THE EXTENT AND NATURE OF ESTABLISHMENT LEVEL DIVERSIFICATION IN SIXTEEN U.S. MANUFACTURING INDUSTRIES

by

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Abstract

This paper examines the heterogeneity of establishments in sixteen manufacturing industries. Basic statistical measures are used to decompose product diversification at the establishment level into industry, firm and establishment effects. The industry effect is the weakest; nearly all the observed heterogeneity is establishment specific. Product diversification at the establishment level is idiosyncratic to the firm. Establishments within a firm exhibit a significant degree of homogeneity, although the grouping of products differ across firms. With few exceptions, economies of scope and scale in production appear to play a minor role in the establishment's mix of outputs.

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1. Introduction

Diversification of U.S. manufacturing firms has been largely a post World War II phenomenon. It has been accomplished through internal growth and, more recently, through vertical and conglomerate mergers. Though product diversification is no longer unusual there is relatively little quantitative information characterizing the importance and extent of diversification in the U.S. economy.[1]

Traditional industrial organization theory focuses on the firm's production technology and cost structure as the important determinants of firm and industry structure. Baumol, Panzer, and Willig (1982) merged the basic neoclassical cost concepts of economies of scale and scope, capacity, and natural monopoly to model multiproduct production. They contend that characteristics of the multiproduct cost function, which are a consequence of the underlying productive techniques and factor prices, are critical for explaining firm and industry structure and behavior. It is the selection of efficient productive techniques to yield multiple outputs consistent with market demand that shapes industry structure. As is often the case, analytic practice has followed theory with a considerable lag. Empirical investigation relating production cost characteristics to firm structure has been limited largely to case studies of a few recently deregulated service industries, such as commercial trucking and airlines, telecommunications, and banking services.

This paper examines the activities which manufacturing firms undertake, starting at the establishment level. We examine what activities are grouped together within an establishment, and how they vary within and between sixteen manufacturing industries. An establishment is defined as a single physical location, under one ownership, engaged in one of the categories of industrial activity in the Standard Industrial Classification System (SIC).[2] Manufacturing establishments are often referred to as plants, factories, or mills. The industries selected have a significant number of single and multiproduct establishments. The degree and dimension of output heterogeneity among the multiproduct establishments is examined.

We distinguish between three basic components of output heterogeneity: an industry effect, an establishment effect, and a firm effect. By industry effect, we mean the relative importance of the establishments's primary activity, at the four-digit level. The industry effect is the weakest of the three, the primary activity of the establishment clearly dominates, accounting for 70-90 percent of the average establishment's value of shipments. Nearly all the heterogeneity we observe is establishment specific. There are no common patterns, except for the firm effect, our third component. Establishments within a firm exhibit a significant degree of homogeneity; however, firms are quite heterogeneous with respect to the pattern of nonprimary products produced.

This paper presents a set of facts describing the extent and patterns of product diversification of U.S. manufacturing establishments and how they vary over time. We examine how output mix differs across establishments and firms within the same industry. This analysis is the first step toward characterizing product diversification at a micro level and yields valuable information for research involving the actual measurement of economies of scale and scope. In particular, we distinguish establishment level economies of scope inherent in the production technology and product mix from firm level economies.

The research analyzes sixteen four-digit manufacturing industries, using data for 1972, 1977, and 1982 from the U.S. Census Bureau's Longitudinal Research Database (LRD). Earlier work utilizing the Center's database and the diversification index developed by Gollop and Monahan (1989) indicates that diversification at the establishment level has decreased between 1963 and 1982. However, diversification has increased at the firm level, indicating that firms are increasingly comprised of multiple establishments producing products not closely related in a technical sense.[3]

An index may capture the extent of diversification, but not much about the nature of the activities involved or how they change over time. This study examines single and multiproduct producers along a number of

dimensions[4]. For multiproduct producers we tabulate the number of products they produce and the number of two, three, and four-digit industries in which they operate. Using this information we consider a number of issues. Is there a tendency for establishments (and firms) to become more or less diversified over time? How specialized are their production activities? For example, do one or two products dominate an establishments production or are a number of products equally important? Are certain products always produced jointly, indicating economies of scope? In essence, we want to find out how heterogeneous are the production activities of establishments, how important is product diversification, and how does it change over time.

The remainder of this paper is organized as follows. Section 2 provides an overview of the data set and the industry selection criteria. Possible weaknesses of the data and selection criteria for measuring product diversification are discussed. Section 3 discusses the output characteristics of single and multiproduct establishments. Several measures of product diversification are reported. Comparisons are made between industries and within industries across time. We also compare the production activities of single establishment firms with those of multiple establishment firms. The final section summarizes the conclusions and outlines plans for future research.

2. Data and Industry Selection Criteria

Empirical research on multioutput production activities has been limited largely due to the lack of sufficiently detailed data at the micro level. Longitudinal establishment, or firm, level data are necessary, but rarely available for other than regulated industries. This study uses the Census Bureau's Longitudinal Research Database (LRD), developed and maintained at the Center for Economic Studies. The database is described in some detail in McGuckin and Pascoe (1988). We use a subset of the LRD consisting of individual establishment-level data collected through the U.S. Census Bureau's Census of Manufacturers for 1972, 1977, and 1982. An advantage of this data

is that it allows us to distinguish between single and multiestablishment firms. We are able to follow the individual establishment, which is the basic production unit, if it changes ownership, is bought or merged with another firm, switches industries, or ceases to exist altogether.

The degree of diversification depends on how finely we define the activities of establishments and firms. The Census Bureau collects output data at the seven-digit level for most manufacturing establishments. The sixth and seven-digits are an extension of the well-known four-digit standard industrial classification code. The first five digits of the product code represent its product class, the first four digits its primary industry or line-of business, the first three digits the industry group, and the first two digits the major industry group in which the individual establishment primarily operates.

We chose to use the five-digit product class to define a unique output, rather than the seven-digit, for several reasons. Not all industries are required to specify their output at the seven-digit level. In some cases, the product detail for the entire product class is reported in a commodity survey and only summary information is reported. In such cases the sixth and seventh digit are zeros. The over 13,000 seven-digit product codes are thus consolidated into approximately 1,600 five-digit product classes. A list of the five-digit products within the sixteen industries analyzed is contained in Appendix A.

A second consideration is that establishment level production material codes are reported only at the six-digit level. In anticipation of phase two of this research, we elected to keep the inputs and outputs at the same level of aggregation. Further aggregation to the four-digit level is undesirable, as much product diversification at the establishment level is hidden. At the four-digit level 76% of all establishments produce only a single product, another 15% produce two products, and only 3% produce four or more products. In comparison, at the five-digit level 65% of the establishments are single product establishments, 17% produce two outputs, 8% produce three, and 10%

produce four or more.

A final consideration is that in non-Census years product information is collected at the five-digit, not the seven-digit level. Later phases of this research will include data from these Annual Survey of Manufacturers (ASM) and for consistency purposes, all products are defined at the five-digit level.

While we measure diversification at the five-digit product class level, for purposes of sample selection we classified establishments into one of the possible 452 four-digit industries according to principal, or primary, five-digit product. This allowed us to group establishments engaging in generally similar manufacturing activities, or line-of business. One reason for grouping establishments into four-digit rather than five-digit industries is that the incidence of switching between groupings over time becomes relatively greater at the five-digit level.[5]

A random sample was not used in selecting the sixteen four-digit industries for closer analysis. Rather, we selected industries from a variety of two-digit major industry groups in which we observe both single and multiproduct production for this exploratory study. Some industries are clearly dominated by single product establishments, while others are dominated by multiproduct establishments. Some effort was made to include industries representing 'high technology' and 'low technology' production processes.[6] In addition, we selected only industries with at least fifty of both single and multiproduct establishments which we could follow over time. A primary concern in selecting these industries was to illustrate how heterogeneous manufacturing industries are.

The sixteen industries selected are canned fruits and vegetables, millwork, mobile homes, corrugated and solid fiber boxes, plastics material and resins, paints and allied products, cyclic organic crudes and intermediates, industrial organic chemicals (NEC), paving mixtures and blocks, concrete products, ready-mixed concrete, fabricated structural metals, construction machinery and equipment, industry controls, radio and tv communication equipment, and semiconductors and related devices. We generally

avoided including the 'Not Elsewhere Classified' (NEC) industries as these tend to collect poorly defined establishments, in the sense that their primary activities are less homogeneous than other industries. We did include the industrial organic chemicals, NEC industry because of the overlap with the cyclic organic crudes industry.

One final criteria for inclusion in the data set focuses on the individual establishment data. If the establishment did not specify both its outputs and inputs, and have employees and shipments greater than zero, it was not included in the analysis. This eliminated so called administrative records,[7] and establishments exempt from specifying their material inputs (such as aircraft and missile establishments), and also establishments which just did not report disaggregated inputs and outputs. This criteria eliminated 41% of the 348,386 establishments in 1982 (37% were administrative records). Of the remaining 206,766 establishments available for study, over 17,000 are included in the sixteen industries examined in this study.

Construction of the data set involved standardizing industry and product definitions across the three census years, matching individual establishments across the years, identifying the products and industries each establishment operated in, identifying which establishments were owned by the same firm and the extent of the parent firm's activities. It should be noted that the data do not include any non-manufacturing activities of establishments or firms. All our measures are of manufacturing diversification at the establishment level. At this time we are not measuring firm level diversification or including non-manufacturing activities.

In reporting the results, we note that the extent of heterogeneity may be, in part, a function of the SIC product classification used. The distance between five-digit product classes is not always uniform; some are more finely defined than others. This is particularly true for industries experiencing rapid technological change and frequent introduction of new products. Recognition and classification of new products is not instantaneous. Therefore, cross industry comparisons of product heterogeneity should be made

cautiously.[8]

3. Characteristics of Product Diversification at the Establishment Level

Relative Importance of Single and Multiproduct Establishments

To understand the patterns and extent of product diversification, we begin with selected summary statistics for manufacturing industries. Table 1 presents the four-digit industries included in this study. The number of single and multiproduct establishments and percent of total value of industry shipments (TVS) are also reported for each Census year. An establishment is classified into a four-digit industry based upon the first four digits of its primary five-digit product. In manufacturing as a whole, single product establishments outnumber multiproduct establishments two-to-one.[9] The number of multiproduct establishments increased from 1972 to 1977 and fell in the 1977-1982 period. As the number of single product establishments increased from 113,290 in 1972 to 145,056 in 1982 (a 28 percent increase) the proportion of multiproduct establishments in manufacturing declined from 34.4 percent to 29.8 percent.[10]

In contrast to their smaller number, multiproduct establishments provide two-thirds of the value of shipments in manufacturing. Some industries, such as mobile homes (2451) and corrugated and solid fiber boxes (2653) are overwhelmingly single five-digit product establishments, both in terms of number of establishments and in the value of their shipments. At the other end of the spectrum are the paint (2851) and industrial organic chemicals (2865), where multiproduct establishments predominate.

Table 2 ranks the sixteen industries from highest to lowest percentage of multiproduct establishments, based on value of shipments and on number of establishments. There are generally only minor changes in the relative rankings between 1972 and 1982. The largest changes are in the radio and tv equipment industry, where multiproduct establishments dropped from fifth to ninth place in terms of shipments, and the cyclic organic crude industry rose from ninth to fifth place. When rankings are based upon the portion of estab-

lishments the cyclic organic crudes industry moved from ninth to first place, while the semiconductor and plastics industries dropped several positions.

Measures of Product Diversification

Measurement of the Extent of Activities

The appropriate measure(s) of diversification selected depends on the question being asked. If the extent of an establishment's activities into industries other than its primary is the focus, then the number of two, three, and four-digit manufacturing industries it operates in and number of five-digit products it produces is relevant. Of the 61,710 multiple five-digit product manufacturing establishments in 1982, 78 percent operate exclusively within their own two-digit industry and less than three percent produce in three or more two-digit industries. As shown in Table 3, slightly over one-half of the multiproduct establishments produce within a single three-digit major industry group, and one-third produce only in their primary four-digit industry. Forty-five percent operate within two four-digit industries and seven percent operate in four or more industries.[11]

Table 4 reports the distribution of establishments by number of five-digit products produced. Of the multiproduct establishments 51 percent produce only two five-digit products; however, 15 percent produce five or more outputs. This suggests that any given establishment is only moderately diversified in the number of production activities, but that the mix of these activities across four-digit industries can be significant. Establishments of high technology industries tend to produce a greater number of products than establishments with lower technological production processes.

Table 5 reports the number of products which account for one percent or more of the establishment's shipments or are produced by one percent or more of the multiproduct establishments.[12] Also reported are the number of two, three, and four-digit industries that one percent or more of the multiproduct establishments operate in, by primary four-digit industry. Establishments in five four-digit industries operate in five or more two-digit major industry groups, while establishments in another five industries operate in only two

two-digit major industry groups.

There is no clear pattern of establishments within any industry increasing their production activities into other two-digit major industry groups over time. Five of the sixteen industries showed establishments adding one or two additional major industries to their range of activities between 1972 and 1982, five remained unchanged, and six decreased the number of two-digit major industries over the period. Seven of the industries increased the number of five-digit products produced by five percent or more, and seven experienced declines of over ten percent.

A caveat is in order regarding the mobile home industry. The large increase in diversification of establishments in the mobile home industry is related to one establishment which switched into the mobile home industry in 1982 from another four-digit industry. This one establishment produced nine five-digit products unique to the industry. Overall, establishments within the industry have not become more diversified.

Measurement of Specialization

Just counting the number of two, three, and four-digit industries in which the establishments in a particular industry operate overstates the degree of heterogeneity. Production activities must be weighted for their importance to total output. One measure to capture this is the portion of activity outside the establishment's primary product and industry. The primary product specialization ratio (PPSR) indicates the portion of the establishment's total output value derived from its primary product and the portion derived from all other products. Similarly, the primary industry specialization ratio (PISR) tells how the portion of the establishment's total output value in its primary four-digit industry and in all others. The higher are these numbers, the more unequal the distribution of the establishment's outputs, and the less diversified it is. Note that for single product establishments both these ratios are one.

The mean primary product specialization ratio at the four-digit level, reported in Table 6, varies from a high of .84 for the mobile home industry to

a low of .63 for the millwork industry. Based on a mean primary industry specialization ratio, the paint industry is the least diversified, with 95 percent of its output value in its own four-digit industry. The paving mixtures industry is the most diversified, with one quarter of its output value outside the primary industry. In general, the primary product accounts for a greater portion of shipment value for establishments within low-to-moderate technology industries than establishments within high technology industries.

Table 6 also reports the average number of employees and products for each industry. The number of products for a single product establishment is always one. As expected, the multiproduct establishments tend to be larger, as measured by number of employees, than single product establishments. However, the strength of the relationship varies considerably across industries. The correlation coefficient between number of employees and number of five-digit products ranges between .7705 for the cyclic organic crudes and intermediates industry, to -.0559 for the mobile home industry. Mobile homes is the only industry with a negative correlation; the correlation is not significant.

A comparison of Tables 1, 3, and 6 yields seemingly conflicting indications of product diversity at the establishment level. For example, consider the paving mixtures industry. Only six percent of the establishments are multiproduct at the five-digit level; they contribute 12 percent of the industry's shipments. The average multiproduct establishment produces two five-digit products, indicating a low level of diversification. However, if we take the PISR as the measure of diversification, the industry's production activities are more evenly distributed between primary and nonprimary products, indicating a high degree of diversification. One fourth of the multiproduct establishments' product value accrue to products other than paving mixtures and blocks. Another indication of high diversification is that 36 of the 59 multiproduct establishments in this industry also operate in a different two-digit industry group.

Distribution of Nonprimary Activities

The industry means reported in Table 6 mask the extent of variation between establishments within the same primary industry. The range of values around the means is broad in all cases. Table 7 lists the major nonprimary activities of diversified establishments, by primary industry. A nonprimary activity is considered major if at least five percent of the multiproduct establishments engage in the activity, or the activity contributes at least five percent of the industry's nonprimary value of shipments. The portion of multiproduct establishments which engage in the nonprimary activity and the percentage contribution to nonprimary shipments are reported. Activities in nonprimary industries account for, on average, ten to thirty percent of multiproduct establishments' production value. The range of possible nonprimary activities is extensive; with little homogeneity in the product mix, either in terms of what is produced or in the relative proportions associated with particular activities.

We can conclude from these simple measures of diversification that most establishments exhibit a low degree of diversification in terms of number of products and degree of specialization. However, within each industry there are some establishments that are quite diversified. We further find that those establishments within the same four-digit industry, which are multiproduct, are very heterogeneous as measured by their mix of five-digit outputs.

3.3. Economies of Scope and Joint Production

It is difficult to determine the extent to which economies of scope in production exist without actual estimation of the underlying production technology. However, economies of scope linked to product mix may exist if we observe significant portions of establishments operating in the same pairs of four-digit industries, even if they do not produce the same primary and secondary five-digit products. Table 8 lists the cases in which we found jointly produced products by at least fifteen percent of multiproduct

establishments. Joint production occurred in eleven of the sixteen industries, although the nonprimary activity rarely contributes even five percent of the establishment's value of shipments. There are only six examples where one-third of an industry's multiproduct establishments engage is the same nonprimary activity. Note that eight of the twenty-nine cases (28%) involve a non-homogeneous NEC or miscellaneous activity.

The numbers in Table 8 can be interpreted as conditional probabilities. For example, given that an establishment's primary industry is paving mixtures and that it produces more than one output, there is a .61 probability that it will also produce ready-mix concrete. As expected joint production occurs most often with products requiring similar input and technology requirements, such as folding and set-up paperboard boxes being manufactured by establishments in the corrugated box industry. Similarly, paving mixture establishments also produce ready-mix concrete, where sand and gravel are major inputs to both products. With the exceptions noted in Table 8, the probability is very low that, given an establishment's primary activity, we can correctly predict the pattern of its other activities. It is possible that there is a size and/or location effects occurring which have not been identified. These two issues will be examined in the next phase of this research.

3.4. Diversification of Multiestablishment Firms

The above discussion illustrates how different single and multiproduct establishments are, and also how diverse multioutput establishments within the same primary industry are. Economies of scope generated by product mix seem to play a minor role in determining the pattern of multiproduct activities manufacturing establishments. Economies of scope may also exist, though, due to factors independent of the product mix, such as in shared capital equipment, transportation, distribution, marketing, and overhead expenses. Is this heterogeneity in production patterns at the establishment level reduced when establishments under common ownership are grouped?

The major finding of this analysis is that the establishments of a single firm within the same primary industry are fairly homogeneous, that is, they tend to engage in the same set of activities. Preliminary analysis indicates little heterogeneity between establishments of multiunit firms classified in the same primary industry. Table 9 reports the percentage of multiproduct establishments engaged in major nonprimary activities and compares it to the average for establishments (within the primary four-digit industry) owned by multiunit firms, where at least one establishment of the firm engages in the activity.[13]

The numbers in Table 9 are interpreted as conditional probabilities. For example, if an establishment's primary industry is cyclic organic crudes (2865), and the establishment produces more than one product, there is a 3.5 percent probability that it will produce industrial gases (2813) as a nonprimary product. If the establishment also has more than 500 employees, the probability increases to 22.2 percent. If the establishment is part of a multiunit firm with industrial gases as a secondary activity there is a 37.5 percent probability that any given establishment of that firm will engage in the activity. It is evident from the higher percentages, that establishments of the same firm are much more likely to engage in the same set of manufacturing activities than are establishments without common ownership, but operating primarily in the same primary four-digit industry. Multiestablishment firms clearly have elected for each establishment to combine the same variety of activities; although the set of activities between firms is heterogeneous.

We examined the activities of all large multiproduct establishments to test if there is a size effect influencing product mix. As shown in Table 9, large establishments, regardless of being single or multiunit firms, are more homogeneous in terms of activity mix than the general population, but less so than establishments under common ownership. We conclude that while there is a relationship between establishment size and its product mix, the relationship is moderate to weak.

4. Summary

This paper provides several measures of the extent and pattern of product diversification in sixteen U.S. manufacturing industries at the establishment level. As discussed in Section 3, there is considerable variation in the importance of multiproduct production between four-digit industries. This is true whether we use number of establishments or value of shipments as a measure. In each industry we found substantial numbers of single product establishments. This suggests that scope economies do not extend to the primary product category.

Within a given industry, the primary five-digit product accounts for approximately 70 percent of the diversified establishment's output value and the primary four-digit industry account for 85 percent. Regardless of the industry, the remaining value of output is distributed across a wide range of nonprimary activities. For any given industry, most establishments' nonprimary activities include not only operations in different four and three-digit industries, but even some two-digit industry groups. Moreover, these nonprimary activities are very heterogeneous across establishments, but less so for establishments under common ownership.

We discern few patterns to the output choices of establishments until we group them by firm. When establishments are grouped by common ownership it is apparent that establishments belonging to the same firm engage in similar sets of activities, although the particular groups of products differ across firms. We conclude that the diversity at the establishment level is primarily due to either economies of scope unrelated to the product mix, or is idiosyncratic to the firm, or some combination of the two. With few exceptions, economies of scope linked to product mix appear to play a minor role in production at the establishment level.

The results of this study indicate further research is necessary to explain the diversity in output that we see. In particular, explicit measurement of economies of scope and identification of the idiosyncratic firm effect. Consideration of either firm specific human and organizational

capital and related learning by doing models may help explain the firm effect. In future work the longitudinal data in the LRD will be used to try and disentangle these issues. Specifically, it is important to study the evolution of establishments over time to determine how their mix of products changes and what relationship establishment age, location, size, and type of ownership may have on the product diversification and survivability.

TABLE 1

NUMBER AND PERCENT OF SINGLE AND MULTIPRODUCT
ESTABLISHMENTS AT THE FIVE-DIGIT LEVEL,
BY PRIMARY FOUR-DIGIT INDUSTRY

Industry	1972 Single Product	1972 Multi Product	1977 Single Product	1977 Multi Product	1982 Single Product	1982 Multi Product
All Industries						
# Establishments	113,290	59,552	121,117	63,111	145,056	61,710
% Establishments	65.6%	34.4%	65.7%	34.3%	70.2%	29.8%
% Shipment Value	35.5%	64.5%	30.9%	69.1%	34.2%	65.8%
2033 Canned Fruits & Vegetables						
# Establishments	356	376	266	320	258	256
% Establishments	48.6%	51.4%	45.4%	54.6%	50.2%	49.8%
% Shipment Value	22.1%	77.9%	23.6%	76.4%	28.2%	71.8%
2431 Millwork						
# Establishments	1,008	494	719	558	847	537
% Establishments	67.1%	32.9%	56.3%	43.7%	61.2%	38.8%
% Shipment Value	39.5%	60.5%	30.9%	69.1%	38.6%	61.4%
2451 Mobile Homes						
# Establishments	484	108	392	98	399	54
% Establishments	81.8%	18.2%	80.0%	20.0%	88.1%	11.9%
% Shipment Value	85.8%	14.2%	81.9%	18.1%	89.0%	11.0%
2653 Corrugated & Solid Fiber Boxes						
# Establishments	1,015	75	1,061	47	1,141	86
% Establishments	93.1%	6.9%	95.8%	4.2%	93.0%	7.0%
% Shipment Value	94.7%	5.3%	95.6%	4.4%	93.5%	6.5%
2821 Plastics Materials & Resins						
# Establishments	143	168	196	191	269	155
% Establishments	46.0%	54.0%	50.7%	49.3%	63.4%	36.6%
% Shipment Value	28.9%	71.1%	31.1%	68.9%	40.2%	59.8%
2851 Paints & Allied Products						
# Establishments	395	721	397	590	466	515
% Establishments	35.4%	64.6%	40.2%	59.8%	47.5%	52.5%
% Shipment Value	15.7%	84.3%	23.8%	76.2%	27.7%	72.3%
2865 Cyclic Organic Crudes & Intermediates						
# Establishments	89	53	48	99	72	85
% Establishments	62.7%	37.3%	32.7%	67.3%	45.9%	54.1%
% Shipment Value	37.3%	62.7%	16.8%	83.2%	25.5%	74.5%

Industry	1972 Single Product	1972 Multi Product	1977 Single Product	1977 Multi Product	1982 Single Product	1982 Multi Product
2869 Industrial Organic Chemicals, NEC						
# Establishments	143	249	151	263	251	265
% Establishments	38.8%	61.2%	36.5%	63.5%	48.6%	51.4%
% Shipment Value	9.7%	90.3%	10.5%	89.5%	14.7%	85.3%
2951 Paving Mixtures & Blocks						
# Establishments	715	66	803	44	902	59
% Establishments	91.6%	8.4%	94.8%	5.2%	93.9%	6.1%
% Shipment Value	84.2%	15.8%	91.0%	9.0%	87.9%	12.1%
3272 Concrete Products						
# Establishments	1,378	471	1,364	520	1,406	468
% Establishments	74.5%	25.5%	72.4%	27.6%	75.0%	26.0%
% Shipment Value	60.1%	39.9%	58.8%	41.2%	64.0%	36.0%
3273 Ready-Mixed Concrete						
# Establishments	2,815	567	3,097	580	3,135	622
% Establishments	83.2%	16.8%	84.2%	15.8%	83.4%	16.6%
% Shipment Value	75.3%	24.7%	76.8%	23.2%	81.5%	19.5%
3441 Fabricated Structural Metals						
# Establishments	930	691	891	722	1,238	659
% Establishments	57.4%	42.6%	55.2%	44.8%	65.3%	34.7%
% Shipment Value	40.1%	59.9%	45.1%	54.9%	58.1%	41.9%
3531 Construction Machinery & Equipment						
# Establishments	248	269	256	281	322	268
% Establishments	48.0%	52.0%	47.7%	52.3%	54.6%	45.4%
% Shipment Value	16.7%	83.3%	14.9%	85.1%	17.5%	82.5%
3622 Industry Controls						
# Establishments	277	105	262	102	426	144
% Establishments	72.5%	27.5%	72.0%	28.0%	74.7%	25.3%
% Shipment Value	44.2%	55.8%	45.7%	54.3%	52.2%	47.8%
3662 Radio & TV Communication Equipment						
# Establishments	807	500	786	395	1,130	444
% Establishments	61.7%	38.3%	66.6%	33.4%	71.8%	38.2%
% Shipment Value	28.0%	72.0%	33.1%	66.9%	44.4%	55.6%
3674 Semiconductors & Related Devices						
# Establishments	142	93	185	95	314	92
% Establishments	60.4%	39.6%	66.1%	33.9%	77.3%	22.7%
% Shipment Value	34.5%	63.5%	31.9%	68.1%	42.0%	58.0%

TABLE 2

RELATIVE RANKINGS OF MULTIPRODUCT ESTABLISHMENTS,
BY PRIMARY FOUR-DIGIT INDUSTRY

Industry	1972		1982	
	% Shipment Value	% Establishments	% Shipment Value	% Establishments
Industrial Organic Chemicals, NEC	1	2	1	3
Paints Products	2	1	4	2
Construction Machinery	3	4	2	5
Canned Fruits & Vegetables	4	5	5	4
Radio & TV Communications	5	8	9	7
Plastics & Resins	6	3	7	8
Semiconductors	7	7	8	12
Cyclic Organic Crudes & Intermediates	8	9	3	1
Millwork	9	10	6	8
Fabricated Structural Metals	10	6	11	6
Industry Controls	11	11	10	11
Concrete Products	12	12	12	10
Ready-Mixed Concrete	13	14	13	13
Paving Mixtures & Blocks	14	15	14	16
Mobile Homes	15	13	15	14
Corrugated Boxes	16	16	16	15

TABLE 3

DISTRIBUTION OF MULTIPLE FIVE-DIGIT PRODUCT ESTABLISHMENTS BY TWO, THREE, AND FOUR-DIGIT INDUSTRIES--1982

Number of Industries Operate In	Industry Level 2-Digit	3-Digit	4-Digit
1	78.0%	53.3%	33.6%
2	19.3	35.9	45.3
3	2.2	7.9	14.0
4	.3	2.1	4.6
5	.1	.5	1.5
6-10	.1	.3	1.0
11+		<.1	<.1

TABLE 4
DISTRIBUTION OF MULTIPRODUCT ESTABLISHMENTS BY NUMBER OF FIVE-DIGIT PRODUCTS PRODUCED--1982

Number of Products	Number of Establishments	Percent of Establishments	Percent of Multiproduct Establishments
1	145,056	70.2%	--
2	31,383	15.2%	50.9%
3	14,319	6.9%	23.2%
4	7,012	3.4%	11.4%
5	3,670	1.8%	5.8%
6-10	4,806	2.2%	7.8%
11-15	475	.2%	.8%
16+	45	*	.1%
Total	206,766	100.0%	100.0%

*Less than .1%.

TABLE 5

NUMBER OF FIVE-DIGIT PRODUCTS PRODUCED AND
NUMBER OF INDUSTRIES ESTABLISHMENTS OPERATE IN,*
BY PRIMARY FOUR-DIGIT INDUSTRY

Industry	1972	1977	1982
All			
5-Digit	1,600	1,600	1,600
4-Digit	452	452	452
3-Digit	144	144	144
2-Digit	20	20	20
Canned Fruits & Vegetables			
5-Digit	25	24	27
4-Digit	10	8	10
3-Digit	4	3	5
2-Digit	2	1	2
Millwork			
5-Digit	29	26	25
4-Digit	14	11	11
3-Digit	10	8	7
2-Digit	4	4	4
Mobile Homes			
5-Digit	9	9	21
4-Digit	4	4	10
3-Digit	3	2	7
2-Digit	2	2	3
Corrugated & Solid Fiber Boxes			
5-Digit	37	24	34
4-Digit	25	17	22
3-Digit	15	6	13
2-Digit	9	5	9
Plastics Materials & Resins			
5-Digit	41	44	32
4-Digit	19	19	15
3-Digit	11	12	12
2-Digit	4	5	5
Paints & Allied Products			
5-Digit	17	13	14
4-Digit	6	5	6
3-Digit	4	4	5
2-Digit	1	1	2

Industry	1972	1977	1982
Cyclic Organic Crudes & Intermediates			
5-Digit	51	54	62
4-Digit	27	27	28
3-Digit	17	17	16
2-Digit	8	9	7
Industrial Organic Chemicals, NEC			
5-Digit	38	41	43
4-Digit	18	18	19
3-Digit	9	9	10
2-Digit	3	2	3
Paving Mixtures & Blocks			
5-Digit	30	21	14
4-Digit	18	16	10
3-Digit	13	12	6
2-Digit	6	6	3
Concrete Products			
5-Digit	9	12	7
4-Digit	6	7	4
3-Digit	4	5	2
2-Digit	3	4	2
Ready-Mixed Concrete			
5-Digit	9	12	9
4-Digit	7	8	6
3-Digit	5	5	3
2-Digit	2	2	2
Fabricated Structural Metals			
5-Digit	22	22	22
4-Digit	9	11	9
3-Digit	3	4	3
2-Digit	3	2	2
Construction Machinery & Equipment			
5-Digit	35	35	41
4-Digit	18	14	20
3-Digit	11	8	12
2-Digit	4	3	5
Industry Controls			
5-Digit	34	32	36
4-Digit	21	16	22
3-Digit	11	8	12
2-Digit	5	3	3

Industry	1972	1977	1982
Radio & TV Communication Equipment			
5-Digit	38	36	27
4-Digit	22	22	18
3-Digit	14	13	10
2-Digit	5	5	4
Semiconductors & Related Devices			
5-Digit	39	45	43
4-Digit	26	34	29
3-Digit	16	21	14
2-Digit	5	9	8

*A product is excluded if it accounts for less than one percent of the establishment's value of shipments or is produced by less than one percent of the industry's multiproduct establishments. Many nonprimary five-digit product classes did not meet this criteria. For example, in the canned fruits and vegetable industry 39 five-digit products are produced by less than one percent of the multiproduct establishments and not included in this table.

TABLE 6

SINGLE AND MULTIPRODUCT ESTABLISHMENT SUMMARY STATISTICS,
BY PRIMARY FOUR-DIGIT INDUSTRY--1982

Industry	# of Products	# of Employees	PPSR*	PISR**
All				
Single	1.0	50	1.00	1.00
Multi	3.1	157	.71	.85
Canned Fruits & Vegetables				
Single	1.0	81	1.00	1.00
Multi	3.3	157	.69	.84
Millwork				
Single	1.0	25	1.00	1.00
Multi	4.0	60	.63	.87
Mobile Homes				
Single	1.0	94	1.00	1.00
Multi	2.3	89	.85	.93
Corrugated & Solid Fiber Boxes				
Single	1.0	74	1.00	1.00
Multi	2.5	86	.77	.77
Plastics Materials & Resins				
Single	1.0	70	1.00	1.00
Multi	3.1	229	.72	.79
Paints & Allied Products				
Single	1.0	34	1.00	1.00
Multi	3.2	69	.74	.95
Cyclic Organic Crudes & Intermediates				
Single	1.0	80	1.00	1.00
Multi	3.6	233	.72	.80
Industrial Organic Chemicals, NEC				
Single	1.0	58	1.00	1.00
Multi	3.9	365	.66	.75
Paving Mixtures & Blocks				
Single	1.0	13	1.00	1.00
Multi	2.1	47	.74	.74
Concrete Products				
Single	1.0	23	1.00	1.00
Multi	2.3	41	.75	.92

Industry	# of Products	# of Employees	PPSR*	PISR**
Ready-Mixed Concrete				
Single	1.0	19	1.00	1.00
Multi	2.4	28	.82	.82
Fabricated Structural Metals				
Single	1.0	46	1.00	1.00
Multi	1.7	65	.74	.82
Construction Machinery & Equipment				
Single	1.0	74	1.00	1.00
Multi	3.0	326	.68	.83
Industry Controls				
Single	1.0	78	1.00	1.00
Multi	2.8	204	.75	.75
Radio & TV Communication Equipment				
Single	1.0	175	1.00	1.00
Multi	2.9	586	.72	.83
Semiconductors & Related Devices				
Single	1.0	233	1.00	1.00
Multi	3.1	976	.70	.86

* PPSR = Primary Product Specialization Ratio
= Value of Primary 5-Digit Product/Total Shipments Value

**PISR = Primary Industry Specialization Ratio
= Value of Products In Primary Four-Digit Industry/Total Shipments Value

TABLE 7

MAJOR NON-PRIMARY ACTIVITIES OF DIVERSIFIED ESTABLISHMENTS,
BY FOUR-DIGIT PRIMARY INDUSTRY--1982 Census

Canned Fruits & Vegetables (2033)

Nonprimary Activity	2032	2035	2037	2086	2087	2099
% Establishments	17.2%	14.1%	15.6%	17.2%	9.8%	17.6%
% Nonprimary Value	20.6	8.9	22.9	16.4	8.0	12.7

Millwork (2431)

Nonprimary Activity	2421	2426	2434	2499	2541	3079	3442
% Establishments	8.2%	2.2%	23.1%	4.1%	3.4%	2.2%	12.1%
% Nonprimary Value	17.0	6.0	13.7	8.1	5.3	5.1	23.5

Mobile Homes (2451)

Nonprimary Activity	2452	3444	3442
% Establishments	5.6%	3.7%	7.4%
% Nonprimary Value	21.8	32.5	33.0

Corrugated & Solid Fiber Boxes (2653)

Nonprimary Activity	2643	2649	2651	2652	2654	2655	3079	3993
% Establishments	5.8%	11.6%	23.3%	26.7%	9.3%	5.8%	12.8%	24.9%
% Nonprimary Value	12.2	5.6	18.7	7.7	2.6	1.9	14.7	26.7

Plastics Materials & Resins (2821)

Nonprimary Activity	2843	2851	2865	2821	2869	2911	3079
% Establishments	16.1%	5.8%	8.3%	38.7%	18.1%	4.5%	16.1%
% Nonprimary Value	4.0	2.3	10.7	37.7	5.6	6.6	20.5

Paints & Allied Products (2851)

Nonprimary Activity	2821	2842	3676
% Establishments	5.6%	2.5%	14.4%
% Nonprimary Value	37.0	6.6	26.3

Cyclic Organic Crudes & Intermediates

Nonprimary Activity	2816	2819	2821	2833	2843	2851	2869	2911
% Establishments	9.4%	18.8%	17.6%	9.4%	12.9%	5.9%	44.7%	3.5%
% Nonprimary Value	2.9	9.0	23.8	1.7	2.5	1.3	25.5	15.7

Industrial Organic Chemicals, NEC (2869)

Nonprimary Activity	2812	2813	2819	2821	2822	2833	2843	2865	2873	2879	2899	2911
% Establishments	5.3%	5.3%	31.3%	17.0%	4.5%	5.3%	16.6%	28.3%	6.0%	9.8%	9.1%	6.0%
% Nonprimary Value	7.1	.8	8.0	27.5	6.4	1.7	4.6	18.6	3.4	4.0	3.1	11.1

Paving Mixtures & Blocks (2951)

Nonprimary Activity	2891	2911	2952	3272	3273	3281
% Establishments	5.1%	5.1%	16.9%	11.9%	61.0%	5.1%
% Nonprimary Value	1.2	6.9	12.2	18.4	53.7	2.5

Concrete Products (3272)

Nonprimary Activity	2951	3271	3273
% Establishments	3.6%	11.1%	13.9%
% Nonprimary Value	2.8	36.5	38.5

Ready-Mixed Concrete (3273)

Nonprimary Activity	2951	3241	3271	3272
% Establishments	7.4%	6.3%	43.2%	67.8%
% Nonprimary Value	10.8	5.5	44.6	34.1

Fabricated Structural Metals (3441)

Nonprimary Activity	3443	3444	3446	3449	3531
% Establishments	21.9%	20.1%	32.8%	23.3%	.9%
% Nonprimary Value	18.4	8.2	13.7	20.9	7.1

Construction Machinery Equipment (3531)

Nonprimary Activity	3519	3523	3532	3533	3536	3537	3599	3714
% Establishments	1.5%	10.1%	8.6%	3.4%	5.6%	4.5%	5.2%	4.5%
% Nonprimary Value	5.5	28.1	6.9	12.6	10.7	6.0	1.0	5.9

Industry Controls (3622)

Nonprimary Activity	3613	3629	3643	3662	3679	3822	3825
% Establishments	44.4%	3.5%	9.7%	6.9%	12.5%	5.5%	11.1%
% Nonprimary Value	44.5	5.1	5.1	3.7	1.5	.7	2.6

Radio & TV Communication Equipment (3662)

Nonprimary Activity	3489	3573	3661	3679	3811	3825
% Establishments	1.4%	5.2%	7.0%	22.3%	5.6%	8.3%
% Nonprimary Value	5.3	10.4	6.6	14.9	13.4	7.4

Semiconductors & Related Devices (3674)

Nonprimary Activity	3559	3573	3662	3671	3675	3676	3679
% Establishments	2.2%	12.0%	5.4%	5.4%	10.9%	3.3%	31.5%
% Nonprimary Value	6.9	35.9	11.5	.3	1.9	7.7	27.8

TABLE 8

PRIMARY ACTIVITY AND JOINT NONPRIMARY ACTIVITIES,
BY FOUR-DIGIT PRIMARY INDUSTRY--1982

Primary Industry	Percent of Multiproduct Establishments in Primary Industry and Engaged in Nonprimary Activity	
Canned Fruits & Vegetables	17%	Canned Specialties
	16%	Frozen Fruits, Fruit Juices
	17%	Bottled & Canned Soft Drinks
	18%	Food Preparations, NEC
Corrugated Boxes	23%	Folding Paperboard Boxes
	27%	Set-up Paperboard Boxes*
	28%	Signs & Advertising Displays
Cyclic Organics	19%	Industrial Inorganics, NEC
	18%	Plastic Materials & Resins
	45%	Industrial Organics, NEC
Industrial Organics	31%	Industrial Inorganics, NEC
	28%	Cyclic Organics
	17%	Surface Active Agents
	17%	Plastics Materials & Resins
Industry Controls	44%	Switchgears & Switchboards
Millwork	23%	Wood Kitchen Cabinets
Paving Mixtures & Blocks	61%	Ready-mix Concrete
	17%	Asphalt Felts & Coatings
Plastics Materials & Resins	16%	Surface Active Agents
	39%	Industrial Inorganics, NEC
	18%	Adhesives & Sealants
	16%	Misc. Plastics Products
Ready-Mix Concrete	43%	Concrete Blocks & Bricks
	68%	Concrete Products
Fabricated Metals	32%	Architectural Metal Work
	22%	Fabricated Plate Work
	20%	Sheet Metal Work
	23%	Misc. Structural Metal Work
Semiconductors	32%	Electronic Components, NEC

*15 percent produced folding and set-up paperboard boxes. This was the only instance of three activities being present at any significant level by the same establishment.

TABLE 9

PERCENT OF MULTIPRODUCT ESTABLISHMENTS AND MULTIUNIT FIRMS
ENGAGED IN NONPRIMARY ACTIVITIES--1982 Census

Canned Fruits & Vegetables (2033)

Nonprimary Activity	2032	2035	2037	2086	2087	2099
Industry Average	17.2%	14.1%	15.6%	17.2%	9.8%	17.6%
Large Estab. Average[1]	46.7	26.7	0.0	26.7	26.7	33.3
Firm Average	51.9	65.5	56.4	57.8	54.2	63.3

Millwork (2431)

Nonprimary Activity	2421	2434	3442
Industry Average	8.2%	23.1%	12.1%
Large Estab. Average[12]	20.0	20.0	40.0
Firm Average	44.9	33.3	78.0

Mobile Homes (2451)

Nonprimary Activity	2452	3442
Industry Average	5.6%	7.4%
Large Estab. Average[23]	0.0	0.0
Firm Average	50.0	50.0

Corrugated & Solid Fiber Boxes (2653)

Nonprimary Activity	2643	2649	2651	2652	2654	3079	3993
Industry Average	5.8%	11.6%	23.3%	26.7%	9.3%	12.8%	24.9%
Large Estab. Average[23]	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Firm Average	100.0	100.0	50.0	75.0	50.0	58.3	87.5

Plastics Materials & Resins (2821)

Nonprimary Activity	2843	2851	2865	2821	2869	2899	2911	3079
Industry Average	16.1%	5.8%	8.3%	38.7%	18.1%	4.5%	4.5%	16.1%
Large Estab. Average[1]	13.6	0.0	18.2	63.6	0.0	0.0	18.2	31.8
Firm Average	60.0	41.0	36.1	58.2	48.4	13.4	50.0	57.1

Paints & Allied Products (2851)

Nonprimary Activity	2821	2842	3676	3679
Industry Average	5.6%	2.5%	14.4%	2.1%
Large Estab. Average[1]	0.0	16.7	0.0	0.0
Firm Average	28.7	17.2	35.3	25.0

Cyclic Organic Crudes & Intermediates (2865)

Nonprimary Activity	2816	2819	2821	2833	2843	2851	2869	2911
Industry Average	9.4%	18.8%	17.6%	9.4%	12.9%	5.9%	44.7%	3.5%
Large Estab. Average[1]	14.3	32.1	28.6	10.7	7.1	3.6	53.6	3.6
Firm Average	37.5	58.3	75.0	33.3	55.5	16.7	77.3	33.3

Industrial Organic Chemicals, NEC (2869)

Nonprimary Activity	2812	2819	2821	2822	2833	2843	2865	2873	2879	2899	2911
Industry Average	5.3%	31.3%	17.0%	4.5%	5.3%	16.6%	28.3%	6.0%	9.8%	9.1%	6.0%
Large Estab. Average[1]	17.3	50.0	46.2	15.4	11.5	25.0	61.5	15.4	15.4	19.2	19.2
Firm Average	32.6	59.1	51.3	47.0	25.7	50.5	55.2	35.1	37.6	53.0	46.8

Paving Mixtures & Blocks (2951)

Nonprimary Activity	2911	2952	3272	3273
Industry Average	5.1%	16.9%	11.9%	61.0%
Large Estab. Average[23]	0.0	0.0	50.0	100.0
Firm Average	100.0	75.0	100.0	90.0

Concrete Products (3272)

Nonprimary Activity	2951	3271	3273
Industry Average	3.6%	11.1%	13.9%
Large Estab. Average[2]	0.0	20.0	20.0
Firm Average	66.7	61.7	69.5

Ready-Mixed Concrete (3273)

Nonprimary Activity	2951	3241	3271	3272
Industry Average	7.4%	6.3%	43.2%	67.8%
Large Estab. Average[23]	0.0	100.0	0.0	0.0
Firm Average	83.3	70.4	79.7	94.6

Fabricated Structural Metals (3441)

Nonprimary Activity	3443	3444	3446	3448	3449	3499
Industry Average	21.9%	20.1%	32.8%	2.0%	23.3%	3.3%
Large Estab. Average[1]	42.9	0.0	0.0	0.0	0.0	14.3
Firm Average	70.0	73.5	60.4	50.0	77.3	48.3

Construction Machinery Equipment (3531)

Nonprimary Activity	3523	3532	3536	3537	3599	3714
Industry Average	10.1%	8.6%	5.6%	4.5%	5.2%	4.5%
Large Estab. Average[1]	15.8	7.9	2.6	7.9	0.0	2.6
Firm Average	62.0	76.7	45.6	41.3	33.3	50.0

Industry Controls (3622)

Nonprimary Activity	3613	3643	3679	3822	3825
Industry Average	44.4%	9.7%	12.5%	5.5%	11.1%
Large Estab. Average[1]	66.7	6.7	0.0	0.0	13.3
Firm Average	81.3	50.0	50.0	50.0	25.0

Radio & TV Communication Equipment (3662)

Nonprimary Activity	3573	3622	3651	3661	3674	3679	3811	3825
Industry Average	5.2%	4.3%	3.6%	7.0%	1.6%	22.3%	5.6%	8.3%
Large Estab. Average[1]	9.5	3.8	1.9	10.5	7.6	19.0	9.5	13.3
Firm Average	45.8	37.7	72.1	40.2	46.4	44.2	55.8	52.2

Semiconductors & Related Devices (3674)

Nonprimary Activity	3662	3671	3676	3679
Industry Average	12.0%	5.4%	10.9%	31.5%
Large Estab. Average[1]	18.2	12.1	9.1	42.4
Firm Average	41.5	44.4	66.6	55.7

[1]Establishments with more than 500 employees.
[2]Establishments with more than 250 employees.

[3]Five or fewer multiestablishment firms.

References

Andrews, Stephen H. and Timothy A. Abbott III, 1988. "An Examination of he Standard Industrial Classification System of Manufacturing Activities Using the Longitudinal Research Database," Proceedings of the Fourth Annual Research Conference, U.S. Bureau of the Census, Washington, D.C., (March 23-28), pp. 467-488.

Berry, Charles H., 1974. "Corporate Diversification and Market Structure," Bell Journal of Economics, Vol. 5, pp.196-204.

Baumol, William J., John C. Panzar, and Robert D. Willig, 1982. Contestable Markets and the Theory of Industry Structure, New York: Harcourt Brace Jovanovich, Inc.

Gollop, Frank M. and James L. Monahan, 1990. "From Homogeneity to Heterogeneity: An Index of Diversification", Review of Economics and Statistics, forthcoming.

Gort, Michael, 1962. Diversification and Integration in American Industry, Princeton, Mass.: Princeton Univ. Press.

Gorecki, Paul K., 1974. "The Measurement of Enterprise Diversification," Review of Economics and Statistics, Vol. 56, pp. 399-401.

Goto, Akita, 1981. "Statistical Evidence on the Diversification of Japanese Large Firms," Journal of Industrial Economics, Vol. 29, pp.271-278.

McGuckin, Robert H. and George A. Pascoe, Jr., 1988. "The Longitudinal Research Data Base (LRD): Status and Research Possibilities," Survey of Current Business, Vol. 68, pp. 30-37.

McVey, J.S., 1972. "The Industrial Diversification of Multiestablishment Manufacturing Firms: A Developmental Study," Canadian Statistical Review, Vol. 47 (July), No. 4, 6, pp. 112-117.

Utton, M. A., 1977. "Large Firm Diversification in British Manufacturing," Economic Journal, Vol. 87, pp. 96-113.

APPENDIX 1

PRODUCTS AND INDUSTRIES INCLUDED IN ANALYSIS

2033 Canned Fruits and Vegetables

20330 Canned Fruits and Vegetables, NSK*
20331 Canned Fruits, except Baby Foods
20332 Canned Vegetables, except Hominy and Mushrooms
20333 Canned Hominy and Mushrooms
20334 Canned and Fresh Fruit Juices, Nectar and Concentrates
20335 Canned Vegetable Juices
20336 Catsup and Other Tomato Sauces, Pastes, Etc.
20338 Jams, Jellies, and Preserves

2431 Millwork

24310 Millwork, NSK*
24311 Window Units, Wood
24312 Wood Window Sash, including combination Screen and Storm Sash, and Window Screens, excluding Window Units
24313 Wood Window and Door Frames, and Door Frames Shipped in Door Units, excluding Window Frames Shipped in Window Units
24314 Doors, Wood, Interior and Exterior
24315 Other Wood Doors, including Garage, Screen, Storm, and Combination Screen and Storm, and Louvre
24316 Wood Moldings, except Prefinished Moldings Made From Purchased Moldings
24317 Prefinished Wood Moldings Made From Purchased Moldings
24318 Other Millwork Products, including Stairwork and Exterior Millwork

2451 Mobile Homes

24510 Mobile Homes, NSK*
24511 Manufactured Homes, 35 Feet or More in Length
24512 Manufactured buildings, nonresidential, 35 Feet or More in Length

2653 Corrugated and Solid Fiber Boxes

26530 Corrugated and Solid Boxes, including Pallets

2821 Plastics Materials and Resins

28210 Plastics Materials and Resins, NSK*
28213 Thermoplastic Resins and Plastics Materials
28214 Thermosetting Resins and Plastics Materials

2865 Cyclic Organic Crudes and Intermediates

28650 Cyclic Organic Crudes and Intermediates, NSK*
28651 Cyclic Intermediates
28652 Synthetic Organic Dyes
28653 Synthetic Organic Pigments, Lakes, and Toners
28655 Cyclic (Coal Tar) Crudes

2869 Industrial Organic Chemicals, NEC**

28690 Industrial Organic Chemicals, NSK*
28693 Synthetic Organic Chemicals, NEC, except Bulk Surface Active Agents
28694 Pesticides and Other Organic Chemicals (not formulations), NEC
28695 Ethyl Alcohol and Other Industrial Organic Chemicals, NEC
28696 Miscellaneous End-Use Chemicals and Chemical Products
28697 Miscellaneous Cyclic and Acyclic Chemicals and Chemical Products

2951 Paving Mixtures and Blocks

29510 Paving Mixtures and Blocks

3272 Concrete Products, Except Block and Brick

32720 Concrete Products, NSK*
32721 Concrete Pipe
32722 Precast Concrete Products
32723 Prestressed Concrete Products

3273 Ready-Mixed Concrete

32730 Ready-Mixed Concrete

3441 Fabricated Structural Metal

34410 Fabricated Structural Metals, NSK*
34411 Fabricated Structural Metal for Buildings
34412 Fabricated Structural Metal for Bridges
34413 Other Fabricated Structural Metal

3531 Construction Machinery

35310 Construction Machinery, NSK*
35311 Contractors' Off-Highway Wheel Tractors, except Parts and Attachments
35312 Tracklaying Type Tractors, except Parts and Attachments
35313 Parts and Attachments for Tracklaying Type Tractors, Contractors' Off-Highway Wheel Tractors, and Tractor Shovel Loaders

35314 Power Cranes, including Locomotive Full-Circle Revolving with Booms, Draglines, Shovels, and Parts
35316 Mixers, Pavers, and Related Equipment, Excluding Parts
35317 Tractor Shovel Loaders, excluding Parts and Attachments
35318 Scrapers, Graders, Rollers, and Off-Highway Trucks, Trailers, and Wagons, excluding Parts
35319 Other Construction Machinery and Equipment, including Other Construction Machinery Parts

3622 Industrial Controls

36220 Industrial Controls

3662 Radio and TV Communication Equipment

36620 Radio and TV Communication Equipment, NSK*
36621 Communication Systems and Equipment
36622 Broadcast Studio and Related Electronic Equipment
36623 Intercommunication Equipment (except Telephone and Telegraph), Alarm Systems, and Traffic Control Equipment
36625 Search and Detection, Navigation, and Guidance Equipment
36627 Electronic Systems and Equipment, NEC**

3674 Semiconductors and Related Devices

36740 Semiconductors and Related Devices, NSK*
36741 Integrated Microcircuits, Including Semiconductor Networks, Microprocessors, and MOS Memories
36742 Transistors
36743 Diodes and Rectifiers
36749 Other Semiconductor Devices, including Semiconductor Parts, such as Wafers and Heat Sinks

*The NSK, or not specified by kind, product classes are designated by a zero as the fifth digit. This category includes shipments which are too general to code below the four-digit level. Frequently these products are residuals in the company's records, which it felt could not be classified in further detail.

**The NEC classification is designated by a nine as the third or fourth digit. This category covers establishments which are not elsewhere classified, and generally do not constitute homogeneous primary activity groups. They are grouped together to preserve the homogeneity of the other industries in the group.

ENDNOTES

1. Notable exceptions are the works of Gort (1962), Berry (1974), Gollop and Monahan (1989), and Lichtenberg (1989). Gort and Berry examined the history of a number of large diversified corporations and concluded that both the amount and rate of firm level diversification had increased in the post-World War II era. Lichtenberg found that from the mid-1970's the rate of diversification has slowed considerably and that a number of conglomerates are actually becoming less diversified. Gollop and Monahan concluded that establishment level has declined, but is still increasing at the firm level.

2. In some cases, multiple diverse production processes occur at a single location. The subdivision of such single physical locations into multiple establishments is performed to capture the production of products which are produced and consumed (usually as intermediate products) at the same location.

3. There were no administrative records in the 1963 Census; however, by 1982 37% of the Census manufacturing establishments were administrative records. Administrative records include no information on material inputs and only four-digit information on products. As the industry average at the five-digit level was imputed for these establishments the diversity in later years may be understated. To the extent that administrative records are small establishments, the shipment weighted diversification measures are affected minimally.

4. Single product establishment is defined as one producing all products within one 5-digit product class. Similarly, a multiproduct establishments produces products in more than one 5-digit product class.

5. Andrews and Abbott (1988) calculate that even at the four-digit level approximately seven percent of all manufacturing establishments switch classification groups between consecutive censuses.

6. In this analysis, a conventional definition of high technology industries from the Office of Technology Assessment is used. Two criteria are used to determine if an industry is "high-tech" or not. The first is the portion of employees which are scientists and engineers; the second is the ratio of research and development expenditures to sales. The drawbacks to this definition is that not all R&D expendutures go to developing new products, some is aimed at new production processes. Second, not all products of an industry are high technology products. It is possible that an establishment within a high technology industry produces only low technology products.

7. Administrative record establishments are generally small plants which are exempt from the Census. Data on sales, employment, and payroll are collected from IRS filings to minimize reporting burden.

8. We recognize the possibility that our measurement of heterogeneity may be in part an artifact of the SIC system. The Center For Economic Studies is exploring alternative methods of classifying the activities of manufacturing units. Andrews and Abbott (1988) have considered three alternative methods in comparison with the SIC system.

9. Statistics reported for all industries cover all 448 four-digit manufacturing industries, not just the sixteen included for more detailed analysis.

10. The increase in single product establishments is partly due to a special mailing survey to 10,000 administrative record cases in 1982. These survey cases are included in the 1982 data, but not the earlier years' data. These AR cases are generally small establishments (less than 100 employees). The effect of including these establishments is reflected in the fact that the increase of small, single-product establishments between 1977 and 1982 is

three times the rate between 1972 and 1977. The economic recession of the early 1980's may also contribute to the decline in multiproduct establishment and increase in single product establishments if firms contracted their range of products and switch from the multi- to single output category. The extent of this later effects has not been examined.

11. The most diversified establishment in the sample produces in sixteen four-digit, thirteen three-digit, and eight two-digit industries.

12. The number of products produced by, and number of industries multiproduct establishments operating in, are sensitive to the selection criteria. Our initial selection criteria was based on one percent of shipments and being produced by at least two establishment. By altering the selection criteria to one percent of shipments or one percent of multiproduct establishments the sample for most industries expanded.

13. Includes multiestablishment firms which have more than one establishment classified in the same four-digit industry. The average number of establishments per firms in the same industry is three; the maximum is thirteen.