving rates of return on new investment unchanged over time.[4] In con-

[2] It is the after-tax rates of return that, in the long-run, can be expected to move towards equality.

[3] When only the numerators of the ratios are correlated, a very high rank correlation coefficient results, but this is merely a consequence of the fact that both income and assets are a function of industry size. The Spearman coefficient for asset-to-output ratios in 1948 and 1953 was .833. This reflects a fair amount of instability considering that there were only five intervening years and that both 1948 and 1953 were generally years of peak output—a fact which greatly reduces the possibility that distortions in asset to output ratios will arise from the presence of excess capacity.

[4] For the period 1889–1957 real wages in manufacturing show an average annual percentage rise of 2.3. Assuming that labor inputs account for 70 per cent

TABLE 1
RATIOS OF GROSS INCOME TO OUTPUT AND CAPITAL ASSETS TO OUTPUT, TWENTY-TWO MANUFACTURING INDUSTRIES, 1948–53

Industry	*Ratio of Gross Income to Output* 1948–53	*Ratio of Capital Assets to Output* 1948	1953
Beverages	.0372	.571	.413
Food	.0290	.347	.328
Tobacco	.0396	.569	.658
Textile mill products	.0527	.555	.631
Apparel	.0160	.338	.342
Lumber and wood products	.1219	1.112	1.135
Furniture	.0350	.376	.431
Paper, pulp, and products	.1054	.764	.753
Printing and publishing	.0695	.690	.669
Chemicals	.0858	.716	.840
Petroleum and coal products	.0567	.893	.763
Rubber	.0428	.518	.510
Leather	.0291	.407	.414
Stone, clay, and glass	.0845	.738	.686
Primary metals	.0727	.710	.764
Fabricated metal products	.0603	.575	.538
Machinery (except electrical)	.0745	.712	.657
Electrical machinery	.0552	.583	.527
Transportation equipment	.0377	.967	.666
Motor vehicles and parts	.0747	.493	.425
Instruments (professional, scientific, etc.)	.0702	.711	.655
Miscellaneous manufacturing	.0432	.669	.788

SOURCE: Gross income taken from *Statistics of Income*. It is an average for the years 1947–54 of net income after taxes, plus depreciation and minus dividends received from other corporations. The values for each year were deflated by GNP price deflators (1929 = 100) to correspond to output, which was also expressed in 1929 prices. Data for output and for capital assets were taken from Daniel Creamer, Sergei P. Dobrovolsky and Israel Borenstein, *Capital in Manufacturing and Mining: Its Formation and Financing*, Princeton University Press for NBER, 1960, Table 26. The estimate of average output for the period 1948–53 is the average of output for the two individual years, 1948 and 1953.

sequence, as technology changes, the returns on old investment decline. In short, the market value of old "machines" declines not only because the remaining years of economic life are fewer, but also because old "machines" must compete with more efficient new ones which earn no more than the old ones did when they were new. While an adequate measure of capital consumption

of total inputs, the rise in total real costs from changes in wage rates is 1.6 per cent per year or almost equal to the average annual gain in total productivity (capital and labor) for the private domestic economy. Data on changes in wage rates and productivity taken from Solomon Fabricant, *Basic Facts on Productivity Change*, New York, NBER, Occasional Paper 63, 1959, Table 6.

could, in principle, allow for both sources of decline in the market value of old assets, none of the widely used methods of depreciation accounting achieve this objective. In particular, straight-line depreciation is designed primarily to measure declines arising from reductions in the period of remaining useful life. Thus depreciated book values generally tend to overstate the values of old relative to those of new assets, and the faster the rate of technological change the greater is this overstatement likely to be. Hence, when industries with differing rates of technological change are compared, those with more rapid technical gains will tend to have relatively lower income-to-asset ratios (assets measured by book values) and this is reflected in the previously noted differences in ranks based on income-to-output as compared with asset-to-output ratios.

While from the standpoint of value, balance sheet data tend to overestimate old capital as compared with new, depreciated book values as a gauge of current capacity to produce either output or income may err in the opposite direction. This is because depreciated book values take into account the period of remaining economic life. That is, assets represent a store of value rather than a flow of current services. In consequence, in industries with high rates of investment and, hence, a declining average age of assets, ratios of capital (as shown in balance sheets) to output will tend to rise even though the flow of the current services of capital is unchanged.[5]

Another problem is that idle assets do not contribute to income though they are included in measures of the stock of capital. The existence of idle assets stems partly from fluctuations in demand but partly also from the presence in most industries of obsolescent capacity held as a reserve for contingencies. Not all of this obsolete capacity will have been fully depreciated in balance sheet values of fixed assets.

The preceding discussion neither exhausts the possible distortions in capital-output ratios nor is it meant to establish an unqualified preference for a particular measure of capital inputs. The measure chosen must depend on the function it is intended to serve. The data presented, however, do show significantly different results when capital inputs are taken as the market price of the

[5] This point is developed in detail by Zvi Griliches in "Measuring Inputs in Agriculture: A Critical Survey," *Journal of Farm Economics*, December 1960.

current services of capital from those obtained when such inputs are measured on the basis of the book value of assets.

The Chief Problems of Measurement

Most of the difficulties in measuring factor shares by industry are the general obstacles to measuring property and labor income for the economy as a whole. However, they affect the various industries unequally and hence introduce questions of comparability for interindustry analysis of income shares. For measurement on an industry basis, the most serious of these general problems are (1) the difficulty of distinguishing property income from the compensation of property owners for labor services, and (2) that of separating current expenses from capital outlays. In addition, analysis on an industry basis is affected by a difficulty not present for analysis at the total economy level. Specifically, the activities of firms frequently are not restricted to a single industry, with the result that the allocation of income by industry of origin raises awkward estimating problems.

IDENTIFYING PROPERTY AND LABOR INCOME

The problem of distinguishing between the returns to capital and to labor arises mainly because in large sectors of the economy owners of property perform managerial and other services. This problem arises most frequently in the measurement of business income in industries where the noncorporate form of organization predominates (e.g., agriculture) but it is by no means restricted to these sectors. In owner-managed corporations the distinction between profit and officers' compensation is frequently quite arbitrary, being affected by such objectives as the minimization of tax liability. The distortion in the measure of business income is likely to be far greater in industries in which small firms account for a large proportion of output and income, partly because the salaries of the highest ranking officers are larger relative to reported profits for the smaller firms and partly, also, because a larger proportion of small firms are owner-managed. Because of wide differences among industries in size distributions of firms, the impact of distortions arising from arbitrary executive salaries is likely to be highly uneven among the various sectors of the economy.

Attempts to adjust profits for arbitrary officer compensation

have shown that "excess compensation" may significantly affect rates of return for firms in the lower asset-size classes. For a sample of 500 small corporations, McConnell[6] compared officer salaries in owner-managed firms with those in which at least 15 per cent of the stock was held by nonofficers (the net excess of the former over the latter being a measure of "excess compensation"). He found that salaries for the former were substantially higher. Alexander[7] compared officer compensation per dollar of assets for deficit and income corporations, and classified the net excess of the latter over the former as profit. The rationale for this procedure was that owner-managers in deficit corporations have no incentive to withdraw more as compensation for services than their "true" salaries.

For the purpose of measuring the role of property as a source of income, both McConnell's and Alexander's adjustments depend on the assumption that the managerial services performed in the two classes of firms compared have approximately the same opportunity cost. Such services may differ markedly both in quality and quantity. If differences in executive salaries among owner- and nonowner-managed firms merely reflect differences in the market value of the services performed (as measured by the rates of compensation the executives would have secured in alternative employment), the net excess of one over the other cannot be classified as property income.

IDENTIFYING CURRENT COSTS AND CAPITAL OUTLAYS

As is well known, a substantial volume of outlays, though expected to yield income over more than one accounting period, is nonetheless reported as a current expense. This includes research and development outlays, expenditures on the promotion of new products, the cost of employee training programs, at least a part of advertising, and many others. Since these expenditures appear to be increasing more rapidly than total private investment, the relative understatement of returns to capital is likely to be rising. Of

[6] Joseph L. McConnell, "Corporate Earnings by Size of Firm," *Survey of Current Business*, May 1945.

[7] Sidney S. Alexander, "The Effect of Size of Manufacturing Corporations on the Distribution of the Rate of Return," *Review of Economics and Statistics*, August 1949. Alexander's adjustment shows a marked effect on rates of return in 1937 for firms with assets up to $100,000. At today's prices, the asset levels at which a significant effect would be present should, of course, be substantially higher.

special importance to the analysis of factor shares by industry is the fact that the distribution of investment outlays for intangibles is highly uneven over the industrial spectrum. For example, the 1959 research and development outlays as a percentage of total assets were more than sixteen times as large for the electrical machinery industry as for stone, clay, and glass products.[8] Generally, the relative volume of investment in intangibles is strongly correlated with firm size, with the result that distortions from this source in measures of returns to capital are concentrated in industries in which large firms account for a sizable proportion of industry output and income.[9]

The expensing of investment in intangibles is closely related to the general problem of arbitrary charges for capital consumption for fixed as well as for intangible assets. The magnitude of errors in charges for capital consumption for fixed assets is, once again, likely to be highly uneven among the industries. This stems not only from the fact that the economic life of assets is harder to forecast in some sectors than in others but also from sharp variations in the duration of their economic life. In industries in which assets are short-lived, capital consumption will generally be larger relative to gross income, with the result that potential errors in estimating net income are increased accordingly.

Factor Shares and the Heterogeneity of Output

There are three problems peculiar to measuring capital and labor income by individual industry. The first is more concerned with classification than with measurement and arises from the fact that some capital resources are leased rather than owned by the producer. The second stems from heterogeneity in the output of establishments, and the third, from the combination under common ownership of establishments in more than one industry.

The leasing of plant and equipment creates an arbitrary distinc-

[8] Research and development expenditures reported in U.S. National Science Foundation, *Review of Data on Research and Development*, Number 24, December 1960, and assets for 1956 as shown in U.S. Internal Revenue Service, *Statistics of Income*. Differences among industries in expenditure rates for research and development are materially reduced when outlays financed by the federal government are excluded, but they still remain large.

[9] For example, in 1958, of total company research and development outlays of roughly $8.2 billion, $6.9 billion was spent by firms with 5,000 or more employees. National Science Foundation, *Funds for Research and Development in Industry*, 1958 and 1961.

tion between returns to capital that are included in rent, on the one hand, and those shown as interest or earnings on equity, on the other. Clearly a building used by a petroleum refiner is a capital input in the petroleum industry regardless of the industry of the firm that is its legal owner. For most economic problems, the industry classification of returns on investment should be independent of the method of financing used (e.g., mortgage debt versus a rental contract). In short, for purposes of industry estimates of returns to capital, reported business income needs to be adjusted for the interest component of rental payments—that is, increased by this amount for rent payers and reduced for rent recipients.

For an allocation of income by industry, how serious is the problem raised by heterogeneity in the output of firms? The answer largely depends on the level of industry detail one chooses to use. At the two-digit level (as defined in the Standard Industrial Classification Code) nonhomogeneity in the output of *establishments* (as contrasted with firms) is negligible and the problem of income allocation is restricted to companies with establishments in more than one industry. At the higher levels of industry detail, plant heterogeneity increases[10] but the data which would permit an allocation of output or income by industry of the products produced (as contrasted with an allocation by the industry in which plants are classified) are not currently available.

It is much harder to measure by industry the returns to capital than wage and salary income. Leaving aside practical problems of data collection, the obstacles to measuring labor income by industry arise mainly in connection with administrative and supervisory employees and (to a lesser extent) sales personnel. On the basis of the 1954 Economic Census, employment in central administrative offices accounts for less than 3 per cent of the total employment of companies classified in manufacturing; and for central administrative and sales offices combined the percentage is less than 6.5. For the aggregate of companies in minerals extraction, wholesale and retail trade, and services, central and sales office

[10] At the four-digit level, almost 30 per cent of value added in manufacturing is contributed by plants whose secondary products account for more than 10 per cent of the plants' output. However, only 4 per cent of value added is contributed by plants whose secondary activities account for more than 20 per cent of plant output. Frank A. Hanna, *The Compilation of Manufacturing Statistics*, U.S. Department of Commerce, 1959, Table 4.

employment accounts for less than 2 per cent of total company employment. Moreover, the overwhelming majority of sales office employees, and probably most of those in central offices, serve production activities in a single rather than in several industries. To be sure, in multiindustry companies the higher salaried employees tend to direct activities in several industries, while the activities of employees receiving lower rates of compensation are restricted to individual industries. Thus, a larger share of labor income than of employees is subject to the allocation-by-industry problem. Furthermore, the earnings of administrative personnel in multiproduct plants are subject to the same allocation-by-industry problem as those of employees in central offices. Nonetheless, the proportion of total labor income not readily measurable by industry is substantially smaller than that of property income, and the discussion below will therefore focus on the latter problem.

Table 2, though based on employment data, gives a rough estimate of the distortions in industry distribution of business income that arise from classifying all the earnings of companies in their primary industries.[11] The table shows that, at the two-digit industry level, the aggregate employment of companies in six manufacturing industry classes differed from that of establishments in the same classes by more than 10 per cent of the former. At the one-digit level, establishment employment in mining and quarrying exceeded company employment by almost 30 per cent. Wholesale and retail trade and services also showed more employees on an establishment than on a company basis, but the discrepancies at this classification level were modest. Company employment in manufacturing moderately exceeded estabilshment employment. The problem increases as the level of industry detail used becomes greater, since a larger proportion of the activities of companies falls outside their primary industries when the latter are defined more narrowly. Table 3 shows that in 34 of 117 three-digit[12] industries, company employment differed from establishment employment by more than 10 per cent.

The extent of industrial heterogeneity in the employment of companies may differ from that for income for several reasons. The secondary activities of companies in some industries may be

[11] A firm's primary industry is one which, individually, contributes more to the firm's total employment (and, presumably, output) than any other activity.

[12] The industry classification used in U.S. Bureau of the Census, *Company Statistics,* 1958.

more (or less) capital intensive than the primary ones, with the result that a larger (or lesser) proportion of income than of employment emanates therefrom. Second, rates of return for some classes of companies may differ markedly between primary and secondary activities so that the industry composition of income differs from the composition of output. In addition, for many companies a sizable proportion of costs are common to plants in more than one industry. The more important of these costs are for general administration, engineering, research, and marketing (including advertising and the operation of sales outlets). The distribution of these costs by industry is not closely related to the distribution of employees and, in any event, the allocation of costs by industry raises conceptual as well as empirical problems.

Tables 2 and 3 are based on a definition of "company" which subsumes the establishments of all corporate subsidiaries under the latters' ultimate parent firms.[13] Users of information on the industry distribution of business income most often employ data contained in *Statistics of Income* and based on a definition of "company" that is substantially narrower than that used in Census data. Specifically, the degree to which parent-subsidiary relations are reflected in the identification of separate companies in *Statistics of Income* is based on the degree of consolidation of corporate tax returns. In 1957–58, for the aggregate of all industrial divisions, only about 13 per cent of the total assets of all corporations belonged to firms that submitted consolidated tax returns. Thus, for companies as defined in *Statistics of Income*, the discrepancy between company and establishment employment should be less for most industries than that shown in Table 2.[14]

Users of data from tax returns are confronted with still other sources of difficulty if they wish information over a period of time rather than for a single year. The degree of consolidation of tax

[13] All firms were asked in the 1954 Census to report the companies they controlled. This information constituted the basis for grouping subsidiaries with their parent companies.

[14] Virtually all tax returns were deconsolidated in 1934 and a measure of the effect of deconsolidation can be derived from data in the 1934 *Statistics of Income*. A relatively large interindustry shift in total receipts appears when the 1934 data are compared with what they would have been had the degree of consolidation and the industry classification of companies that submitted consolidated returns in 1933 remained unchanged. However, the degree of consolidation of returns was far greater in 1933 than currently. Moreover, the magnitude of the shift in some sectors raises some doubt about the consistency in the classification principles used in the two years.

TABLE 2

DISCREPANCIES BETWEEN INDUSTRY EMPLOYMENT ON A COMPANY AND ON AN ESTABLISHMENT BASIS, 1954[a]

Industry	Company Employment Minus Establishment Employment as Percentage of Company Employment
MINING AND QUARRYING	−29.2
Metal mining	−75.7
Anthracite mining	−3.5
Bituminous coal	−17.9
Crude petroleum and natural gas	−38.6
Nonmetallic minerals	−14.8
MANUFACTURING	1.7
Food	3.2
Tobacco	2.7
Textile mill products	1.4
Apparel	−2.4
Lumber and wood products	−1.2
Furniture	−4.0
Paper, pulp, and products	−2.9
Printing and publishing	0.0
Chemicals	6.0
Petroleum and coal products	−10.3
Rubber	17.9
Leather	2.0
Stone, clay, and glass	−1.5
Primary metals	13.2
Fabricated metal products	−9.4
Machinery (except electrical)	−5.3
Electrical machinery	10.3
Transportation equipment	−8.9
Motor vehicles and parts	25.3
Instruments (professional, scientific, etc.)	4.4
Miscellaneous manufacturing	−15.7
PUBLIC WAREHOUSES	−4.7
WHOLESALE TRADE	−5.3
Commission merchants	−1.9
Other wholesalers	−22.6
RETAIL TRADE	−1.1
Food stores	0.8
General merchandise	6.5
Apparel and accessories	−4.3
Furniture, home furnishings	−5.9
Automotive dealers, dealers in parts, etc.	−3.3
Drug stores	−1.2
Eating and drinking places	−0.2
Lumber, building materials, and hardware dealers	−4.5
Other retail trade	−11.0

(continued)

TABLE 2 (concluded)

Industry	Company Employment Minus Establishment Employment as Percentage of Company Employment
SELECTED SERVICE TRADES	−1.1
Personal services	−0.1
Business services	−4.0
Automobile repair services and garages	−0.4
Other repair services	−10.6
Motion picture theaters	1.4
Amusement and recreation services	−0.1
Other services	0.1

SOURCE: Based on data in U.S. Bureau of the Census, *Company Statistics*, 1958.

[a] "Company employment" consists of the employees of all companies classified in the industry regardless of the industries of establishments in which the employees work. "Establishment employment" consists of the employment of all establishments in the industry regardless of the industry in which the parent company is classified. For comparability, employment in central administrative offices was added to industry employment on an establishment basis inasmuch as it was automatically included in company employment.

TABLE 3

DISCREPANCIES BETWEEN EMPLOYMENT ON A COMPANY AND ON AN ESTABLISHMENT BASIS, 117 INDUSTRIES, 1958[a]

Net Difference Between Company and Establishment Employment as Percentage of Company Employment	Number of Industries
0– 2.5	31
2.6– 5	26
5.1–10	22
10.1–20	24
20 and over	14
Total	117

SOURCE: U.S. Bureau of the Census, *Company Statistics*, 1958.

[a] "Company employment" consists of the employees of all companies classified in the industry regardless of the industries of establishments in which the employees work. "Establishment employment" consists of the employment of all establishments in the industry regardless of the industry in which the parent company is classified.

returns has changed over time. For example, the proportion of total assets[15] contributed by consolidated returns (in all industries combined) rose from 8.7 per cent in 1948 to 12.3 per cent in 1954—a rise which, though not spectacular, may be sufficient to affect materially estimates of the magnitude of secondary activities for at least some industry classes of companies. Moreover, if a

[15] For corporations submitting balance sheets.

longer time span is taken, the change is more dramatic. For example, in 1933 consolidated returns accounted for 43.6 per cent of total assets in all industries combined.

Another problem, and one which for comparisons of income in successive years may be even more serious, is that of frequent changes in *Statistics of Income* data in the industry classification of some large companies. For example, from 1951 to 1954 at least one-fourth of the total assets reported for the highest asset-size class of companies (in *Statistics of Income*) disappeared in thirty-two three-digit manufacturing industries. Since these assets did not appear in the adjacent size class in the affected industries, one must presume that the disappearance was a result of reclassification. The gravity of this problem is considerably reduced if analysis is restricted to the two-digit industry level.

In summary, heterogeneity in the output of companies introduces an error in estimates of property income by industry source if all the income of companies is classified in their primary industries. This error is only moderate for most industry classes but fairly large for some, particularly at the higher levels of industry detail. The fact that most corporations currently submit unconsolidated federal tax returns reduces the error for measures of corporate income by industry based on data in *Statistics of Income*. However, this source often suffers from noncomparability of industry statistics over time resulting from changes in degree of consolidation of tax returns and from the frequent reclassification of companies for other reasons. The question to which we now turn concerns the ways in which estimates of business income may best be made for "pure" industries as contrasted with estimates of income from the conglomerate activities of companies.

Measuring Income for "Pure" Industries

Basically there are two approaches one can take. The first is to estimate profits directly from data for establishments. The second, and more promising, is to estimate the total earnings generated in a given industrial activity from the relation between profits and statistics available on an establishment basis (e.g., sales, value added, employment, etc.) for companies with homogeneous product structures. The latter approach should soon be rendered feasible by information currently being developed by the Bureau of the Census and Internal Revenue Service. This information

will link Census establishment and *Statistics of Income* data for a sizable sample of medium-sized and large firms (including most large firms in sectors of the economy covered by the 1958 Economic Census).

A measure of operating income for an establishment can be derived from the difference between the value of sales (or shipments) and expenses of the establishment.[16] The estimate, however, would differ in several critical ways from a conceptually acceptable measure of profit. For shipments between plants of the same company, the prices at which such shipments are valued will frequently deviate from market prices. An arbitrary (nonmarket) price, either for the final product of a plant or for raw materials and other components incorporated in the final product, renders the measure of operating income also arbitrary. Second, for multiestablishment companies a sizable proportion of total expenses (e.g., those for sales, advertising, engineering and legal services, central administration, etc.) may be common to the activities of several plants. For many companies, these common costs are larger than reported net income. Consequently, measuring income on the basis of arbitrary allocations of these expenses—and only arbitrary methods are available with existing information—would be solving a problem by assuming it away. In short, this approach is not likely to prove fruitful.

The linking of Census statistics with data on earnings taken from tax returns makes it possible to compute for a given company ratios of earnings to sales, value added, or other establishment statistics. If these ratios are developed for companies with establishments in but a single industry, they can then be applied to total sales or value added in the industry to secure an estimate of industry income.[17] An assumption implicit in this procedure is that both the production function and the rate of return for a given

[16] Information on both expenses and the value of shipments is currently available in Census data for manufacturing and mining industries.

[17] Since firms within a given industry differ in degree of vertical integration, a ratio of earnings to value added should vary less among companies than that of earnings to sales, and is hence to be preferred. Unfortunately, however, information on value added is not currently available for all sectors of the economy. An alternative in these sectors is the use of ratios of earnings to employment. If separate estimates are made for each of several size classes of firms within an industry, ratios of earnings to employment may prove reasonably satisfactory. This is because within groupings of firms delimited by size as well as by industry, the variance in the relative magnitudes of capital and labor inputs is probably not large.

activity are generally the same whether or not the producing firm is engaged in activities in other industries as well. It is, of course, always possible to cite circumstances under which this would not be true, but the assumption is in general a plausible one if allowance is made for firm size. It will be noted that no assumption is made here that all firms in an industry are of equal efficiency. Rather what is assumed, first, is that diversified firms are *on the average* neither more nor less efficient than homogeneous ones, and second, that there are no important and persistent differences in *average* managerial efficiency between industries. The size of a firm affects ratios of earnings to sales or value added in two ways. First, it has been established that large firms use production methods that are more capital-intensive, as measured by capital-output ratios, than those of smaller firms.[18] Thus earnings relative to sales or value added should be positively correlated with firm size. Second, rates of return appear to vary with company size also, though in part, as previously noted, because of arbitrary executive salaries for the smaller owner-managed companies. It follows then that estimates of income made on the basis of the above ratios are best made separately for each size class of companies. Hence, among the data requirements for an effective use of this approach is an expansion of information on size distributions of firms by industry.[19]

If estimates of business income by industry are made on the basis of the aforementioned ratios, the choice of a sample of firms for these ratios should focus primarily on the selection in each industry of an adequate group of homogeneous firms over the entire size range of companies. Contrary to a common impression, relatively small multiestablishment firms frequently have a large volume of secondary production. Indeed, for multiestablishment firms diversification, as measured by the ratio of production in secondary to that in primary activities, is not strongly correlated with firm size.[20] Thus the selection of a sample of companies with homogeneous output is a problem not restricted to large

[18] Daniel Creamer, Sergei P. Dobrovolsky, and Israel Borenstein, *Capital in Manufacturing and Mining: Its Formation and Financing*, Princeton University Press for NBER, 1960, pp. 60–65.

[19] Size of firm can be envisaged in two ways: conglomerate size and size in individual industries. As a basis for grouping firms to reduce variability in capital-labor ratios, the latter is the more relevant.

[20] Michael Gort, *Diversification and Integration in American Industry*, Princeton University Press for NBER, 1962.

enterprises. However, at the upper tail of the size distribution, inclusion in the sample of an adequate group of firms is more difficult by virtue of the fact that in some industries all of the largest firms have a heterogeneous output.

A variety of checks are possible to assess the adequacy of estimated ratios of earnings to sales, value added, or employment. For example, for a given group of companies, the establishments and their output could be distributed by industry. By applying to the output in each industry class ratios of earnings to value added (derived from homogeneous firms), the total earnings of the group of companies can be estimated. This estimate can then be compared with aggregate reported income for the same companies.[21]

A discussion of methods of estimating income should not obscure the fact that for many industry classes (as may be judged from Table 2) the distortion arising from heterogeneity of company output is small and reported earnings on a company basis are acceptable unadjusted.

Rates of Return and the Heterogeneity of Output

For many problems, measures of property income by industry are useful only when expressed as rates of return on investment rather than as absolute amounts. The extent to which heterogeneity in output produces rates of return that differ between "pure" industries and those composed of conglomerate companies depends on two factors: the extent of secondary output for the latter and the magnitude of differences in rates of return between primary and secondary activities.

For most industry classes of firms, secondary activities are widely dispersed over the industrial spectrum with little concentration in individual narrowly defined sectors. This arises from two sources: first, companies classified in a given industry generally differ considerably in the nature of their secondary activities and, second, the nonprimary activities of individual large enterprises are themselves widely dispersed. The consequence of this is that the average rate of return for all the secondary activities in a given industry (the latter composed of conglomerate firms) is likely to approximate the average rate of return for all industries

[21] Information to permit tests of this type should be available from the linking of Census with Internal Revenue data.

in the economy as a whole. As a result, in a given industry class the rate of return for the primary activity and the average rate of return for the secondary ones are unlikely to be at opposite ends of the distribution of profit rates. This greatly reduces the importance of heterogeneity in company output as a problem in measuring profit rates for "pure" industries.

In the absence of income measures for firms with homogeneous product structures, estimates of rates of return for "pure" industries were made on the basis of a simplifying assumption. Specifically, the contribution of each activity to the total earnings of firms in a given industry was assumed to be proportional to that activity's share in the total employment of these firms. Since the purpose of such estimates was merely to provide a rough indication of the effect of heterogeneity on reported profit rates, the somewhat arbitrary nature of this assumption is not critical to the results. Accordingly, if R_j represents the reported profit rate for industry class j (composed of companies with conglomerate output), r_i represents the profit rate for "pure" industry i, and p_{ij} is the proportion of employment for companies in class j contributed by activities in industry i, we have the equation:

$$\sum_{i=1}^{n} p_{ij} r_i = R_j$$

Inasmuch as there is one equation for each industry class of companies, and since the number of such classes is equal to the number of unknowns (profit rates for "pure" industries), the values of the latter can be found by solving a set of simultaneous linear equations. In Table 4, rates of return for two-digit "pure" industries are obtained by a modified version of this method.[22]

Table 4 shows, as expected, that adjusted rates of return (those

[22] The modified method assumes that the rate of return for each industry class of manufacturing companies is derived from two sources: the profit rate in the primary activity and the average profit rate for all manufacturing activities exclusive of the primary one. In short, secondary activities are treated as a single industry. Thus, for example, the profit rate for food manufacturing is obtained by solving two simultaneous equations in which the profit rates for food companies and for all manufacturing companies are given (as well as the relative magnitude of secondary activities for food companies and the relative magnitude of food manufacturing for all manufacturing companies combined). The fact that secondary activities for most industry classes of companies are widely dispersed permits the use, for these activities, of an average profit rate in all industries.

TABLE 4
RATES OF RETURN REPORTED AND ADJUSTED FOR NONHOMOGENEITY OF OUTPUT, 22 MANUFACTURING INDUSTRIES, 1953 AND 1954
(per cent)

Industry	*1953*		*1954*	
	Reported	Adjusted	Reported	Adjusted
Beverages	6.21	6.18	5.44	5.38
Food	6.05	5.99	5.93	5.90
Tobacco	5.78	5.75	6.49	6.50
Textile mill products	3.74	3.44	2.64	2.26
Apparel	3.09	2.85	3.10	2.88
Lumber and wood products	6.00	5.93	6.41	6.44
Furniture	5.15	4.94	4.81	4.60
Paper, pulp, and products	7.60	7.71	7.37	7.50
Printing and publishing	6.59	6.59	6.30	6.31
Chemicals	7.00	7.16	7.61	8.09
Petroleum and coal products	7.64	9.22	6.40	6.70
Rubber	6.07	5.86	5.73	5.52
Leather	4.43	4.15	4.75	4.56
Stone, clay, and glass	7.56	7.73	8.24	8.58
Primary metals	6.30	6.19	5.16	4.66
Fabricated metal products	6.51	6.50	6.01	5.95
Machinery (except electrical)	6.73	6.78	6.46	6.53
Electrical machinery	7.10	7.35	6.83	7.11
Transportation equipment	4.67	4.23	5.96	5.91
Motor vehicles and parts	8.09	9.03	8.37	9.69
Instruments (professional, scientific, etc.)	7.19	7.44	8.34	9.14
Miscellaneous manufacturing	4.99	4.57	4.97	4.64
All manufacturing	6.53		6.19	

SOURCE: "Reported" rates of return were obtained from George J. Stigler, *Capital and Rates of Return in Manufacturing Industries*, Princeton for NBER, 1963. They are based on data, reported in *Statistics of Income*, for income (including interest payments) and total assets. The data for both income and assets were deflated by Stigler for price changes. "Adjusted" rates of return are developed from the "reported" ones. The adjustment, described in the text, is designed to show an estimated rate of return for the activities of companies restricted to their primary industries. That is, it attempts to exclude the effect on "reported" rates of return of the secondary activities of companies.

for "pure" industries) generally differed only modestly from those reported on a company basis—that is, generated by conglomerate activities. For 1953 and 1954, of all two-digit manufacturing industries, only petroleum refining in the former year and motor vehicles in both years showed sizable differences between adjusted and reported profit rates. Thus, in most industries heterogeneity in the product structures of companies is not a severe obstacle to measuring rates of return.

COMMENT

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Professor Gort's paper discusses questions related to the measurement of returns to capital and labor in twenty-two manufacturing industries. The problems involved include the basic ones of identifying property and labor income plus problems peculiar to individual industries. These problems combine to make interindustry comparisons of factor income extremely difficult.

In identifying property and labor income, Gort discusses the problem raised by the arbitrary distinctions between profit and officers' compensation which owner-managers of small corporations make in the firm's accounts for income tax or other reasons. This well-known problem was discussed by several speakers at the conference. Similar problems of income definition and measurement occur in regard to expense accounts, stock options, and capital gains. These important sources of management compensation should be taken into account in any thorough analysis of factor incomes.

In addition, I suggest that the whole subject of executive salary determination be examined. Management groups of many large corporations whose stock is widely held are subject to little control by the stockholders. The latter legally own the business and, together with bondholders and other creditors, are entitled to receive all the property income generated by the firm. But, since the management group frequently determines its own compensation, this compensation might exceed or fall short of management's marginal revenue product which theoretically should determine its total income from the enterprise.

Executive compensation varies considerably between industries and companies, but executive performance appears to vary even more. In the automobile industry, for example, stockholders in General Motors Corporation consistently received a higher rate of return on their stock equity than was the case for other firms in the industry. Although the General Motors' management group was well paid as corporate compensation goes, it may have been grossly underpaid on the basis of its marginal revenue product. If so, the group was exploited in the interest of the stockholders. On the other hand, one can find examples of the reverse situation, where management performance is poor, its compensation prob-

ably exceeds marginal revenue product, and management is exploiting the stockholders. The proper definition and measurement of management's labor income is admittedly difficult, but this is a subject which deserves more consideration.

In discussing the problem of allocating factor income between industries for companies with heterogeneous outputs, Gort shows that the problem is less difficult for labor income than for property income because most employees can be identified with a particular product and industry. For the more difficult problem of allocating property income, Gort suggests two solutions which are useful but are not without serious limitations. The first method is to determine profit rates (as a percentage of some relevant base such as sales, value added, or employment) for companies with homogeneous product structures and then to use these rates in allocating profits of firms with heterogeneous product structures. This method requires the dubious assumption that all firms in an industry have the same profit rate. To cite one example, should we use the profit rate for the highly successful International Business Machines Corporation to determine the property income of computer divisions of less profitable firms which produce computers and also other items classified in other industry groups?

Gort's second suggested method for allocating property income by industry for firms with heterogeneous outputs requires the assumption that profit rates on sales in secondary industries will equal the average rate for the entire manufacturing sector. Application of this method of adjustment has the effect of raising the profit rate in the primary industry if the company's over-all profit rate exceeds the average for all manufacturing, and vice versa. This method of profit adjustment is illustrated in Gort's Table 4; in the motor vehicle and parts industry, for example, the reported profit rate for all firms classified in the industry in 1953 was 8.09 per cent, and Gort's adjusted profit rate for the industry is 9.03 per cent. This upward revision is based on the assumption that nonautomobile sales earned only the average for all manufactures, or 6.53 per cent. The effect of a similar adjustment for the apparel industry reduces its profit rate from 3.09 to 2.85 per cent.

The net effect of these profit rate adjustments is to increase the range of profit rates in 1953 for the twenty-two industries from 5.0 to 6.37 percentage points. Incidentally, this wide range of re-

turns seems to contradict Gort's contention that rates of return tend to be the same in all industries. But returning to the point at issue here, I question whether returns from secondary industries tend to be nearer the average for all manufacturing than those for the primary activity engaged in by the firm. The firm's management ability is the controlling factor, and, in general, a firm may do everything it attempts well or badly rather than do some things well and others badly. General Motors Corporation, for example, seems to excel at most everything it attempts and has a policy of discontinuing activities which do not measure up to its profit standards.

Gort compares two ratios for twenty-two industries: property income to output and capital assets to output (see his Table 1). Essentially, he is correlating property income and capital assets by industry, and a high degree of correlation would be expected if industry rates of return on capital are anywhere near equal. The two pairs of ratios are fairly closely correlated, especially if two troublesome industries—transportation equipment and motor vehicles—are omitted from the calculation. To facilitate the reader's analysis of these interindustry differences, the data in Gort's Table 1 are restated in terms of industry ranks in my Table 1.

It is interesting to observe the degree of variation between the two sets of ratios of capital assets to output for 1948 and 1953. As my Table 1 shows, industry rankings change considerably over this five-year period. This change reflects a number of factors, including shifts in production functions, but perhaps most importantly, variations in the rate of capacity utilization.

I conclude with a word of caution; for an empirical study such as Gort's, which attempts to test hypotheses concerning industry differences in factor incomes, the concepts of factor income as well as the data available are imperfect. The concept of the industry itself is a source of difficulty. Even at the three- and four-digit level, "industries" include a wide variety of products with different production functions. Short-run comparisons are complicated by such problems as "sick industries," and the short run can last for decades, as in the case of the textile industry. Long-run comparisons are complicated by changing technologies. The aircraft industry, for example, is rapidly evolving into the missile industry, which in turn, soon may be transformed into the

TABLE 1
INDUSTRY RANKING BY RATIOS OF GROSS INCOME TO OUTPUT AND CAPITAL ASSETS TO OUTPUT, TWENTY-TWO MANUFACTURING INDUSTRIES, 1948–53

Industry	Ratio of Gross Income to Output 1948–53	*Ratio of Capital Assets to Output*	
		1948	1953
Beverages	18	14	20
Food	21	21	22
Tobacco	16	15	10
Textiles	13	16	13
Apparel	22	22	21
Lumber and wood products	1	1	1
Furniture	19	20	17
Paper and products	2	4	6
Printing and publishing	9	10	8
Chemicals	3	6	2
Petroleum and coal products	11	3	5
Rubber	15	17	16
Leather	20	19	19
Stone, clay, and glass	4	5	7
Primary metals	7	9	4
Fabricated metal products	10	13	14
Machinery (except electrical)	6	7	11
Electrical machinery	12	12	15
Transportation equipment	17	2	9
Motor vehicles and parts	5	17	18
Instruments	8	8	12
Miscellaneous manufacturing	14	11	3

SOURCE: Gort's Table 1.

space industry. This change is accompanied by rapid and radical shifts in the proportions and composition of labor and capital inputs. Finally, problems arise from differences in accounting practices between industries and even between firms in the same industry. These differences further complicate interindustry comparisons and reduce the usefulness of analyses based on industry aggregates and averages.

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The Department of Commerce has been interested in this subject for many years. The cross-classification of factor earnings by industry and by form has been a central feature of the Department's national income reports ever since the first one was issued

[1] The author was formerly Chief, National Income Division, Department of Commerce.

in 1934. Economic analyses of cyclical and trend changes in the share distribution—as such, and as influenced by shifts in the industrial structure—have appeared at frequent intervals in the *Survey of Current Business* and its national income supplements.

Besides the particular application of these statistics which Gort has chosen for purpose of illustration, these data, of course, serve to illuminate many of the questions of long-term economic growth and social change, on the one hand, and the anatomy of business cycles, on the other, which have been discussed during this Conference.

The statistical problems of estimation noted by Gort are significant but are probably not serious enough to cast much doubt on conclusions of the sort that are commonly drawn from the data we have. The tables presented in the paper suggest that for most though not all major industries, these data distort the level of income and its distribution only to a relatively minor extent. With one or two important exceptions, moreover, movements through time are represented faithfully enough to meet the major analytical needs.

Exceptions occur, of course, and for some of these no cure is even in sight. The charging of research and development purchases to current expense, for example, affects both the numerator and the denominator of the capital-output ratio, and the tendency for the two effects to be offsetting will not prevent some distortion in the ratios for research-intensive industries relative to the all-industry average.

Though the problems are unimportant in some cases and seem insuperable in others, there are clearly substantial advantages to be gained by refining our statistical measures of the income shares originating in specific industries. Besides rendering the data more satisfactory in some of their present applications, such refinements should eventually make possible a whole series of new applications in studying cost structure, investment potential, and other aspects of individual industries. The careful job Gort has done in breaking down the statistical difficulties into bite-sized chunks for further quantitative study represents a stride in this direction.

I should like to emphasize what seem to me the salient features of his review by means of a graphic formulation of it. Besides providing a convenient framework to integrate one or two com-

ments of my own with those he has made, this may perhaps prove useful as a mnemonic device.

Visualize then, if you will, a productive process. This process is absorbing labor and property services, along with raw or "intermediate" materials, supplies and services of many sorts; and each of these inputs is evaluated in terms of the cost payment made to obtain it.

At the other end of the process there emerges a product. The nature of this product is the main criterion for classifying the process in one or another of the many industries distinguished in the SIC.

This conceptual Garden of Eden is infested in practice by two sorts of reptiles which seem to me to be siblings if not twins. In real life, productive processes are so organized institutionally that too often we find a single economic entity turning out a heterogeneous set of products, and our ability to classify it by industry is of course impaired as a consequence. We find that many of the inputs consist of units which are likewise heterogeneous from the standpoint of our analytical needs—units, that is, which straddle our functional categories of labor services, property services, and intermediate products instead of fitting neatly into any one of these. We are troubled, I should say in summary, by the twin problems of heterogeneity in our units of input and heterogeneity in our bundles of output.

Inputs

Let us examine the problem by proceeding to fill in details on the input side of the production process.

One input factor or set of factors is delimited by the fact that payment for it takes the form of wages and salaries. A second set is defined in terms of its remuneration through interest or business net income; its gross value is sufficient to cover capital consumption charges also. A third group of inputs is distinguished by its involvement with purchases from other enterprises.

A problem emerges at once on the boundary line between the labor services which form set number one and the property services which form set number two. This is the problem posed by the heterogeneous input of the owner-manager. In the case of noncorporate business, there is commonly no institutional basis for

splitting this. As Gort points out, moreover, even in the corporate sector the institutional basis available for a functional split of the owner-managers' contribution is rather artificial.

The line which separates the first two categories of inputs—and which must be drawn sharply if we are to have a precise statistical measure of either sort of input—is thus seen to be in fact a zone or band of indeterminate character.

Moving farther down the input line we come to a second major division, where the property services of set number two give way to the interbusiness cost purchases of set number three.

In this neighborhood, too, we find a number of outlays that might be included on either side of the line. Most of the research and development expenditures mentioned above, which contribute to the longer-term profitability of the process and are made to this end, are expensed in our present national income estimates. Being deducted in the calculation of business net income, in effect they enter our picture below the line in the value measure of intermediate product. For some purposes it might be more appropriate to capitalize them—i.e., treat them as a portion of business net income which has been realized as such and then reinvested. If this alternative is chosen, the immediate result is to raise the estimate of property income, but a more or less offsetting effect follows when capital consumption charges are deducted. The extent of the offset depends on the convention which is selected to govern the size and time-pattern of the charges.

Problems of this character are not unfamiliar in national income work. Some of them are recognized in the explicit allowance we make for capital outlays charged to current expense. This is restricted to outlays for tangible goods which for reasons of convenience or custom are not capitalized in ordinary business accounting but which will render significant productive services—thereby paying for themselves and returning a profit or loss—in a subsequent accounting period.

There are various other blurry spots along the line between property-service input and intermediate-product input. One of these has to do with productive services obtained by the payment of rent. Gort deals with this separately, but I think it can neatly be cited here.

Productive services remunerated by rent virtually always owe something to the managerial and other efforts of the lessor, as well

as to the physical property concerned. Basically, the question here is whether the latter element is sufficiently predominant so that the former can be ignored without doing overmuch violence to reality. An alternative possibility, which would seem to me more realistic in most cases, is to view the rent payment as purchasing an intermediate product from the landlord-entrepreneur, who has produced it by combining the factor services of labor and property.

Nearly all intermediate products are produced with the aid of substantial capital nowadays—the carriage of freight and the supplying of electric power hardly less so than the services purchased by the payment of rent in an office building. The service bought in each case is clearly an input from the purchaser's standpoint. Whether it is an input sufficiently homogeneous at bottom to be attributed exclusively to one factor of production is not so clear.

In terms of the three-way division I am using, rent payments and capital outlays charged to current expense may be said to lie close to the border of property income. I would add that they have analogues along the region of labor income. Just as it is clear that producers' durables expensed on the books should be capitalized and the deduction added back to business net income, so pension and welfare fund payments by employers should be added to payrolls in measuring the market value of labor input. Employer outlays which go to provide fringe benefits in kind are not so clear a case. Multiuse facilities and other purchases which play a part in the productive process may also provide direct satisfaction to employees using them, and this makes it cheaper to recruit and retain workers. Besides the often-cited privileges of the expense account and the company cars and airplanes for executives, one might think of a wide range of conveniences which have become standard in modern factory practice after having been thought for many years to be unnecessary to the production process.

Let me summarize my review of the input heterogeneities in terms of the three zones of uncertainty noted above. First, there are units of input which straddle any simply drawn border between those intermediate products which go as fringe income to labor and those that do not. Passing across the zone of what are clearly labor earnings, we come to the earnings of owner-managers, which represent units of mingled labor and property services.

And still further on, beyond the area of what are unmistakably property services, we find rent, development, etc.—outlays which might or might not be regarded as intermediate-product purchases deductible in arriving at an income measure of property inputs.

In pursuing these interesting and fruitful lines of thought opened up by Gort, we should, of course, not lose sight of the fact that the bulk of all inputs is substantially free of such ambiguities and options. Payrolls make up two-thirds of the national income; and profits of million-dollar and larger corporations—calculated on principles widely understood and accepted (and not much affected by the owner-manager type of distortion, judging from McConnell's study)—represent as much as 90 per cent of all corporate profits and over 10 per cent of national income. Nevertheless enough inputs are of mixed character to create significant problems for the social accountant, and the specialized user should be aware of them.

Outputs

Turning now to the output side, we observe that the units of product are often entirely homogeneous within themselves and readily classifiable in terms of the SIC code. Unfortunately this is not enough. A statistical cross break of income by type and by industry requires that we classify not only the product but the whole process and the plant in which it is carried on, since most of the inputs (and other characteristics) of the process cannot be established for any unit narrower than the plant.

This situation gives rise to no problem when the output of the plant is homogeneous. It does make trouble whenever the output includes by-products or other secondary products. The industrial classification of the plant must then generally be made according to the *principal* product, as if this were the only product and, in many though not all compilations, as if the plant's total output, input and other dimensions were all aimed at providing this one product.

As Gort points out, the distortion that results in practice is not so very great when we are dealing with labor inputs, which for the most part can at least be identified with a particular plant as the unit to be classified. It frequently happens, though, that one plant is integrated with others, under the control of a multi-industry corporation or group of affiliated corporations. In this

case, it has commonly not been feasible to tie down the measure of property services to any entity narrower than the corporation, the affiliated group as a whole (if a consolidated tax return is filed) or, at best, the corporate affiliates individually. The classification of property service inputs by industry becomes less accurate, of course, as the outputs of the legal entities employing these services become more heterogeneous: To the extent that this condition exists, services used in producing the secondary products are erroneously associated with the production of the primary product.

Such heterogeneity in the outputs of our institutional producing units makes trouble of three sorts for analysts using the data. The first comes in measuring an industry's magnitude, for comparisons over time or with other industries, when secondary production bulks large in the companies' outputs. The phenomenon Gort notes of multiindustry companies shifting back and forth across industry lines, which has occasionally plagued us in the preparation of our own tables, has its roots in such situations. Statistical measures of the comparative sizes of certain interrelated industries are seriously impaired for the same basic reason. The well-known difficulty of comparing petroleum extraction with petroleum refining as originators of profits and national income is a case in point.

Secondly, interindustry differences in the pattern of resource use, profitability, etc. tend to be watered down. This effect is illustrated neatly in Gort's assumption concerning the profitability of secondary operations in the industries covered by his Table 5. It is clear that the structural differences between auto and electrical machinery production, for example, will be understressed in data which reflect the extensive production of home appliances by companies in both these industry groups.

Finally, there is a tendency to distort the relative magnitudes of property and labor income within particular industries. The plant statistics basic to the industry measures of labor income covers some plants owned by corporations which are classified in the property-income statistics—in terms of their principal product —outside the industry being analyzed. This tends to make labor's percentage share appear higher than is really typical of the processes one commonly associates with the industry. On the other hand, the basic statistics of labor income for a given industry exclude plants whose processes belong outside this industry but

which are owned by corporations classified inside. The income total reported for this industry will include the property income generated by these plants, but not the labor income; and the latter's share in the total will tend to be understated accordingly. There is a broad tendency for these two sources of noncomparability to offset one another. In certain cases, such as automobile manufacturing and petroleum and primary metals production, however, the offsets are very far from complete.

As I have already suggested, Gort's illustration of possible uses and interpretation of this sort of data is only one of a large number he might have selected from among the Conference papers and other relevant literature. The case he has chosen, however, is probably about as satisfactory for the purpose as any he could have found. The ratio of property income to total income is a statistic which is of wide interest, and significant in various analytical connections, and in a number of these it is readily replaceable by the profit-output ratio he has computed. The capital-output relationship is of similarly wide interest and multiple applicability.

Taking the profit-output and asset-output ratios as alternative measures of capital intensiveness, Gort notes that among manufacturing industries the rank-order correlation is not very high. It seems to me that the set of possible economic explanations he advances might go far to explain why the correlation is not higher, and that statistical problems cited earlier in the paper might also be found to play a recognizable part in the results.

I was interested enough to dig beneath the correlation coefficient a little, by means of a scatter diagram. From this it appeared that the income-output ratio for motor vehicles was out of line on the high side while the ratios for transportation equipment, petroleum products, tobacco and miscellaneous manufacturing were on the low side. If these deviations could be rationalized, the over-all relationship would look pretty good to me as these things go.

Gort might well have gone on to examine the "problem industries" individually in terms of the body of critical thought provided here and elsewhere in his paper. I believe that this addition would have increased the value of his contribution in several ways. It might have provided a focused summary, an indication of the relative magnitudes and bearings of the different sources of distortion he has noted, and a thumbnail guide to the dangers these may pose for long-term, short-term and static analyses of such data.