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CENSUS PRINCIPLES OF INDUSTRY AND PRODUCT CLASSIFICATION, MANUFACTURING INDUSTRIES

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BUREAU OF THE CENSUS

1. Introduction

WHETHER concentration of industry (number of firms accounting for bulk of output of competitive products) can be measured and whether it can be related to profits and other economic characteristics depends on how the basic data are classified. The concentration ratio is profoundly affected, on an industry basis, by the range of products defined within the industry, and on a product group basis, by the detailed breakdown of products within the group. Generally the more detailed the definition of product, the more likely will be concentration of its output in a small number of firms. Thus the systems used for describing products and for grouping firms by their product outputs is fundamental to the analysis of economic concentration.

The classification used for organizing the nation's principal industrial statistics was not, of course, established chiefly to measure business concentration. The study of business concentration deals with the competitive nature of products and of firms producing them. This is only one characteristic of an industry; others are method of manufacture, types of facilities, and other physical or technological factors.

Comparison of product output concentration with data on employment, capital expenditures, inventory cumulation, etc., requires use of the establishment unit and data from establishments grouped into industries. In contrast, comparison of profits and other financial data with product output requires the use of the firm as a unit and data from firms grouped into industries. Industry data for establishments or firms are only rough approximations of measures of products or product groups. Such approximations derived from establishment units, of course, tend to be much closer than those derived from firms.

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When firm, establishment, and product data are used to relate prices, profits, capital expenditures, inventory cumulation, etc., to output, a certain amount of noncomparability arises. This varies inversely with the degree of specialization of activity of establishments and firms in the particular product output. The choice of units is of course limited by the available data. Such data are often not sufficiently comparable to be useful and must therefore be carefully selected or adjusted. For example, practically no data will be available for a study of concentration and profits of a very detailed product such as 2-row corn planters. On the other hand, for textile fabrics, data for establishments and firms would approximate that for products fairly closely.

Available data on manufacturing activity useful for analyzing concentration may be divided roughly into three categories: (1) product output, published mainly by the Bureau of the Census, Department of Agriculture, Tariff Commission, Bureau of Mines, and by trade associations; (2) industry data (employment, earnings, output, capital expenditures, inventories, cost of materials, value added, etc.), derived from establishment reports, published mainly by the Bureau of the Census, Bureau of Labor Statistics (BLS), and on a limited basis by the Bureau of Old-Age and Survivors Insurance, and state employment security agencies; and (3) industry data (profits, income, sales, etc.), derived from firm reports, published mainly by the Department of Commerce (Office of Business Economics and Bureau of the Census), Bureau of Internal Revenue, Federal Trade Commission (FTC), and Securities and Exchange Commission (SEC). These data have been used in recent years in a number of attempts to measure concentration in manufacturing. They include such compilations as: Census of Manufactures industry tabulations by size of establishment; tabulations of census data showing subtotals for the largest 4, 8, 20, and 50 companies in each industry (1937 and 1947); tabulation of census data for 1937 showing proportion of total output accounted for by 4 largest producers for each of approximately 1,800 individual commodities; Temporary National Economic Committee (TNEC) investigations on concentration of economic power (1940); and FTC-SEC 1947 tabulations on largest companies in selected industry groups.

In addition to the above compilations, existing census records could be adapted to facilitate concentration analysis. For example, separate industries for cane and beet sugar could be combined into one; and separate industrial data could be prepared for companies

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producing farm freezers (part of the broader refrigeration and air-conditioning industry).

Industry data derived from the firm and establishment are directly comparable, of course, when the firm and establishment are the same, that is, for single-establishment firms, and when all of the establishments of a multi-unit firm are classified in the same industry. In manufacturing, single-establishment firms represent 80 to 90 per cent of the total number of establishments, but account for less than half of production. Analysis of census data indicates that the larger producers of particular products are frequently classified as firms in some other industry (air conditioning, margarine).

2. Industry Classification

PURPOSES, DEFINITIONS, AND CRITERIA

ONE of the main purposes of industry classification is to facilitate the compilation of data describing the magnitude and characteristics of the country's economic activity in an orderly manner and in terms of a manageable number of meaningful categories. The industry concept is useful in empirical statistical studies of the behavior of the economic system.

A classification of manufacturing activities by industry (rather than product) is needed because establishments and firms frequently are engaged in the output of more than one product (as defined in the classification system) and data for many input factors (employment, earnings, inventories, capital expenditures, etc.) are not generally reportable on a detailed product basis.

An industry classification is intended primarily for aggregating data for establishment units, rather than for firms. While data for firms may be summarized into the same industry categories, such data will generally represent aggregations of a greater variety of products than those derived from establishment units. In general, the larger the firms controlling establishment units, the less comparable will be the data from the different units. A huge food manufacturing firm engaged in activities scattered in many of the forty-odd food manufacturing industries, in can making, label printing, retail trade, and related fields, would be assigned to only one industry, say wholesale meat packing, on a firm basis. Its importance in that industry would be overstated by the relatively large part of its total activity which, if separable, would be assigned to other industries. On the other hand, the significance of that firm in each of the other industries, where it may be a leading producer, would be lost.

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Concentration data in the other industries where some of the establishments of the firm would have been important would be less meaningful. By the establishment approach, the different major activities of the firm carried on at each of the establishments are allocated more closely among the various industries in which the activities are defined. It further makes it possible to correlate the firm's importance in any particular industry with its activities in other industries. An understanding and measurement of these interindustry relationships may be useful in interpreting the significance of business concentration.

The differences between industry concentration measures on an establishment and firm basis may be illustrated by 1947 data compiled from census and FTC reports.¹ Comparison of concentration measures by the two methods for selected industries is shown in Appendix Table A-1. Census establishment figures indicate that the largest four companies in the meat products industry accounted for a maximum of 38 per cent of the total shipments for the industry. From FTC corporate (firm) data, the largest four firms accounted for 69 per cent of the total net capital assets for the industry.

For most purposes, the basic units used in compiling manufacturing statistics are defined in the same way by the principal government agencies collecting establishment reports—Bureau of the Census, BLS, Bureau of Old-Age and Survivors Insurance, and Bureau of Employment Security.

Definition of industry. An industry is defined as a group of establishments primarily engaged in the same line or similar lines of economic activity. In the manufacturing field, the line of activity is generally defined in terms of the products made or the processes of manufacture used. On this basis, there may theoretically be thousands of manufacturing industries corresponding to the different types of products and the processes used in their manufacture. However, industries established in this manner would be too numerous to deal with and would not generally satisfy the criteria considered essential for a good system of industry classification.

In the 1947 Census of Manufactures, the *Standard Industrial Classification (SIC) Manual, Volume I, Manufacturing Industries*,²

¹ *Study of Monopoly Power*, report for H. Subcommittee, prepared by the Bureau of the Census from 1947 Census of Manufactures schedules, December 1, 1949. *The Concentration of Productive Facilities*, 1947, Federal Trade Commission, 1949.

² *Standard Industrial Classification Manual, Vol. 1, Manufacturing Industries*, Bureau of the Budget, 1945.

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was followed except for relatively minor modifications.³ The manual lists a number of general guiding principles which were followed in the development of the industry classification system:

- "1. The classification should conform to the existing structures of American industry;
- "2. The reporting units to be classified are establishments, rather than legal entities or companies;
- "3. Each establishment is to be classified according to its major activity;
- "4. To be recognized as an industry, each group of establishments must have significance from the standpoint of the number of establishments, number of wage earners, volume of business, employment and payroll fluctuations, and other important economic features."⁴

The meaning of the first principle—that the classification should conform to the existing structure of American industry—may be made clear by an illustration. A system created entirely on the basis of materials used in the manufacturing process would not be satisfactory because many establishments produce the same end product from different materials. An example is gaskets: most establishments making this item produce rubber gaskets, leather gaskets, asbestos gaskets, etc., on the same premises. It would therefore be inappropriate to create separate industries for rubber, leather, asbestos, etc., gaskets.

In addition to the above principles, the classification should maximize the homogeneity or similarity of activity of the establishments in an industry. This means that a high proportion of the total activity of the establishments should be represented by the products, processes, or operations defining the industry. For example, the 1947 output of establishments in the malt liquor industry consisted entirely of malt liquors. On the other hand, only 68 per cent of the output of establishments in the cereals preparation industry consisted of cereal preparations, a large part of the other 32 per cent being represented by prepared feeds and grain mill products. The average "industry homogeneity" for all manufacturing establishments in 1947 was 90 per cent.

Homogeneity depends to some extent on the efforts made to ob-

³ The differences between 1947 census and SIC classifications are explained in the 1947 Census of Manufactures volumes, Appendix E.

⁴ *Standard Industrial Classification Manual*, as cited, p. iv.

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tain separate establishment reports for locations engaged in two or more large-sized distinct activities (each industry classification being a distinct activity). Further, while an industry may be relatively homogeneous with respect to output of all products defining the industry, the industry may be defined on the basis of a variety of somewhat related products.

While the output of the establishments of an industry may to a high degree consist of the products of that industry, it may not represent a high proportion of total output of those products made by all establishments. This brings us to the related principle of "primary activity coverage," which requires that the establishments in the industry account for a large portion of the total activity defining the industry. For example, the total output of hydraulic cement is manufactured by establishments in the hydraulic cement industry. On the other hand, only 54 per cent of the total production of suspenders and garters is accounted for by establishments in the suspenders and garters industry, the remaining 46 per cent being made as secondary products by establishments in other industries. Some manufacturing industries are defined in terms of both product and type of operation or stage of production. In many of these industries, the primary product coverage may be low when the same product is defined as belonging to two industries which are distinguishable mainly in terms of operations. For example, although the beehive coke oven industry produces nothing but coke products, its coke production represents only 9 per cent of the total coke output. The other 91 per cent comes from the by-product coke oven industry.

Another criterion of industry classification structure is the extent to which the individual establishment within an industry tends to produce the full range of products primary to the industry. This implies that the activities of a significant number of the establishments are distributed among the various products, processes, or operations defining the industry. If any considerable number of the establishments concentrated on a single one of the activities among those defining the industry, such specialization would constitute a basis for further subdivision of the industry. For example, SIC industry 3543, *Metal-working machinery accessories*, includes establishments primarily manufacturing (a) dies, jigs, and fixtures on a "custom" basis and (b) standard small cutting tools. Very few establishments are engaged in both activities. This indicates that the two types of manufacturers do not belong in the same industry.

Summary distributions of industry size, homogeneity, and cover-

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age are shown in Appendix Tables A-2 through A-5. For individual industries, see Census of Manufactures volumes.

From the foregoing discussion, it will be noted that primary emphasis in defining and describing the industry is on the supply side of the economic picture. Physical or technological structure and homogeneity of production are more important considerations in the classification system than close substitutability of demand for products. Although the industry generally represents a group of close competitors, producing close substitute commodities, the different commodities frequently cannot be substituted (lathe and drill press). Further, all close substitute commodities are not in the same industry. For example, tin cans and glass containers are close substitute commodities, but are defined in two different industries because of the differences in materials, process of manufacture, types of machinery, etc., that is, differences in supply characteristics.

Establishment. Given a system of industry classifications, it is then necessary to define the basic unit of industry classification: the establishment. The SIC manual defines an establishment as “. . . a single physical location where business is conducted or where services or industrial operations are performed; for example, a factory, mill, store, mine, or farm. Where a single physical location comprises two or more units which maintain separate payroll and inventory records and which are engaged in distinct or separate activities for which different industry classifications are provided in the SIC, each unit shall be treated as a separate establishment. An establishment is not necessarily identical with the business concern or firm which may consist of one or more establishments. It is also to be distinguished from organizational subunits, departments or divisions within an establishment.”⁵

Perhaps to this definition, there ought to be added an economic flavor—a guiding principle, explicitly stated, that an establishment is an economic unit, and as such, is engaged in an activity of concern in management policy decisions. These decisions involve questions regarding rate of output, price policy, inventory cumulation, plant expansion, etc.

In summary, the establishment is an economic unit characterized by these elements: physical location, distinctive activity, reportability (e.g., ability to supply data on employment, payrolls, shipments, etc.), and management policy control.

In 1947 census practice, some flexibility was allowed in the appli-

⁵ *Ibid.*, p. 1.

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cation of the above rules. Where a company did not keep separate records for two or more establishments engaged in the same line of activity and located within the same county (but in different cities), a consolidated report was sometimes accepted and the plants counted as a single establishment.

The separate reporting of distinct lines of activity at the same location was also selectively applied. In particular instances—e.g., in the separation of blast furnaces from steel works, or of pulp mills from paper mills—reporting manufacturers were required to provide separate reports and in many cases somewhat arbitrary values were assigned to material transferred from one phase to another of an integrated industrial operation. For most industries outside the paper and products and some sections of the metals and products (including machinery) industries, consolidated reports were accepted and the plant classified in the industry accounting for the largest proportion of its shipments. Where, however, companies operated two or more establishments engaged in different lines of activity at different locations, separate reports were secured, even though this involved the assignment of estimated values for materials transferred from one plant to another.

The content of a particular industry may include both merchant and captive (whether or not separately located) establishments engaged in the same activity. In the manufacturing of some materials and components to be subsequently incorporated into end products, captive production (primarily for interplant transfer to other establishments of the same firm) may account for a significant part of the total. Since the demand for the output of captive plants is narrowly limited or controlled in contrast to the commercial market channels of merchant producers, it might be desirable, in a study of business concentration, to recognize instances where captive operations are important. Producers searching for buyers are much more closely competitive with each other than with captive establishments.

There were a total of 241,000 establishments in the 1947 Census of Manufactures: 206,000 independent or single-unit establishments (80 per cent of total number) accounting for 40 per cent of total value added for all manufacturing establishments; and 35,000 multi-unit establishments operated or controlled by about 8,000 firms.

For Census of Manufactures purposes, the firm is identical with the establishment for single-unit manufacturing firms. Multi-unit establishment firms consist of the manufacturing establishments of the parent corporation as well as the manufacturing establishments

of all of its separately controlled (through stock ownership or otherwise) subsidiaries. The definition of the firm used by the Bureau is essentially similar to that used by FTC and SEC.

Auxiliary units and central administrative offices. Associated with the establishment concept is that of the auxiliary unit, which like the captive manufacturing plant, is a phenomenon chiefly of large business. These are elements of integration that tend to increase the total amount of production (and presumably profit) per unit of final output. The problem of classifying auxiliary units occurs particularly when such units are separately reported or separately located from "operating" establishments of the same firm. The main distinctions between an "operating" establishment and an auxiliary unit are: (1) an auxiliary unit is engaged in nonmanufacturing activity to facilitate the principal activity of establishments of the same firm; its existence depends on the establishments it serves; and (2) it is operated for the use of the firm's own establishments, that is, it is not operated commercially for other business concerns or individuals. The SIC manual does not provide specifically for separate auxiliary units; they are assigned to the industry of the establishments served. For example, a warehouse serving "operating" manufacturing establishments of the same firm has been classified by most agencies as an auxiliary unit in the manufacturing division; the SIC manual provides an industry for public but not for "captive" warehouses. On the other hand, a separate captive paper box manufacturing plant whose entire output is transferred to dress manufacturing plants of the same firm for packaging the dresses would be considered a manufacturing establishment, classified in the paper box industry. The SIC manual recognizes manufacturing for interplant transfer as a manufacturing activity.

The main types of auxiliary activities carried on for own use by the manufacturing establishments of a firm are: force account construction; power generation; warehousing and storage; repair and maintenance of own facilities and equipment; testing, research, and development work; buying operations; shipping and delivery operations; and garage operation.

The central administrative office of multi-unit manufacturing firms represents another type of unit in an establishment-reporting system. There are two schools of thought as to how these offices should be treated for classification purposes. One says that these units are engaged primarily in administration and management of the firm, and the classification system should recognize this by creat-

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ing a separate management industry. The other school claims that these units serve (administer, manage, keep records, etc.) other establishments of the same firm just as the executive, administrative, and clerical employees of a single-unit establishment serve other parts of the establishment.

In the 1947 Census of Manufactures, the Bureau collected reports for central administrative offices but did not compile data for them along with that for "operating" establishments. The Bureau did not collect schedules for separate activities auxiliary to manufacturing (separate warehouses, garages, maintenance shops, etc.). It is expected that data for both auxiliary units and central administrative offices will be accounted for in the 1954 census.

Data from firms. Agencies collecting financial data use the firm rather than the establishment unit in compiling statistics by industry. The FTC and the SEC, in their quarterly financial report series, obtain reports from corporations. The classification unit may be a single corporation (independent or subsidiary), or a parent corporation consolidating data for parent and all subsidiaries in its annual report to stockholders. The Bureau of Internal Revenue data in the *Statistics of Income* series for corporations are based largely upon returns of separately incorporated entities. Consolidated returns for parent and subsidiary corporations are permitted in certain cases. They accounted for 6 per cent of net income of all returns showing net income in 1947.⁶

THE INDUSTRY CLASSIFICATION

THE *Standard Industrial Classification Manual* (SIC), Volume 1, *Manufacturing Industries* (1945), was used with some minor modifications in the 1947 Census of Manufactures and subsequent annual surveys of manufactures. A description of the scope and characteristics of manufacturing establishments is contained in the introductions to the SIC manual and the Census of Manufactures volumes.

The manufacturing universe is divided into 21 major groups (designated by 2-digit codes), subdivided into about 150 industry groups (3-digit codes) which are further divided into some 470 industries (4-digit codes). Most of the industries are defined mainly in terms of establishments primarily engaged in manufacturing a specific product or group of products. In some instances, distinctions are made in terms of operations (examples: stamping, forging,

⁶ *Statistics of Income for 1947*, Bureau of Internal Revenue, p. 2.

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foundry, and machine shop industries); some, in terms of process of manufacture or stage of production (examples: sweaters made in knitting mill vs. cut-and-sew plants from purchased knit fabric; coke made in beehive vs. by-product ovens). Some industries are of a service type primarily servicing other manufacturing establishments, usually on a contract basis on materials owned by others (examples: dyeing and finishing textiles; apparel contracting; galvanizing, electroplating, etc., metal products; printing trade services). Important instances where the same products may be assigned to two or more industries on the basis of differing types or levels of production operations performed are listed in Appendix Table A-6.

APPLICATION OF THE INDUSTRY CLASSIFICATION

THE 1947 Census of Manufactures inquired about input (employment, manhours, earnings, cost of materials, inventories, capital expenditures, etc.) and output of products. Except for a few dozen industries, the product inquiries called for shipments (and sometimes, production) of a preprinted and precoded list of products of each of the industries. Additional information (process of manufacture, method of distribution, materials consumption, etc.) was requested, where necessary, to permit industrial classification of the establishments.

While the SIC manual establishes a system for dividing the universe of economic activities into smaller industry categories, it does not deal at length with specific application of the system in assigning industry classifications to establishments. It does provide that the establishment be assigned to an industry on the basis of its major activity, and the manual also states that ". . . in most cases, the industry assignment is determined on the basis of the principal product made in the establishment, but in a number of instances other criteria are used. . . ." However, SIC does not prescribe the measuring rod (value of sales or receipts, value added, employment, etc.), nor any more specific method of applying the SIC system.

Theoretically, the major activity of an establishment would probably best be measured in terms of income produced or value added, but such information is generally not reportable in the detail necessary for determining an industry classification. In practice, the Bureau and most other establishment-report collecting agencies measure activity in terms of value of sales of products or receipts for services.

¹ *Standard Industrial Classification Manual*, as cited, p. 3.

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In the 1947 census, an establishment was assigned to or classified in an industry generally on the basis of the principal products made. The products made by each establishment were grouped according to the industries to which they belong, and the group of products accounting for the largest part of the total value of shipments of the establishment determined its industry classification. This group of products is said to be the primary products of the establishment as well as of the industry which it defines; all other products made by establishments classified in the industry are referred to as secondary products.

In some instances, a knowledge of the types and value of products shipped was not sufficient for determining the proper industry classification of an establishment. It was also necessary to know the process used in the manufacture of the products, or the materials used, or other characteristics of the operations of the establishment. For example, an establishment primarily engaged in producing insulated copper wire was classified in Industry 3392, *Wire drawing*, if it purchased copper rods, drew the rods into wire, and insulated the wire, but classified in Industry 3631, *Insulated wire and cable*, if it purchased copper wire and insulated it. In both cases, the major product value of shipments would be insulated wire.

There are a number of limitations to the above method of assigning an industry classification to an establishment. In the first place, the assignment is based upon the plurality of a group of products (of an industry) having the greatest value. Thus an establishment can be classified in Industry A even if only a small proportion, say, 30 per cent, of its total shipments consists of products of Industry A, provided the value for that group exceeds the value for any other group of products in an industry classification. However, this situation probably does not occur very frequently, as evidenced by the 90 per cent average "homogeneity" (see above) for all manufacturing industries.

Further, the use of value of shipments as a measuring rod is sometimes inadequate in approximating income produced or value added. This occurs particularly for establishments engaged in two or more distinct activities crossing economic division lines (manufacturing, wholesale trade, retail trade, services, etc.). In many of these cases, the use of value of shipments may lead to misleading results since a dollar's worth of manufactured product shipments may not be equivalent in terms of income produced to a dollar's worth of, say, wholesale trade sales. For example, an establishment

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reporting the manufacture of motors valued at \$1 million, and also the purchase and resale at wholesale of hardware at \$1.5 million, would be classified in wholesale trade on the basis of value of sales. However, on the basis of income produced, one dollar's worth of manufactured product sales is probably more nearly equivalent to five or six dollars of wholesale sales, and therefore the establishment would be classified in manufacturing. Fortunately, the number of these borderline cases is undoubtedly limited to isolated establishments within certain industries and probably does not affect a significant portion of manufacturing establishments.

During the processing of the 1947 Census of Manufactures, a number of difficulties were encountered in arriving at establishment industry classifications. Many of the difficulties occurred in the borderline between the manufacturing and nonmanufacturing division—in the fringe industrial segments where establishments were engaged in manufacturing activities combined with nonmanufacturing activities or where a significant part of the output of manufactured products was attributable to establishments in nonmanufacturing industries. It was often a problem to distinguish manufacturing from nonmanufacturing classifications for establishments engaged in such activities as manufacturing and wholesaling of meat and poultry products; manufacturing dairy products and distributing fluid milk; manufacturing and sale at retail or wholesale of bakery products, confectionery, prepared feed, fertilizers, awnings, venetian blinds, window shades, etc; manufacturing millwork and lumber distribution; manufacturing and repairing truck bodies; sheet metal work and special trade contracting; fabricated structural steel production and general construction, etc.

The Bureau of the Census has been conducting annual surveys of manufactures on a sample basis since 1949. In many instances where only the current major activity is used as a basis for classification, a small actual change in activity may be reflected in an exaggerated change in industrial classification. For example, in 1947 an establishment with 1,000 employees shipping \$10 million worth of products including \$5.1 million worth of butter and \$4.9 million of cheese would be assigned to the butter industry. If the butter and cheese figures were reversed in 1949, the establishment would be assigned to the cheese industry on a current activity basis. This would shift the whole 1,000 employees, \$10 million shipments, etc., to the cheese industry, whereas actually the change affected only \$200,000 of shipments, and approximately 20 employees. To avoid

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these abrupt and unrealistic fluctuations, the Bureau applied a "resistance" factor which would permit only significant changes in real activity to be reflected in industry code changes. The resistance factor was derived so as to minimize the combined errors of industry trend and current level, assuming equal importance (weights) for trend and level.

The resistance factor technique was applied to a universe of approximately 30,000 of the larger establishments in the 1949 sample survey of 45,000 establishments. Of these 30,000 establishments, primary activity changes occurred for 1,000 establishments. Application of the resistance factor prevented a change in code for 35 per cent of these 1,000 cases. For the 15,000 smaller establishments, the old (1947) codes were maintained, that is, 100 per cent resistance was applied.

As will be noted from the above discussion of the application of the industry classification, the nature and detail of information available are important factors in determining industry classifications of establishments. The detailed list of some 6,500 products and other inquiries on census schedules have resulted in establishment classifications often different from those assigned by other agencies.

For several years now the Bureau has been participating with other establishment-report collecting agencies (Bureau of Old-Age and Survivors Insurance, BLS, Bureau of Employment Security), under the sponsorship of the Bureau of the Budget, in attempting to achieve greater comparability of industrial statistics. An important beginning was the development of the SIC manual for use by government agencies compiling data from establishment reports. However, a standard classification system is not enough, by itself, to accomplish the desired level of uniformity. Among other things, the system must be uniformly interpreted, the classification units—establishments—must be the same, and the same classification must be assigned to identical units for a given time period. The agencies are at present directing their efforts toward these objectives.

3. Product Classification

THE 200-odd schedules sent to manufacturers contained an aggregate of some 6,500 different products for which the Bureau of the Census desired to collect shipments and, sometimes, production data.

A number of guiding principles were followed in the creation of the product list. An attempt was made to arrive at a balanced list of homogeneous products. In general, a product was not included if

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its 1939 production was valued at less than \$2 million. On the other hand, product items which were reported in large volume by a large number of establishments in 1939 were split up in 1947 into a number of products, where feasible. In most cases, parts and accessories of machinery and equipment were listed separately from complete units. Distinctions were made in many instances between consumer and producer goods; for example, household washing machines, etc., were listed separately from commercial washing machines, etc. Finally, each product was set up so as to be assignable in its entirety as "primary" to a particular industry; that is, one part could not belong to one industry, and another part to another industry. For example, dress gloves were divided between leather and fabric gloves since establishments primarily making leather gloves were assignable to a different industry from those making fabric gloves.

Basically, the products were organized or grouped into a structure related to origin of production, that is, according to the industry primarily responsible for their output. This is in contrast to the 1946 Standard Commodity Classification which follows the sequence of the stage of production process. The latter system divides all products into three major groups: crude materials, fabricated basic materials, and end products. While the basic structures of the two systems are organized differently, at the detailed product level, they are comparable and consistent.

The 6,500 products were preprinted and precoded on the various schedules so that it was generally necessary to assign codes only when the respondent reported shipments of items not listed on his schedule. Such items were written in on blank lines by the respondent and were assigned codes corresponding to one of the 6,500 products of the system.

The term "products," as used in the Census of Manufactures, may have a broader or narrower content than in common usage. For example, automotive gasoline was reported as a single item. On the other hand, cotton broad-woven goods were distributed into nearly 200 individual "products" according to type of weave, width of fabric, and other specifications. For some items, e.g. bearings, it would have been desirable to obtain product information in much greater detail than that actually requested, but the extent to which the production of individual types and sizes is concentrated in one or two individual companies would have made it impossible to publish detailed data. Thus the 6,500 individual products included on

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the forms merely represent the number of items for which it was considered practical to publish census information.

Of the 6,500 items included on the forms, data were actually published for approximately 6,300. The balance were eliminated because their publication would involve disclosure of the activities of individual companies or because a number of important producers could not report products in the detail requested. A frequency distribution of the value of product shipments is shown in Appendix Table A-7.

To compile certain types of data, the 6,500 detailed products were condensed into approximately 1,000 broader classes of products. These product classes, with some modifications, were also used in collecting shipments data in the sample annual surveys of manufactures for 1949, 1950, and 1951.

The extent to which industry and product statistics can be matched with each other is indicated in transition tables (Table 5's, Census of Manufactures, Volume II, Statistics of Industry) which show, on the one hand, the proportions by value of the primary and secondary products shipped by the industry and, on the other, the value of the primary products of the industry made as secondary products in other industries.

Following is an illustration of the relation between industry and product value data for the oleomargarine industry and the product, oleomargarine.

PRODUCT	SHIPPED BY		
	<i>Oleomargarine Industry</i>	<i>Other Industries</i>	<i>All Industries</i>
	<i>(millions of dollars)</i>		
Total shipments of			
oleomargarine industry	215		
Oleomargarine (primary product)	173	64	237
Secondary products of			
oleomargarine industry	42		
Salad dressings	36		
Shortening and salad oils	3		
Other secondary products	3		

The above table shows that establishments in the oleomargarine industry shipped products valued at \$215 million, only \$173 million of which consisted of oleomargarine. On the other hand, total oleomargarine shipments amounted to \$237 million of which \$64 million was contributed by industries other than the oleomargarine industry.

In a classification system dividing the manufacturing field into

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some 470 separate industries to which establishments are assigned on the basis of their principal activity, a certain amount of overlapping production by one industry of products of other industries is bound to arise. Such overlapping is particularly prevalent in such industry groups as apparel, furniture, and metal fabricating, where establishments within each group, employing the same basic types of machinery and fabricating operations, produce a wide variety of products belonging to a number of different industries. For 1947, the average amount of overlapping for all industries was approximately 10 per cent in both directions, compared with from 15 to 20 per cent for the furniture and metal fabricating (except transportation equipment) groups of industries. The greater the degree of overlapping, the less meaningful are the relationships between general and product statistics for the particular industry.

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STATISTICAL APPENDIX

TABLE A-1

Comparison of Concentration Ratios Derived from 1947 Census of Manufactures, Establishment Reports and 1947 Federal Trade Commission Sample of Corporation Reports^a

SIC Industry or Industry Group	Census of Manufactures: 1947		FTC Estimated
	1947 Value Added, Total for Industry ^b (mill. \$)	Percentage of Total Industry Shipments by First Four Companies, 1947 ^c	Percentage of Total Net Capital Assets Owned by First Four Companies, 1947
201, Meat products	\$1,281	max. 38	69
202, Dairy products	595	max. 36	60
203, Canning and preserving	917	max. 29	39
204, Grain mill products	1,002	max. 28	36
2051, Bakery products, except biscuit, etc.	1,101	16	30
2052, Biscuit, crackers, and pretzels	265	72	71
2085, Distilled, rectified, and blended liquors	472	75	85
2111, Cigarettes	368	90	88
2232, Woolen and worsted fabrics	600	28	30
2271, 2273, Carpets and rugs	248	max. 49	58
2274, Hard-surface floor coverings, n.e.c.	83	80	94
281, 282, Industrial chemicals	2,006	max. 56	52
283, Drugs and medicines	749	max. 36	30
3011, Rubber tires and tubes	650	77	88
314, Footwear, except rubber	786	max. 28	47
321-323, Glass and glassware	713	max. 60	62
331, 332, Primary steel	3,780	max. 40	55
3334, Primary aluminum	65	100	100
3411, Tin cans and tinware	232	78	96
3431, Plumbers' supplies	156	35	74
352, Agricultural machinery	754	max. 52	75
357, Office and store machines	504	max. 61	74
371, Motor vehicles and parts	3,819	max. 54	71
372, Aircraft and parts	955	max. 58	44

^a Industries selected are 23 of the 26 industries shown in the Federal Trade Commission report. Census data are based on classification of individual establishments. To determine concentration ratios, establishments of same company in a particular industry were consolidated; a company could have establishments in many different industries. FTC data are based on classification of corporation as a whole (parent corporation and its subsidiaries), so that the corporation is classified in only one industry.

^b Value added data for all establishments of industry listed to indicate size of the various industries.

^c Percentages based on value of shipments of largest 4 companies in each SIC industry. Ratios shown for combinations of 2 or more industries represent a maximum possible percentage that would be obtained if the first 4 companies of each of the industries of the combination were identical. Ratios for these combinations are prefixed with the symbol "max." (maximum). Ratios are based on value of shipments, except for the following industry groups containing individual industries with extensive duplication in shipments figures: 201, meat products; 2271 and 2273, carpets and rugs; 331 and 332, primary steel; 371, motor vehicles and parts; 372, aircraft and parts. Ratios for these industries are based on "value added" data.

Sources: *Census of Manufactures: 1947*, Bureau of the Census, Vol. II (value added data); *Study of Monopoly Power*, a report for H. Subcommittee prepared by the Bureau of the Census from 1947 Census of Manufactures schedules, December 1, 1949; and *The Concentration of Productive Facilities, 1947*, Federal Trade Commission, 1949.

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TABLE A-2

Frequency Distribution of Industries by Total Employment Size Class, 1947

<i>Employment Size Class of Industry (thousands of employees)</i>	<i>Number of Industries</i>	<i>Number of Establishments (thousands)</i>	<i>Number of Employees (thousands)</i>	<i>Value Added by Manufactures (mill. \$)</i>
All industries, total	453	240.9	14,294	\$74,426
Less than 1.0	9	.2	6	9
1.0- 1.9	24	1.6	34	219
2.0- 2.9	19	1.8	46	311
3.0- 3.9	20	2.1	68	394
4.0- 4.9	19	2.3	84	447
5.0- 9.9	95	17.6	709	3,942
10.0-24.9	118	40.0	1,869	10,009
25.0-49.9	70	50.9	2,521	13,635
50.0-99.9	52	51.9	3,523	18,974
100.0 and over	27	72.5	5,434	26,456

Source: *Census of Manufactures: 1947*, Bureau of the Census.

TABLE A-3

Frequency Distribution of Industries by Value Added Size Classes, 1947

<i>Value Added Size Class of Industry (millions of dollars)</i>	<i>Number of Industries</i>	<i>Number of Establishments (thousands)</i>	<i>Number of Employees (thousands)</i>	<i>Value Added by Manufactures (mill. \$)</i>
All industries, total	453	240.9	14,294	\$74,426
Up to \$4.9	13	.6	12	46
\$ 5-\$ 9.9	25	1.8	45	199
10- 24.9	60	8.4	249	1,097
25- 49.9	86	16.9	700	3,290
50- 99.9	83	21.7	1,162	6,090
100- 249.9	99	65.3	2,949	15,119
250- 499.9	57	52.0	3,648	20,158
500- 999.9	22	37.0	2,873	14,475
\$1,000 and over	8	37.2	2,656	13,952

Source: *Census of Manufactures: 1947*, Bureau of the Census.

TABLE A-4

Frequency Distribution of Industries by Degree of Homogeneity of Activity, 1947

<i>Percentage Industry Homogeneity Class Interval^a</i>	<i>Number of Industries</i>	<i>Number of Establishments (thousands)</i>	<i>Number of Employees (thousands)</i>	<i>Value Added by Manufactures (mill. \$)</i>
All industries, total	453	240.9	14,294	\$74,426
50-59	1	.1	4	18
60-69	6	.9	50	439
70-79	37	7.4	520	2,772
80-89	129	60.6	3,767	19,238
90-99	255	162.0	9,400	47,820
100	25	9.9	553	4,139

^a 1947 value of shipments of primary products of each industry as a per cent of the industry's shipments of all products. Average homogeneity for all industries is 90 per cent.

Source: *Census of Manufactures: 1947*, Bureau of the Census, Vol. II, *Statistics by Industry*, Table 5's.

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TABLE A-5

Frequency Distribution of Industries by Percentage Coverage of Primary Activity, 1947

<i>Percentage Industry Coverage Class Intervals^a</i>	<i>Number of Industries</i>	<i>Number of Establishments (thousands)</i>	<i>Number of Employees (thousands)</i>	<i>Value Added by Manufactures (mill. \$)</i>
All industries, total ^b	449	238.5	14,257	\$74,252
Less than 50	19	3.5	366	1,737
50-59	9	3.3	86	479
60-69	19	5.7	216	1,231
70-79	50	18.2	838	4,226
80-89	110	60.0	3,195	16,458
90-99	207	118.2	7,423	38,212
100	35	29.6	2,133	11,909

^a 1947 value of shipments of primary products by each industry as a per cent of shipments of the products by all industries. Average coverage for all industries is approximately 90 per cent.

^b Excludes the following primarily service-type industries: 3465, enameling and lacquering; 3466, galvanizing; 3467, engraving on metal; and 3468, plating and polishing.

Source: *Census of Manufactures: 1947*, Bureau of the Census, Vol. II, *Statistics by Industry*, Table 5's.

TABLE A-6

Principal Product Groups Primary to Two or More Manufacturing Industries^a

<i>Product Group (A)</i>	<i>Industries in which Primary (B)</i>
Prepared meats	2011. Meat packing, wholesale 2013. Sausages and other prepared meat products
Process cheese	2022. Natural cheese 2025. Special dairy products
Flour, blended and prepared	2041. Flour and other grain-mill products 2045. Blended and prepared flour
Sugar, refined	2062. Cane-sugar refining 2063. Beet sugar
Knit apparel	2253-2255. Knit outerwear, underwear, and glove mills 23. Various apparel industries
Waterproof outer garments	2385. Raincoats and other waterproof outer garments 3099. Rubber industries, not elsewhere classified
Other apparel and fabricated textile products	23. Various apparel industries
Box shooek	2421. Sawmills and planing mills, general 2444. Wooden boxes (except cigar boxes)
Converted paper products	264-269. Paper product industries except pulp and paper board products ^b
Soap	2841. Soap and glycerin 2842. Cleaning and polishing preparations
Fertilizers	2871. Fertilizers, manufacturing and mixing 2872. Fertilizers, mixing only
Coke	2931. Beehive coke ovens 2932. By-product coke ovens

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TABLE A-6 (Continued)

<i>Product Group</i> (A)	<i>Industries in which Primary</i> (B)
Lubricating oils and greases	2911. Petroleum refining 2992. Lubricating oils and greases not made in petroleum refineries
Laminated glass	3211. Flat glass 3231. Glass products made of purchased glass
Glassware, decorated	321. Flat glass 322. Pressed or blown glass and glassware 3231. Glass products made of purchased glass
Ferroalloys and other additives	3311. Blast furnaces 3313. Electrometallurgical products
Refined unalloyed nonferrous products	333. Primary smelting and refining, nonferrous metals 334. Secondary smelting and refining, nonferrous metals
Nails and spikes	3392. Wire drawing 3481. Nails and spikes
Wire, except insulated	3312. Steelworks and rolling mills 335. Nonferrous rolling and drawing 3392. Wire drawing
Fabricated wire products, except insulated wire	3392. Wire drawing 3489. Wirework, not elsewhere classified
Insulated wire and cable	3312. Steel works and rolling mills 335. Nonferrous rolling and drawing 3392. Wire drawing
Fire-control equipment	3631. Insulated wire and cable 1941. Sighting and fire-control equipment 3831. Optical instruments and lenses

^a Establishments primarily engaged in manufacturing products listed in Column A are classified in one of the two or more industries shown in Column B, on the basis of types of operations performed or materials used. For example, an establishment primarily manufacturing blended and prepared flour from grain milled at the same establishment is classified in 2041, Flour and other grain-mill products; from purchased flour, in 2045, Blended and prepared flour.

^b Most of the industries in major group 23, apparel and other finished products made from fabrics and similar materials and in industry groups 264-269, paper converting industries, are defined in terms of establishments primarily engaged in making products from purchased materials (fabric for major group 23, and paper and paperboard for industry groups 264-269). The presumption is that if the establishments make the same products from their own materials (produced at the same establishment) they are to be classified elsewhere (weaving mill or pulp and paper mill industries).

Source: Bureau of the Census.

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TABLE A-7

Frequency Distribution of Value of Individual Products Published in
Census of Manufactures: 1947

<i>Value of Shipments Class Interval (millions of dollars)</i>	<i>Number of Products</i>	<i>Per Cent of Total Number of Products</i>
All products, total	6,292	100
\$.0-\$ 1.9 ^a	1,539	24
2.0- 3.9	913	15
4.0- 5.9	630	10
6.0- 7.9	426	7
8.0- 9.9	384	6
10.0- 14.9	554	9
15.0- 19.9	361	6
20.0- 29.9	445	7
30.0- 39.9	251	4
40.0- 49.9	144	2
50.0- 59.9	89	1
60.0- 69.9	90	1
70.0- 79.9	80	1
80.0- 89.9	42	1
90.0- 99.9	38	1
100.0-199.9	170	3
200.0-299.9	54	1
300.0-399.9	33	1
400.0-499.9	14	x
500.0-599.9	6	x
600.0-699.9	4	x
700.0-799.9	6	x
800.0-899.9	3	x
900.0-999.9	5	x
\$1,000.0 and over	11	x

^a A large proportion of the products of small value are of the unavoidable "residual" type or of the type needed to simplify classifications or instructions for reporting other products.

x Means less than .5 per cent.

Source: *Census of Manufactures: 1947*, Bureau of the Census.

C O M M E N T

SOLOMON FABRICANT, National Bureau of Economic Research

ECONOMISTS belong to that hungry tribe of whom it is said that when shown a finger they try to seize the hand. Those of us concerned with business concentration do not admit the richness of the census for our purposes; we point only to the obvious fact that the census can be made richer—with no additional cost as far as we are concerned.

We ask, for example, for information on net capital assets, which would provide us with a more stable measure of size than does out-

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put, value of product, or other flow items. It is true that some difficulties were encountered when the possibility of securing data on capital assets was explored in a pre-test of the 1947 census. However, if the census can secure useful information on capital expenditures, it is difficult to believe that it cannot at the same time secure useful information on capital assets.

More information on central offices and related activities would also be useful. Many of these offices straddle a variety of industries, and we need to know more about their relative importance before we can be sure we are measuring individual industries adequately. We need to know more also about ownership connections between industries, and not only within manufacturing but also between manufacturing and mining, trade, etc.; and central office information would help. A "distribution of sales" schedule also would help.

At present we are in some degree victims of the way in which the work of the Bureau of the Census is divided between its Industry Division and its Business Division—not to speak of its Agriculture Division. Ownership connections are broken when an enterprise is split between the Census of Manufactures and the Census of Trade. But even for enterprises entirely within manufacturing, our measures of business concentration depend on the classification of establishments followed by the Bureau of the Census. It would be informative, therefore, if the Bureau told us how its classifications compare with those implicit in various administrative rulings, such as those made by the Wage and Hour Division. And we ought to be given a clearer idea as to how congruent the census industries are with the clusters of establishments organized in trade associations and similar groups.¹

Besides extending the census to provide additional data, the Bureau can produce a valuable body of source material merely by making new arrangements of data now in its files. Generally speaking, this means providing breakdowns and cross classifications of various sorts. Aggregates are only the beginning of information.

For example, we would like to know how individual establishments or enterprises change in size from one year or census to an-

¹ When discussing the classification question, Conklin and Goldstein mention a "resistance" factor to avoid "abrupt and unrealistic fluctuations" in the scope of industries. It would be interesting to know in which industries the resistance factor is most important. It would be well also if the Bureau of the Census indicated whether it expects to adhere to resistance factors even when a new census is taken, for apparently the factor has been applied so far only in moving forward from the 1947 census via the annual surveys.

other. Light on this question would be provided if for each industry we had a cross tabulation of establishments, by size in one year against size in another year, size being measured by value added, employment, or value of product, or—if the information were obtained—capital assets. It might not be necessary to do this for all establishments; a sample in each industry might be sufficient. If we had such information, we would know the extent to which establishments or enterprises shift into and out of the "top four," and could deal with one of the questions that Rosenbluth raises in his discussion of the time period. More generally, information would be provided about the shifts that occur in the position of individual firms wherever they may be in the size distribution. We might learn something also about the movement of establishments between industries; or within industries, of shifts in major product or extent of specialization.

Everybody knows the story of concentration in livestock purchasing. We could do with a few fresh examples of concentration in buying. What we need is a classification of a wide range of industries with respect to concentration in buying of various materials. I suspect that the census already has a fair amount of the basic data; perhaps all that is needed is to tabulate them in suitable form.

Suits mentions the relationship between product and industry. Tabulations already available in the Census of Manufactures provide information for narrow groups of industries. It would be desirable if, on occasion, the census could publish larger segments of the full product-by-industry tabulation that covers all industries and products.

Information already available could be organized to indicate how concentration in production of end products in a given industry is related to concentration in production of intermediate materials in that industry. We would like to know also how concentration in production is correlated with concentration of labor in trade unions in the same industry. Available information could probably be organized to show how frequently oligopolies face one another in their transactions.

Apart from the question of developing and extending our data, there is the problem of using the data most effectively to measure business concentration.

Value added or net value added has been suggested as superior to value of product in measuring concentration because materials and fuel differ in importance among establishments. However, even

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value added is not free of difficulties associated with varying degrees of integration. Companies that do their own construction and maintenance work or other auxiliary activities will necessarily have a larger value added than will concerns that do not, yet this kind of integration is largely irrelevant to our purpose. A further point: value added includes profits. When profits are high, value added will be high and so will profit rates. If we take value added as a measure of size and correlate it with the rate of profit, as we sometimes do, we may get spurious results. This is one of the reasons for asking that the census try to obtain information on capital assets.

A problem arises when using value of product in concentration measures because "captive" establishments transfer their output to affiliated establishments at assigned values. These values are usually lower than market values, as may be seen in the 1947 census statistics on the blast furnace industry, and the concentration ratios may be too low also. In any case, the presence of these "arbitrary" values—to use the term favored by Conklin and Goldstein—is disturbing. Perhaps better than value of product, then, is physical volume. One could omit "captive" establishments, as Conklin and Goldstein suggest; but what is really needed is knowledge of their importance, and of the extent to which shifts occur in the proportion between transferred and sold outputs.

It may be noted, further, that in some industries substantial quantities of goods are produced and consumed in the same industry. These goods will not find their value reflected in the total value of the output of that class of goods, since the total value will usually relate to the quantities sold.

Many of our concentration measures are based on industry classes as defined in the census and similar sources. Yet there may well be considerable competition between, say, manufacturing industries on the one hand and nonmanufacturing industries on the other. Thus the manufacture of canned fruits and vegetables is closely competitive not only with the manufacture of dried fruits and vegetables but also with the sale of fresh fruits and vegetables and with home canning. Another and perhaps better example is cheese or butter, which are (or used to be) produced on farms as well as in factories.

Whatever we do, difficulties will be encountered in getting up sensible concentration measures and using them. It must be emphasized, however, that these difficulties are not merely technical matters. They reflect phenomena of the economic world that are themselves worthy of study by economists. We need to know, for

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example, when auxiliary activities are taken on, when they are sloughed off. We need in fact a theory of auxiliary activity—recall Stigler's recent paper on specialization.

Another illustration is found in the type of analysis performed by Rosenbluth in which he distinguishes between changes in concentration within industries and changes in the weights of different industries and asks what has been the effect of each type of change on the over-all concentration ratio. A real question here is whether or not there is an economic relationship between these two "independent" factors. More specifically, is there any tendency for highly concentrated industries to grow less rapidly because they are more highly concentrated? A related question looks the other way along the line of causation. How does stage of growth of an industry influence the degree of concentration that characterizes it? Further, how does degree of concentration fluctuate with the business cycle? These questions, raised by Moses Abramovitz in an article now fifteen years old, still need looking into.

The stage we have reached in our study of concentration in business is much like the stage reached in the study of concentration of incomes a decade or so ago. At that time we thought the major question was the shape of the income distribution. We have since graduated to a higher level in which we worry about the factors that determine the position of a family in the income distribution and the bearing of that position on the division of income between savings and consumption. We seem to be approaching this new level of analysis in the present field. If we learn from the experience of investigators of income distribution, we should rise to the new level sooner.

FRANK J. KOTTKE, Federal Trade Commission

THE construction of a concentration ratio poses a problem in classification. Use of a single concentration ratio involves acceptance of two categories as comparable and relevant. Contrast of two or more concentration ratios generally predicates their comparability. The possibilities are great that the most readily available data are not comparable, or, though comparable, are not relevant to the problem at hand. Consequently, economists must take care to avoid the misuse of data in studies of economic concentration.

Publications of the Industry Division of the Bureau of the Census are the principal basis for concentration ratios for manufacturing

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activities in the United States. Conklin and Goldstein have rendered an important service in explaining precisely the classification principles on which such data are developed, and in indicating some of the considerations to be reviewed before any figure is incorporated in a concentration ratio. Many matters are involved in defining the categories of a census study. The Bureau of the Census must consider not only the interest of students of business concentration, but also the needs of other scientists, lawmakers, businessmen, and labor unions. The Bureau must consider the bases upon which informants can supply data, and also the importance of establishing specifications that all informants will interpret in the same way. Finally, the Bureau endeavors to accommodate its reporting program to those of other government statistical agencies. Even if there were only one concept of economic concentration, adjustment to these several needs almost certainly would leave much of the data less than ideal for the measurement of concentration.

A few comments on two of the industries listed in Appendix A illustrate difficulties for which a student of concentration must be on guard. Consider the dairy-products industry in 1947: The Federal Trade Commission (FTC) estimated that the four leading companies accounted for 60 per cent of the net capital assets, while the Bureau of the Census estimated that the four leading companies accounted for not more than 36 per cent of the value of shipments and interplant transfers originating in this industry.¹ Conklin and Goldstein imply that the difference is attributable to the procedure of the FTC in this particular study in assigning to one industry the entire capital assets of each parent company. Yet well over 90 per cent of the capital assets of the four leading dairy companies were directly related to the manufacture and distribution of dairy products. National Dairies had a minor commitment in frozen foods and salad products. Borden had seven chemical plants and eight special-products plants, but for the products of many of these plants, milk was an important raw material—viz., casein, milk sugar, beverage bases, and prescription foods. Carnation made its own cans and operated several feed mills. Another circumstance that might conceivably account for such a discrepancy is that the leading companies held large capital assets outside the continental United

NOTE: The views expressed in this comment are the writer's and not necessarily those of the Federal Trade Commission.

¹ The report of the Federal Trade Commission was issued August 24, 1949. The data on which the census ratios are based were released December 1, 1949.

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States. But in 1951 (the closest year for which the information is available), less than 2 per cent of the assets of National Dairies was located abroad. Borden in 1947 operated in two Canadian provinces, and two of Carnation's thirty milk plants were in Canada: this would account for a difference of not more than a few percentage points in the two concentration ratios. The denominator for the FTC ratio, of course, included the value of nondairy assets, and of capital assets outside the continental United States, for all companies primarily engaged in manufacturing dairy products.

The difference between the FTC ratio of 60 per cent and the maximum ratio of Conklin and Goldstein is traceable to aspects of the dairy-products business not covered by the census data they employed. All establishments distributing fresh milk and cream, including those establishments for which the manufacture of dairy products was the more important part of their operations, were excluded in developing the census data.² Establishments for receiving milk, establishments for storing dairy products, and facilities for transporting dairy products all were excluded. The result is a concentration ratio based on a much more limited conception of the dairy-products industry than that which the FTC had in mind.

As another example, newspaper and business writers constantly refer to the "automobile industry." However defined, this industry provides employment for the largest group of manufacturing workers in the United States. The following are some of the concepts that may be considered relevant to a study of concentration in the automobile industry (with concentration measured, for convenience, in terms of the four leading companies):

1. The percentage accounted for by the four largest producers of the value (f.o.b. plant) of all passenger automobiles shipped during a year. A close approximation, for which data are available, is the per cent of new passenger-car registrations. The four largest companies accounted for 88 per cent in 1947.³
2. The percentage accounted for by the four largest producers of

² In 1947, combination mercantile and manufacturing plants manufactured \$1.7 billion of dairy products, whereas exclusively manufacturing plants accounted for \$3.6 billion. In 1948, sales of milk dealers and dairy-product stores were \$2.9 billion.

³ Registration data are from *Automotive News*, 1952 Almanac Issue, p. 32. The FTC suggested that 1948 production figures were preferable to those for 1947, as strikes, material shortages, and other factors seriously disturbed production in 1947. However, census data are available for 1947 but not 1948; consequently, Conklin and Goldstein had no choice but to use 1947.

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the value (f.o.b. plant) of all motor vehicles shipped during a year. The term "motor vehicles" as used here includes passenger automobiles, ambulances, buses, and trucks, but not road-building equipment, self-propelled construction equipment, combat vehicles, farm machinery, locomotives, or motorcycles. The best approximation available is the per cent of new passenger-car and truck registrations. The four largest companies accounted for 85 per cent of such registrations in 1947.

3. The percentage accounted for by the four largest producers of the value of shipments (including miscellaneous receipts) of all establishments in which motor vehicle production is of greater value than output of goods primary to any other industry, as defined by the Bureau. The four leading companies here are those whose motor-vehicle establishments so defined, had larger shipments than did the establishments in the motor-vehicle industry controlled by any other combination of four companies. As of 1935 their share was 87 per cent. (Subsequently, the Bureau of the Census abandoned this concept of the industry.)

4. The percentage accounted for by the four largest companies of the value added by manufacture by establishments in which production of motor vehicles, motor-vehicle parts, or both motor vehicles and motor-vehicle parts is of greater value than output of goods primary to any other industry, as defined by the Bureau. Here the four companies are those whose motor-vehicle establishments so defined, added a larger value by manufacture than did the establishments in the motor-vehicle and parts industry controlled by any other combination of four companies. This is the measure used by Conklin and Goldstein. The share of the first four companies in 1947 was 56 per cent.

5. The percentage accounted for by the four largest companies of the net capital assets of all companies in which capital resources directed to the production of motor vehicles, motor-vehicle parts, or both motor vehicles and motor-vehicle parts are of greater value than those committed to any other industry as defined in sufficiently broad terms to facilitate classification of parent corporations in a single industry. With this approach, the leading companies are those having the largest net capital assets. This is the concept used by the FTC in its report on concentration.⁴ The share of the four largest companies in 1947 was estimated at 71 per cent.

6. The percentage accounted for by the four largest companies of

⁴ *The Concentration of Productive Facilities, 1947*, FTC, 1949.

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the total assets of all companies in which capital resources directed to the production of motor vehicles, motor-vehicle parts, or both motor vehicles and motor-vehicle parts are of greater value than those committed to any other industry, as defined in sufficiently broad terms to facilitate classification of parent corporations in a single industry. Here the leading companies are those with the largest total assets. On this basis the share of the four largest companies at the close of 1947 was 68 per cent.

Concept 1 is, of course, a "product" concept. For purposes of market analysis, some economists might prefer to divide it into three or four price classes. Its purpose, and that of 2 and 3 as well, is to measure the fraction of the supply of a commodity provided by the largest companies. Concept 2 recognizes that automobiles, buses, and trucks generally are produced and distributed by the same companies, often with the same facilities. Some persons might consider this an industry concept, although in Bureau of the Census terminology it is a combination of certain "product classes."

Concept 3 corresponds to the census basis for measuring 1947 concentration in 440 of the 452 industries recognized in tabulations for that year. In measuring concentration, it serves as a substitute for 2. Sometimes it is a poor substitute, for reasons described by Conklin and Goldstein. However, the Bureau of the Census no longer recognizes a motor-vehicle industry, presumably because important integrated producers cannot develop satisfactory estimates of their production of motor-vehicle parts. For the motor-vehicle and parts industry, which it does recognize, value added by manufacture is used instead of value of shipments plus interplant transfers, since the motor-parts fraction of the latter would be counted again in the value of the assembled motor vehicles. This is concept 4. It gives weight to integration within a limited area of the motor vehicles industry, although it is not a complete measure of the extent to which motor-vehicle producers are integrated, even in that segment of their business classified as manufacturing.

Concept 5 is a measure of "total economic strength or productive potential."⁵ So also is concept 6, which is identical in coverage but employs a different criterion of size.⁶ In this they should be dis-

⁵ *Ibid.*, p. 12.

⁶ M. A. Adelman, among others, has urged total assets as preferable to net capital assets. The issues are developed in "The Measurement of Industrial Concentration," *Review of Economics and Statistics*, November 1951; John M. Blair, "The Measurement of Industrial Concentration: A Reply," and M. A. Adelman, "Rejoinder," both in *Review of Economics and Statistics*, November 1952.

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tinguished sharply from concepts 1, 2, and 3, which are measures of the share of the supply actually accounted for by the largest producers. According to the reasoning of the FTC in presenting this report, a very large company may affect competition in its major line of activity not only through its current participation but also because of the other resources upon which it may draw. In many instances a very large company could transfer establishments currently engaged in other lines to the production of its principal product. Such reserve capacity is a significant circumstance, according to some students of oligopoly.⁷ Establishments not susceptible to such a transfer generally bear a "vertical" relationship to the manufacture of the company's principal product: they supply materials and components, perform additional processing for certain end uses, distribute or service the product, or perhaps utilize by-products of the main operation. Ownership of such establishments may be a source of strength to a large company in its major line of activity.⁸

The Commission did not extend the analysis to the petroleum industry or to other industries where "capital assets . . . significant in relation to the size of the corporation [were considered to] contribute only indirectly to the corporation's position in the industry, and are not convertible to the industry in which the corporation is classified."⁹ Also excluded were industries where one of the leading

⁷ "A large corporation's productive equipment which is engaged in turning out products in 'other' industries may be convertible to the industry in which the corporation is classified. As was so strikingly illustrated by the experience of World War II, a very large proportion of modern technology is highly flexible and convertible. Hence, from the point of view of measuring a large corporation's productive potential, it might be unrealistic to exclude from the industry in which the corporation is classified that portion of its equipment which happens at the moment to be engaged in an 'outside' industry, but which could be quickly converted to the industry in which the corporation is classified." *The Concentration of Productive Facilities, 1947*, as cited, p. 10.

⁸ The Commission cited as an example the ore boats of a large metal refiner, *ibid.*, pp. 9-10. A more recent report of the FTC staff describes the importance of vertical integration in certain situations: *Monopolistic Practices and Small Business, 1952*, pp. 21, 39.

⁹ *Ibid.*, p. 11. Ratios on the primary steel industry were published only after comparison with industry data on capacity suggested that such limitations would not result in any serious overstatement of concentration. The Commission also relied on a special tabulation of the returns of the fifty largest manufacturing companies in the Census of 1937. As summarized by the staff of the Temporary National Economic Committee (TNEC), this tabulation (which suppressed the identity of companies and industries) showed that "the major portion of the total value of products of those companies was accounted for by the value contribution of relatively few products." Willard L. Thorp and Walter F. Crowder, *The Structure of Industry*, TNEC Monograph 27, 1941, Part VI, p. 609.

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companies was classified in another industry, and industries where "specialization by one leading company on certain products, . . . by a second leader on other products, and so on, was so extreme that the figures for the industry as a whole were not significant."¹⁰ The ratios published were "no more than estimates. . . . Errors, however, probably do not exceed a few percentage points. . . ."¹¹

Thus for all economists who have occasion to construct measures of concentration, or to use measures developed by others, the Conklin-Goldstein paper is both an admonition and an aid. It is a warning that not all concentration ratios can be interpreted in the same way; it is a warning also that some data can contribute little to the measurement of concentration. The paper is valuable as a reference on the use of the Bureau's data on manufactures and on the interpretation of measures of concentration developed from such data.

But it seems to me that this informative paper holds lessons for producers of data as well as for consumers of data. For example, the comments on beet sugar and cane sugar and on tin cans and glass containers point up our lack of a description of the participation of an enterprise across many industries. Tabulations are desirable that would indicate the extent to which substitute commodities are (and are not) produced by the same companies, the proportion of the supply of a raw material that is captive to specific consuming industries, and the proportion of still other industries controlled by the companies producing their principal raw materials. Within recent months an encouraging beginning has been made on this problem by the Bureau of the Census in cooperation with the FTC. A still wider description of enterprises is desirable than can be afforded by a study of manufacturing alone. The concurrent censuses of the mineral industries, manufacturing, and trade in 1954 provide the opportunity for valuable tabulations. It is to be hoped that the Bureau is not denied the resources to derive from these censuses a description of the major structural features of our economy. Business decisions are made by *firms*, and the Bureau's publications will be made much more useful by explicitly recognizing that firms do not confine themselves to a single establishment, or to establishments in a single industry.

There is ample reason for revising many heterogeneous categories—both industries and product groups. Of the general characteristics of an industry named by Conklin and Goldstein—competi-

¹⁰ *The Concentration of Productive Facilities, 1947*, as cited, p. 14.

¹¹ *Ibid.*, p. 13.

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tive nature of products, competitive nature of firms, similarity of method of manufacture, similarity of facilities, "other physical or technological factors" (among them, presumably, significant size and sufficient enterprises to permit publication of data), and historical precedent—there are numerous cases in which historical precedent and a generalized complementarity of products seem the principal elements of cohesion. This observation deals only incidentally with the n.e.c., or "not elsewhere classified," genre. Such categories are inescapable, and cause difficulties only when one or more types of establishment in a given residual assume the importance of a separate industry. Food preparation, not elsewhere classified, with 1951 shipments exceeding \$2 billion, is overdue for attention.¹² So also are four other n.e.c. industries with shipments exceeding \$1 billion, and nine with shipments of less than \$1 billion but more than \$1½ billion.

Given the industry concept, the problem that led to the "resistance factor technique" is inevitable once sampling is substituted for complete enumeration. This technique is the practice described by Conklin and Goldstein of not reclassifying an establishment to reflect a change in its primary activity where the discrepancy thereby introduced in the current level of the industry is smaller than the discrepancy avoided in the industry trend.¹³ The fatal weakness of the present technique is that the entire body of industry data developed by a survey is incapable of interpretation. A better policy would be to return the industry to the Standard Industrial Classification concept, and to introduce a new concept, the "historical industry," in which all establishments would retain the same classification as in the last census year. An alternative is to abandon the publication of the survey data on industries appreciably affected by shifts in the primary activity of establishments, and to place greater emphasis on obtaining product statistics, which are not affected by the "resistance" problem.

The greater success of the 1951 and 1952 surveys in developing statistics on product classes than the 1950 or 1949 survey is most encouraging. Yet even for 1952, data are lacking for half the classes,

¹² About two-thirds of the output of this "industry" is roasted coffee. Other important products are peanut butter, ground spices, ready-to-mix desserts, potato chips, and sweetening syrup and molasses.

¹³ Establishments with less than 100 employees have been continued in their 1947 industry without review. While there is little likelihood of such establishments shifting into or out of most industries, dairy and apparel industries would seem to be important exceptions.

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and for many of the categories on which figures are supplied the standard errors are so large that the data are practically useless. In this situation the data on product class groups¹⁴ are most welcome, but even these are not available for a third of the groups, and among those for which data are available the estimates frequently are subject to large standard errors.¹⁵ Product statistics—detailed, current, and reasonably accurate—are important in so many ways that the Bureau of the Census should have vigorous support in its efforts to improve this phase of the annual survey of manufacture.

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THE proper evaluation of classifications can only be made in terms of the objective to be achieved by the use of the resulting classes, and different objectives generally require different classifications. These comments are restricted to classifications suitable for the measurement of concentration on the supply side of the market.

There are a number of attributes or yard sticks—capital, employment, sales, value added, production, etc.—by which we can, at least ideally, obtain a magnitude for each of a set of economic units (firms, establishments) and a total for the set. This total can then be compared with the total for any given subset of the units (the largest one, the four largest, etc.) or the magnitudes of the individual units may be somehow distributed and analyzed. But these measures and the concentration analysis based on them are not, so to speak, meaningful in their own right. They are, rather, indirect ways to approach the measure of something else, which we may call economic power over a market. They derive whatever validity

¹⁴ A "product class group" covers all products primary to a given industry. Thus, conceptually, there is a product class group corresponding to each industry recognized in census statistics. In the margarine example presented by Conklin and Goldstein, \$237 million is the 1947 value of shipments of the product class group margarine, whereas \$215 million is the value of shipments of the margarine industry. In this instance, margarine is the only product class in the group, but commonly there are several classes. For example, the product class group "canned and preserved products, except fish and meat" has nine product classes: canned fruits; canned vegetables and specialties; canned fruit juices; canned vegetable juices; canned baby foods; canned soups and poultry products; jams, jellies and preserves; and bulk fruit and vegetable juices.

¹⁵ For product classes, 158 of the 633 estimates are subject to a standard error of from 6 to 10 per cent of the estimate, and 118 estimates are subject to a standard error of 15 per cent. For product class groups, estimates are available for 154 categories where a group consists of more than one product class. Of these, 48 are subject to a standard error of 6 to 10 per cent, and 16 are subject to a standard error of 15 per cent.

they have from the extent to which they succeed in representing a given output market completely and to the exclusion of other output markets.

If each firm or establishment commonly exercised influence in only one market, the problems of defining product market classes and industrial classes would be the same. Unfortunately under any reasonable definition many establishments—not to say firms—participate in a number of different markets. Thus the appropriate classification of firms or establishments into industries involves a somewhat greater measure of adjustment and compromise than the classification of products into markets, which in turn does not lend itself to the ideal results we might prefer to obtain.

The appropriate classification of products is based on the competitive relations which hold among them. These competitive relations are not fixed, but change over time with alteration of productive techniques, consumer tastes, the introduction of new products, and doubtless in some cases the general level of business activity. Moreover, the competitive relations among products and firms differ in the long run, in which ultimately almost any firm is a competitor of any other, and the short run in which productive facilities are by and large fixed. It is the latter on which any given census focuses attention; thus our objective is a classification that will group together the products of rival productive facilities.

The commodity is merely the physical "embodiment" of the service of the establishment. The economic power possessed by an establishment inheres in the service it can provide, and to measure this service purely on the basis of the particular application being made of it at a given moment would be clearly wrong. Thus close technical substitutes, which are literally alternative embodiments of the same service, should be classified in the same product market. For example, a particular die-casting establishment that produces refrigerator door handles at one time and automobile radiator ornaments at another is part of a market in which similar facilities compete with each other over a wide range of uses. An appropriate classification of products must recognize these alternatives and identify them with a single market class of products.

There are, of course, all degrees of technical versatility and some recognition must be given this fact. Ideally we can conceive of using some minimum level of the elasticity of technical substitution as a criterion. Unfortunately, the basis on which to estimate these elasticities is seldom available and we are restricted to more readily ob-

servable characteristics of products. Two products can be considered technical substitutes if they are commonly produced in substantial amounts in the same establishment, by essentially the same equipment, technical process, and labor, and among which frequent variations in the proportion of output are observable. The existing census emphasis on the technical structure of production is a reflection of this criterion. Likewise, of course, it is the fact of technical substitutability that justifies our disposition to consider products of differing sizes and specifications as constituting a single market class. On the other hand we would consider as distinct two products found in the same establishments but produced by distinct technical processes. Variation among them represents alternative uses of working capital, but not of the fixed facilities themselves. Nor would joint products, appearing in effectively fixed proportions, generally be considered the same product. The establishments compete in the production of the output combinations, but frequently each product enters competition with others that are not subject to the same technical restriction. Cottonseed oil and cottonseed cake and meal, for example, each have important competitors and are therefore distinct. Where the several joint products do not have important "outside" rivals, however, they need not be separated.

The second way in which services substitute for one another is, of course, through the production of substitute products. Market classes should not distinguish among the production of different commodities that are close substitutes to the consumer. Ideally the appropriate measure here would be the cross-elasticity of demands among products, but again we must have reference to more readily observable criteria. Those commodities serving generally similar purposes, and among which users are frequently observed to vary the proportions of their purchases in response to price variations, may be defined as consumer substitutes.

Broad classes of products may be set apart "by eye," but final determination requires intimate technical knowledge of the structure of production, the nature of products and their uses, and familiarity with the habits of their consumers. It would obviously be of advantage if less subjective criteria could be applied, and substitutes identified by the behavior of their prices, sales, margins, etc., as actually observed in the market. The difficulties, however, are considerable, as the following example suggests.

The fact that the prices of close consumer substitutes should move together might serve as a necessary criterion for classification.

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It is obviously not *sufficient* since prices may be kept together by substantial common cost elements, or even move together quite fortuitously. The absolute levels of most prices are highly correlated over wide cyclical changes, but the behavior of the price ratios can be analyzed.

In order to obtain a measure of price variation that is unaffected by the absolute levels of the prices and that also gives the same result no matter which price is selected as the denominator of the ratio, the coefficient of variation of the log of the price ratio is taken.¹

In Table 1, ten commodity pairs are ranked in order of the stability of their price ratios. The two top ranking pairs—Texas and

TABLE 1
Variation in Price Ratios, Selected Pairs of Commodities, 1913-1939

<i>Commodity Pair</i>	<i>Coefficient of Variation of Log of Price Ratio (Per Cent)</i>
Packers' steer hides, native } Packers' steer hides, Texas }	1.7
Men's tan dress welt shoes, calf leather ^a } Men's tan dress welt shoes, side leather }	1.7 ^a
Electrolytic copper ingot } #8 bare copper wire }	4.2
American medium salt } Granulated bulk salt }	6.2
6-foot crosscut saws } Granulated bulk salt }	8.4
Oleomargarine, white, Chicago } Butter, extra firsts, Chicago }	9.0
Bone black } Lamp black }	11.0
Currants } Raisins }	12.1
One-horse walking plows } Southern single warp cotton yarn }	12.9
Packers' steer hides, Texas } American medium salt }	21.2

^a 1913-1929.

Source: Prices are Bureau of Labor Statistics wholesale prices.

native steer hides, and calf-leather and side-leather men's shoes—are, of course, close consumer substitutes, but are also closely related in production. They are followed by the production-related,

¹ The coefficient of variation is the standard deviation measured as a per cent of the mean. Thus it is unaffected by absolute levels. Using the log of the price ratios frees the measurement of the objection that price ratios are necessarily bounded at zero, but have no upper bound.

nonsubstitute pair, copper ingot–copper wire. Oleomargarine–butter shows slightly more price variability than bulk salt–crosscut saws, while bone black–lamp black and currant–raisins show only slightly less variability than one-horse plows–cotton yarn. A much greater number of price ratios would need to be examined before the merit of the method could be assessed, but it is clear that the behavior of quantities, production costs, and other data must be incorporated in the analysis before price behavior can be adequately tested.

Ideally we might hope to apply the criterion of substitutability to partition the universe of commodities into mutually exclusive classes so that (1) any pair of close substitutes fall in the same class and, (2) any two commodities in the same class are a pair of close substitutes. The first objective can always be achieved. It would, indeed, be satisfied by summarily lumping all goods in a single class. Moreover, forming the maximum number of product classes for which (1) will hold true will carry us a considerable way toward the attainment of (2). But the complete satisfaction of the second objective is not necessarily possible.

The difficulty is easily explained in terms of the logic of relations. In order to satisfy both (1) and (2) the relation “close substitute for” must, among other things be transitive.² That is if *A* and *B* and *B* and *C* constitute two pairs of close substitutes, it must follow that *A* and *C* are close substitutes.

Even among consumer substitutes, this transitivity does not always hold. Commodities are often arranged in “chains” where each is a close substitute for its immediate neighbors, but the nearness of substitution becomes less as we compare a given good with those farther away.³

When we have both consumer and producer substitutes, the difficulty is even greater. If *A* is a close technical substitute for *B*, while *B* is a close consumer substitute for *C*, *A* and *C* need bear no direct substitute relationship to each other, while the relationship between *A* and some fourth good, a close technical substitute for *C*, may be even more tenuous.

The magnitude of this problem should not be exaggerated. The

² The substitute relation must also be reflexive (any good is a close substitute for itself) and symmetrical (if *A* is a good substitute for *B*, then *B* is a good substitute for *A*). The three properties taken together mean that the relation “close substitute for” is an equivalence relation, i.e. that it will produce precisely the partitioning of the universe of commodities that we want.

³ An obvious example of this in another context arises in spatial competition.

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merit of discussing the underlying logic of classification derives from the light shed on the process of formulating and evaluating the most useful classes for the purpose at hand. If strict application of the criterion of substitution yields classes that are too heterogeneous, we can frequently subdivide them. This will put some substitute commodities in separate classes, and what is gained by increased homogeneity must be balanced against this loss. Wherever a relatively small amount of production serves as a bridge between two large and otherwise unrelated classes we are clearly justified in subdividing the classes. Where this is not the case, the balance of advantage probably lies with retaining the larger class as a whole.

The decision is again based on subjective considerations, but we can push them back a stage by making a class subject to subdivision if it contains a product which (1) if completely ignored would result in an increase in the number of market classes and (2) if its whole production were assigned to either of the resulting classes the measure of output concentration employed would not be substantially affected.

Aside from the considerable technical knowledge required, there is no reason why such a system of product classes could not be built up from census product detail. Census product classes on the most detailed level (e.g., bottled soft drinks, carbonated, containing kola extract; emulsified asphalt paving materials; builders' door locks, lock sets, and lock trim; etc.) are quite clearly suitable elements for such classification. In fact many of the larger census "bold face total" classes (e.g., soft drinks, total; paving mixtures and blocks, total; etc.) are themselves internally homogeneous with respect to substitution. On the other hand, even at the "bold face total" level there are classes which are not. (Professional furniture, total, includes both hospital bed springs and laboratory cabinets and cases, which are not close substitutes in either sense.) In some cases even those product classes that explicitly define census industries are elementary in this sense, but in general the system of classes must be built up from product classifications below the census industry level.

Where economic concentration is to be related to other variables obtainable only on a firm or establishment basis, the economic units themselves must be classified into industries which follow as closely as possible the lines of the product classes. This is done by assigning each establishment or firm to the industry in which the greatest portion of its output falls.

It is evident that industries based on market classes defined as

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above will differ somewhat from the existing census classification. In particular, establishments separated by the census solely on the basis of the material or technical process employed would appear in a single class. Moreover, although census emphasis on technical similarity tends to cause establishments in a single census industry to fall together in the "new" classification, doubtless some of them would be pulled apart. Even here, however, we should probably find that in most cases the readjustment of industry boundaries required to obtain adequate levels of homogeneity and coverage would result in their recombination.

The problems surrounding homogeneity and coverage arise primarily out of the nature of the firm's activities themselves and are not materially altered by changing the system of classification employed. An acceptable industry must be one for which both homogeneity and coverage, measured in terms of the products that define them, are high. Given fixed product classes, homogeneity and coverage tend to behave inversely. We can always increase the coverage of an industry by transferring into it establishments originally classified in other industries, but we generally do so at the expense of homogeneity. Where raw industrial classes must be adjusted, some compromise between the measures must be accepted.

It is this fact that would probably tend to recombine census industries which the strict application of product classification would split. A group of establishments, most of which were engaged in some production of each of two nonsubstitute commodities, would be split between the two classes involved. If, however, there are no other important substitutes for these commodities, combining the two raw classes would yield an industry of high coverage in terms of either product, while the homogeneity of the combination with respect to either product would be only slightly lower than when taken over the separate raw groups. As a matter of fact, I suspect that we would be disposed in such case to question the usefulness of the product distinction itself and combine the two sets of products into a single class.

In any case, the areas in which meaningful industry classifications are difficult or impossible to attain are precisely those in which existing census classifications are least meaningful, and for exactly the same reason. These are areas in which integrated and nonintegrated production are both common. Classification on the basis of substitutability of product only formally removes the distinction between integrated production and production carried on with pur-

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chased materials. Semifinished and finished products are substitute items of sale to the establishment producing both, but they are in no sense close substitutes in production. The integrated establishment clearly belongs in two distinct industries and whether classification is by the finished or the semifinished product, the result is unacceptable. We can gain high coverage or homogeneity in one industry only at the expense of a low measure in the other, and combining both reduces the homogeneity measure well below what could be obtained from either.

Ultimately, getting usable industry classifications in these areas depends on our ability to redefine establishments and obtain meaningful data from their separate departments. Where this cannot be done, the only alternative is to restrict our analysis of concentration in these areas to product data.

