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INPUT-OUTPUT RELATIONS OF THE STEEL INDUSTRY

An article in an earlier issue of this *Review* discussed the input-output relations of the auto industry.¹ This article presents a similar analysis of the steel industry based upon the preliminary input-output tables published by the U. S. Department of Commerce for the 1958 economy.²

DIRECT INPUTS AND OUTPUTS

Table I provides the basic input-output relationships of the steel industry.³ The input side indicates purchases from other industries plus the value added by the steel industry while the output side reveals sales to other industries and allocations to various final

demand categories.

There are a number of characteristics of the steel industry indicated by the table. On the input side, the steel industry utilizes a considerable amount of its own production (22.7 percent). In evaluating this situation, however, a word of explanation is necessary. The 1958 input-output tables do not differentiate between the intra-industry consumption of steel products similar to those sold to other industries and intra-industry sales of goods in process. For example, if a steel company manufactures a product from non-steel raw materials and sells it to another industry, there is no addition to the steel intra-industry consumption figure in the input-output tables. On the other hand, if the same company only partially finishes the product and sells it to another steel company for completion, an addition results. Therefore, the intra-industry consumption figure for steel in the tables could reflect an absence of vertical integration in the industry rather than the utilization of its own goods. It should be kept in mind, however, that this characteristic of the input-output tables applies to all of the industries to some degree.

¹ "Input-Output Relations of the Auto Industry," *Economic Review*, Federal Reserve Bank of Cleveland, March 1965.

² "The Interindustry Structure of the United States; a Report on the 1958 Input-Output Study," *Survey of Current Business*, November 1964, Office of Business Economics, U. S. Department of Commerce.

³ The industry is described officially as "Primary Iron and Steel Manufacturing" in the 1958 input-output tables. References to the industry in this article utilize the designation "steel."

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TABLE I
Input-Output Schedule for the Steel Industry

Inputs	Percent	Outputs	Percent
Purchases from:		Sales to:	
Mining	8.4	Mining	0.7
Construction	0.6	Construction	12.9
Iron & steel	22.7	Iron & steel	20.9
Other manufacturing	11.8	Other manufacturing	56.2
Transportation, communications & public services	8.0	Transportation, communications & public services	0.2
Wholesale & retail trade	3.6	Total sales	90.9%
Finance, insurance & real estate	1.1	Final demand	
Services	1.2	Personal consumption expenditures	0.1
Govt. enterprises	0.1	Gross private fixed capital formation	0
Gross imports	1.2	Net inventory changes	-0.8
Other industries	0.5	Gross exports	2.8
Scrap adjustment	1.1	Federal government purchases	0.6
Total purchases	60.3%	Total final demand	2.7%
Value added	39.5%	Transfers to other industries ¹	6.3%
TOTAL INPUTS²	99.8%	TOTAL OUTPUTS²	99.9%

¹ Refers to the industry's output of those goods considered secondary to the industry; that is, those that do not come under the definition of goods typically produced by the "Primary Iron and Steel Manufacturing" industry. Such goods are treated in this manner, rather than being redefined as the primary output of another industry, because of the difficulty of isolating the inputs necessary for the secondary goods. It is assumed that the secondary output of an industry is a constant portion of its total output.

² Totals are less than 100 percent because of rounding.

Source: Tables 1 and 2 in "The Interindustry Structure of the United States; a Report on the 1958 Input-Output Study," *Survey of Current Business*, November 1964, Office of Business Economics, U. S. Department of Commerce

Regardless of the actual nature of the intra-industry consumption figure (22.7 percent) and considering that 39.5 percent of the steel industry's inputs represents "value added,"⁴ it can be seen that the steel industry requires only slightly less than 38 percent of its inputs from other industries, including trade, services, and so forth.

Output data reveal that, in addition to sales within the industry, a very large quantity of steel (nearly 70 percent of production) is sold

to other manufacturing industries and to construction firms. Conversely, little is distributed directly to final demand categories, which is indicative of the intermediary characteristic of steel as an industrial commodity.

Table II expands the broad relationships indicated in the previous table and shows the interactions between the steel industry and selected other industries. Columns A and B present the sale of steel from the standpoints of both the steel and the named industries; columns C and D look at the purchases by the steel industry on the same bases; and columns

⁴ "Value added" is comprised basically of labor costs, depreciation charges, and profits.

TABLE II

Steel and Selected Other Industries

	Direct Sales of Steel to Other Industries as % of Total Output of Steel Industry A	Direct Purchases of Steel by Named Industries as % of Total Output of Named Industries B	Direct Purchases by Steel Industry as % of Total Inputs of Steel Industry C	Direct Purchases by Steel Industry as % of Total Output of Named Industry D	Direct and Indirect Requirements Per Dollar of Delivery to Final Steel Demand E	Direct and Indirect Requirements of Steel Per Dollar of Delivery to Final Demand by Named Industries F
Primary iron & steel manufacturing	20.9% ^a	22.7% ^a	22.7%	22.7%	\$1.32	\$1.32
New construction	11.5	4.2	0	0	0	0.11
Motor vehicles & equipment	10.3	8.5	0.2	0	0.01	0.20
Heating, plumbing & structural metal products	9.4	23.8	0.2	0	0.01	0.36
Metal containers	4.7	43.9	0	0	*	0.60
Other fabricated metal products	4.2	19.3	1.7	4.6	0.03	0.29
Stampings, screw machine products & bolts	3.4	19.9	0.6	3.1	0.01	0.30
Construction, mining & oil field machinery	2.4	15.4	0.1	0	0.01	0.26
Other transportation equipment	2.2	11.7	0.1	0	*	0.22
Aircraft & parts	2.1	3.2	*	0	*	0.09
Farm machinery & equipment	1.9	14.3	0.1	0	*	0.25
General industrial machinery & equipment	1.9	10.6	0.3	1.3	0.01	0.20
Electrical industrial equipment & apparatus	1.5	5.7	0.4	1.6	0.01	0.11
Household appliances	1.4	7.6	*	0	*	0.16
Metalworking machinery & equipment	1.3	7.5	0.7	3.1	0.01	0.15
Engines & turbines	1.2	10.1	*	0	*	0.20
Machine shop products	0.6	7.9	0.7	8.8	0.01	0.14
Chemicals & selected chemical products	0.5	0.6	1.0	1.4	0.03	0.03
Nonferrous metal ores mining	0.3	3.9	*	0.5	0.01	0.07
Stone & clay products	0.2	0.2	1.5	3.9	0.03	0.02
Iron & ferroalloy ores mining	0.1	1.5	5.4	84.0	0.08	0.03
Coal mining	0.1	0.8	2.6	18.4	0.04	0.04
Primary nonferrous metal manufacturing	0.1	1.2	1.6	2.7	0.04	0.05
Petroleum refining & related industries	*	*	0.8	0.9	0.02	0.01

* Negligible.

^a Conceptually, the direct purchases by an industry of its own output should equal the industry's direct sales to itself. However, the figures vary slightly because of computational procedures.

Source: Tables 1, 2, and 3 in "The Interindustry Structure of the United States; a Report on the 1958 Input-Output Study," Survey of Current Business, November 1964, Office of Business Economics, U. S. Department of Commerce

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E and F examine the total requirements needed from other industries per unit of production of steel and the contribution of the steel industry to the total requirements of the named industries.

With the exception of the large amount of intra-industry steel consumption, no particular industry consumes a disproportionate amount of steel, as indicated by Table II (A). The largest use of steel is in new construction, with autos slightly behind.⁵ The heating, plumbing, and structural metal products industry is third in order, followed by a variety of industries that consume significantly less steel than the aforementioned top three steel users. By way of comparison, Table II (B) indicates that although the steel industry may sell only small proportions of its output to the named industries, the purchases of steel by these industries usually involve considerably larger percentages of the output of these industries.

Table II (C) quantifies the relatively small role of other manufacturing industries in delivering supplies to the steel industry. None of the listed manufacturing industries contributes an appreciable amount of the steel industry's inputs. Among the various industrial categories, only the mining sectors are relatively important in this respect.

⁵ In ranking steel customers, it should be remembered that 1958 was not a good year for the auto industry. Data from *Ward's Reports* show that final auto sales in 1958 were 4,244,000 units, a sizable decline from the 6,115,000 units of the previous year. In addition, according to the input-output tables, the proportion of steel going to the auto industry is less than that suggested by the American Iron and Steel Institute; part of the difference would be accounted for by the fact that the AISI includes some indirect destinations.

From the standpoint of consumption of output of other industries, the steel industry is its own best customer as well as the leading buyer of the output of iron and ferroalloy ores mining. Also, as Table II (D) indicates, with the exception of two mining sectors and machine shop products, the steel industry does not receive appreciable proportions of the total production of the named industries.

TOTAL REQUIREMENTS

The comparative self-sufficiency of the steel industry can be further corroborated by considering the total requirements necessary for a unit of steel production. Total requirements refer to the amount of both direct and indirect inputs needed per dollar of delivery to final steel demand. In essence, it approximates the total sales activity leading to the production of one dollar's worth of steel.⁶

It can readily be seen in Table II (E) that the steel industry contributes substantially more to its own total requirements (both direct and indirect) than it receives from all the other listed industries. In contrast, as shown in Table II (F), the direct and indirect requirements of steel by other industries, measured against the final demand output of those industries, are much higher.

Table III presents information on 20 industries' total requirements per dollar of delivery to final demand (column B) and the amount provided by each industry's own production (column A). The third column in Table III

⁶ For a hypothetical illustration of why total requirements exceed a dollar's worth of delivery to final demand, see Chart 2, "Input-Output Relations of the Auto Industry," *Economic Review*, Federal Reserve Bank of Cleveland, March 1965.

TABLE III

The Twenty Industries Having the Highest Percentage of Own Production to Total Requirements Per Dollar of Delivery to Final Demand

Industry	Own Production (A)	Total Requirements (B)	A/B
Communications, except radio & TV broadcasting	\$1.01	\$1.28	78.7%
Amusements	1.31	1.87	70.2
Finance & insurance	1.27	1.81	69.9
Real estate & rental	1.04	1.52	68.1
Coal mining	1.21	1.80	67.1
Wholesale & retail trade	1.03	1.54	66.9
Leather tanning & industrial leather products	1.16	1.75	66.2
Crude petroleum & natural gas	1.03	1.60	64.5
Transportation & warehousing	1.08	1.73	62.6
Electric, gas, water & sanitary services	1.22	1.96	62.4
Medical, educational services & nonprofit organizations	1.01	1.62	62.4
Tobacco manufactures	1.24	2.06	60.1
Primary iron & steel manufacturing	1.32	2.21	60.0
Primary nonferrous metal manufacturing	1.45	2.43	59.7
Aircraft & parts	1.26	2.15	58.5
Office, computing & accounting machines	1.10	1.89	58.4
Chemical & fertilizer mineral mining	1.06	1.83	58.1
Lumber & wood products, except containers.	1.40	2.41	58.1
Hotels, personal & repair services (excluding autos)	1.03	1.79	57.8
Nonferrous metal ores mining	1.22	2.11	57.7

Source: Table 3 in "The Interindustry Structure of the United States; a Report on the 1958 Input-Output Study," *Survey of Current Business*, November 1964, Office of Business Economics, U. S. Department of Commerce

shows column A as a percent of column B, with the 20 listed industries ranked in descending order of the resulting percentage (A/B). Table III indicates that the steel industry ranks 13th out of 82 industries in the contribution of its own production to its total requirements. Moreover, within the manufacturing category, steel is exceeded only by the leather tanning and industrial leather products and tobacco industries.

Viewed within the context of the input-output tables, and particularly on the input side, the high proportion of both direct and total requirements of the steel industry provided by its own production indicates relatively small reliance on supplying industries. If this relationship were the major element in

determining an industry's contribution to economic activity, then the steel industry would be far from outstanding.

A similar situation exists in the case of "value added," where the figures also indicate a lack of dependence on suppliers. Steel ranks 49th in the amount of "value added" per dollar of output. In other words, out of 82 industries, there are 33 others that obtain more of their direct requirements from suppliers than does steel. Again, this should not detract from the significance of the magnitude and variety of steel production. The input-output relationships merely suggest that a particular change in the steel industry's output affects fewer suppliers than would a similar change for a number of other industries.

ALLOCATION OF STEEL OUTPUT

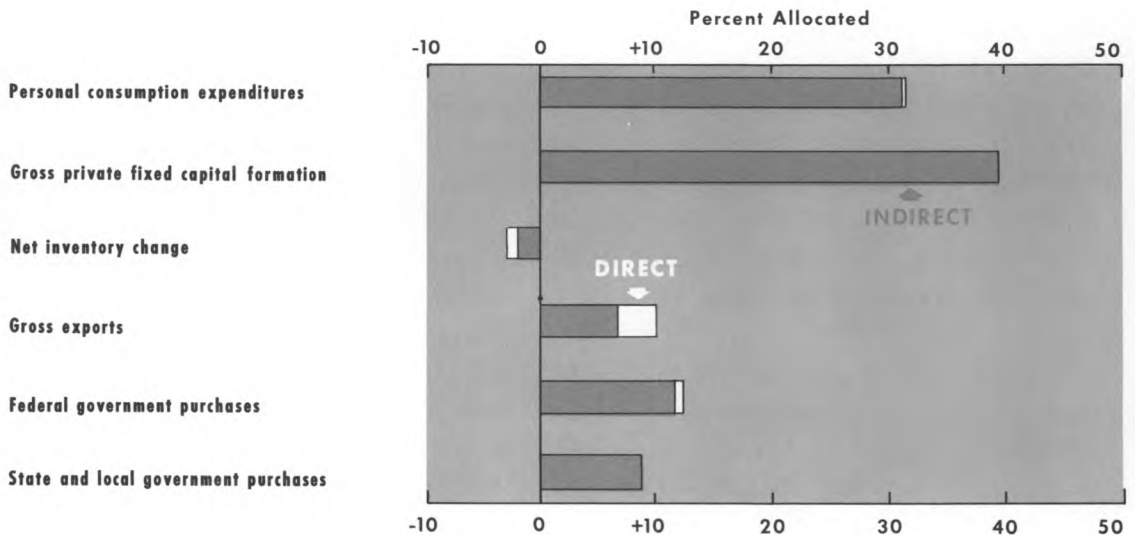
It is clear that steel is used basically as an ingredient for other products rather than as a final demand good. The relative extent of this function is suggested by the distributive allocation of steel production to various final demand categories, and in particular by the large amount of "indirect" allocation (see Chart 1). In only one final demand category — gross exports — is an appreciable amount of steel allocated directly, and even in that situation it is likely that steel exports are used predominantly as intermediate goods in foreign industrial processes.

As the chart also shows, the major portion of total steel output is allocated to gross private fixed capital formation. All of this allocation is indirect since steel is used as an ingredient in the manufacture of capital equipment rather than as a piece of capital equip-

ment itself. This situation explains why the direct allocation of steel to gross private fixed capital formation is zero, as shown earlier in Table I.

The strong indirect relationship between the steel industry and the capital goods sector of the economy can be demonstrated further through a comparison of the steel requirements of those industries that provide considerable amounts of their output to either the personal consumption expenditure sector or to the gross private fixed capital formation sector. Table IV shows the total steel requirements of those industries that deliver at least 25 percent of their output to either sector. From inspection of the figures it is clear that industries delivering large amounts of output to personal consumption expenditures require less steel per dollar of their output than do the capital goods industries. In addition, there

ALLOCATION of STEEL INDUSTRY OUTPUT to FINAL DEMAND



Source of data: Table B, "The Interindustry Structure of the United States; A Report on the 1958 Input-Output Study," *Survey of Current Business*, November 1964, Office of Business Economics, U.S. Department of Commerce

TABLE IV

Steel Requirements of Industries Delivering 25 Percent or More of Their Output Directly to Personal Consumption Expenditures or Gross Private Fixed Capital Formation

Industry	Percentage of Output Delivered Directly to Personal Consumption Expenditures	Steel Requirements Per Dollar of Gross Output	Industry	Percentage of Output Delivered Directly to Gross Private Fixed Capital Formation	Steel Requirements Per Dollar of Gross Output
Medical, educational services & nonprofit organizations	90.1%	\$0.006	New construction	70.5%	\$0.111
Footwear & other leather products	83.6	0.008	Farm machinery & equipment	65.1	0.247
Apparel	78.1	0.007	Special industrial machinery & equipment	57.8	0.169
Hotels, personal & repair services (excluding autos)	77.7	0.010	Other furniture & fixtures	53.4	0.154
Household furniture	73.2	0.062	Office, computing & accounting machines	45.0	0.052
Tobacco manufactures	71.5	0.006	Construction, mining & oil field machinery	42.8	0.264
Food & kindred products	70.2	0.025	Service industry machines	42.4	0.160
Household appliances	67.2	0.156	Materials handling machinery & equipment	32.1	0.213
Wholesale & retail trade	64.6	0.005	Metalworking machinery & equipment	31.5	0.151
Real estate & rental	64.5	0.007	Electric industrial equipment & apparatus	31.3	0.111
Amusements	58.0	0.005	Other transportation equipment	31.2	0.219
Drugs, cleaning & toilet preparations	55.9	0.023	General industrial machinery & equipment	28.0	0.196
Automobile repair & services	55.4	0.041	Engines & turbines	26.1	0.199
Miscellaneous fabricated textile products	48.1	0.010			
Miscellaneous manufacturing	45.7	0.057			
Finance & insurance	44.6	0.003			
Communications, except radio & TV broadcasting	42.1	0.003			
Petroleum refining & related industries	40.3	0.015			
Electric, gas, water & sanitary services	39.7	0.012			
Motor vehicles & equipment	39.2	0.203			
Misc. textile goods & floor coverings	29.7	0.008			
Optical, ophthalmic & photographic equipment	28.9	0.023			
Transportation & warehousing	25.4	0.012			

Source: Tables B and 3 in "The Interindustry Structure of the United States; a Report on the 1958 Input-Output Study," Survey of Current Business, November 1964, Office of Business Economics, U. S. Department of Commerce

appears to be little relationship between steel requirements and the percentage of output delivered to either sector; that is to say, there is no consistent pattern between the relative amounts of output delivered to a sector and steel requirements. The important factor seems to be whether an industry supplies the capital sector or the personal consumption sector.

COMPARISONS WITH THE AUTO INDUSTRY

Steel and automobiles are two of the most important industries in our economy, by many measurements. A comparison of the two industries, however, reveals that each possesses separate and distinct input-output relationships. The major differences between the two

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appear to be (1) the categories of final demand to which they contribute and (2) the degree of dependence on other supplying industries.

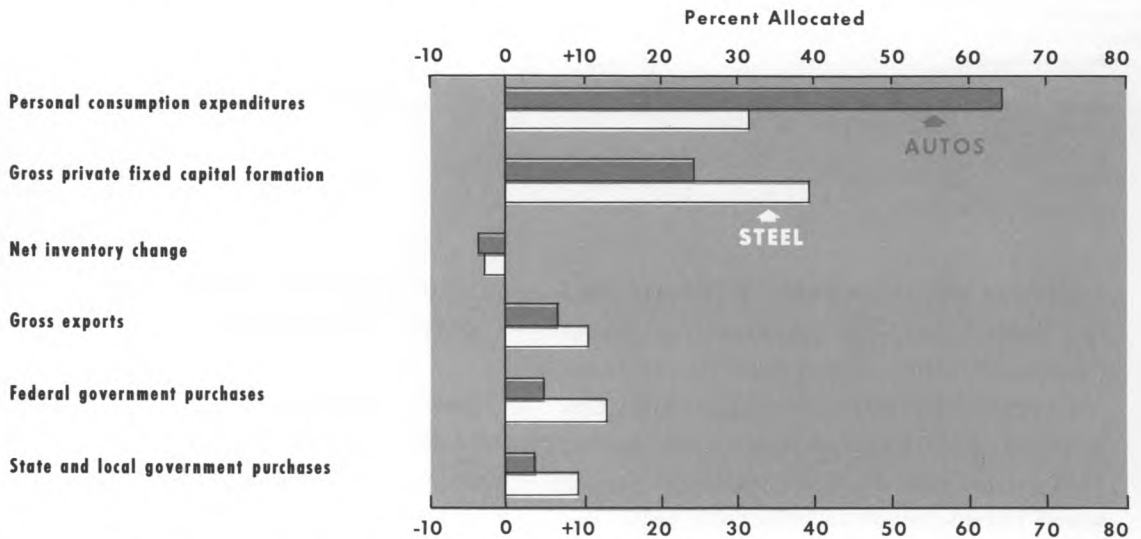
As would be expected, the auto industry makes its greatest final demand impact in the personal consumption expenditure sector (see Chart 2). It should be kept in mind, however, that a sizable proportion of steel's indirect contribution to the personal consumption expenditure sector results from the auto industry's utilization of steel.

The steel industry leads in the percentage of its output allocated to the other final demand categories with the exception of net inventory change. In regard to the latter, the negative figures shown in the chart reflect the experience of the 1957-58 recession and should not be interpreted as the normal con-

tribution of either industry to this particular final demand sector.

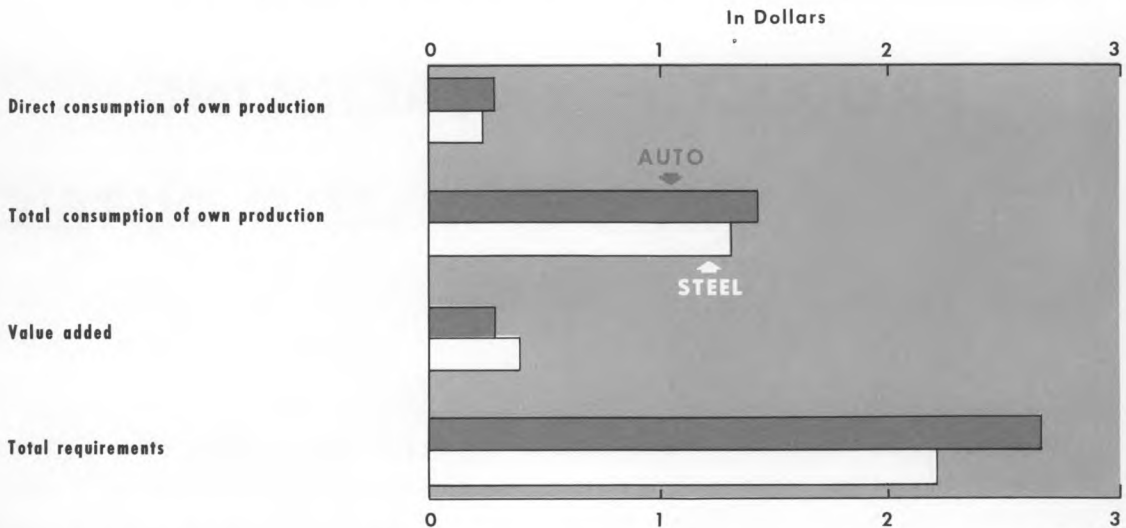
With reference to proportionate allocations of its output, the steel industry is more in excess of the auto industry in the case of gross private fixed capital formation (39.6 percent compared with 24.4 percent) than in any other category. While both industries show relatively large amounts allocated to exports in the input-output tables (1958), it is likely that considerable changes have taken place in these magnitudes in recent years. That is to say, against the background of widely known developments in foreign trade, both steel and autos have been exporting relatively less of their total production. Such a shift highlights one of the disadvantages of the input-output approach, namely, the lag between the year to which the data apply and the date of publication.

ALLOCATION of TOTAL OUTPUT of AUTOS and STEEL to FINAL DEMAND



Source of data: Table B, "The Interindustry Structure of the United States; A Report on the 1958 Input-Output Study," *Survey of Current Business*, November 1964, Office of Business Economics, U.S. Department of Commerce

3.
SELECTED INPUT CHARACTERISTICS of the AUTO and STEEL INDUSTRIES



Source of data: Tables 2, 3, "The Interindustry Structure of the United States; A Report on the 1958 Input-Output Study," *Survey of Current Business*, November 1964, Office of Business Economics, U.S. Department of Commerce

A number of selected input characteristics and relationships are shown in Chart 3. It should be kept in mind, however, that each of the characteristics can be qualified by the particular structure of each industry. For example, Chart 3 indicates that the auto industry leads the steel industry in both the direct and total consumption of its own production per dollar of delivery to final demand. One of the reasons for the larger figure for autos lies in the fact that the industry is characterized by extensive subcontracting, with major firms largely assembling the products of smaller manufacturers or of their subsidiaries. It is doubtful, however, that the auto industry consumes a significant amount of its own cars and trucks.

In addition, the auto industry displays a greater need for total requirements per dollar of delivery to final demand than does the steel industry (\$2.65 compared with \$2.21).

This factor, coupled with the relative "value added" positions, indicates that the initial impact of a commensurate change in production for both industries would be felt more by suppliers to the auto industry.

SUMMARY

The input-output approach reveals the relationships that exist between the steel industry and the rest of the economy. It has been shown that the steel industry consumes a significant portion of its own output for both its direct and total requirements. The remainder of its output is allocated mainly to the construction and manufacturing sectors of the economy with very little allocated directly to the consumer sector. Thus, steel output contributes to the economy primarily through an indirect distribution to the capital goods sector.

TIMBER RESOURCES AND WOOD PRODUCT MANUFACTURING IN THE FOURTH DISTRICT

An article in the May issue of this *Review* discussed some of the broad aspects of the wood-using industries in the United States.¹ The present article is in effect a sequel to the earlier article, and considers both timber resources and wood product manufacturing in the Fourth Federal Reserve District.

The forest resources that remain in the Fourth District are substantial despite the transition in land use that has occurred over the past 150 years. A government inventory² taken in 1958 indicates that approximately 16.7 million acres of land in the District, or one of every three acres, is in growing timber. (See Table I.) The heaviest concentration of timber resources in the Fourth District lies in eastern Kentucky, where 58 percent of the total land area is covered with forest. The lightest concentration is in Ohio where only 21 percent of the land area is forested.

¹ See "Recent Trends in the Wood-Using Industries," *Economic Review*, Federal Reserve Bank of Cleveland, May 1965.

² Compiled jointly by representatives of several divisions of the United States Department of Agriculture under the leadership of the U. S. Soil Conservation Service.

QUALITY OF TIMBER PRODUCTS

All acreage classified as timber land is not equally productive. In addition to overall acreage, factors that affect the productivity of forest resources include the volume of standing timber in the various stages of development and the quality of forest management. While neither of these factors can be measured with precision in the same way that overall acreage can be totaled, some insight may be gained by considering the land ownership.

The vast bulk of forest land in the Fourth District, or slightly over 92 percent of the total, is in privately owned tracts, according to the 1958 inventory.

About two-fifths of private holdings are composed of farm tracts, while about three-fifths are in nonfarm tracts. Individual farm tracts tend to be relatively small since they are only part of larger units devoted mainly to agricultural enterprise. For that reason, farm tracts often present a problem to the owner in the application of efficient timber management techniques. Furthermore, farm wood lots are apt to be of secondary interest to the

TABLE I
Forest Land
Fourth Federal Reserve District

	<u>Ohio</u>	<u>Kentucky^a</u>	<u>Pennsylvania^b</u>	<u>West Virginia^c</u>	<u>Total</u>
Forest land (acres)					
Privately owned	5,163,780	6,084,779	3,724,500	415,900	15,388,959
Publicly owned:					
Federal	109,658	458,468	231,300	none reported	799,426
State, county & municipal	272,000	50,000	201,500	6,083	529,583
Total forest area (acres)	5,545,438	6,593,247	4,157,300	421,983	16,717,968
Total land area (acres)	26,219,896	11,335,040	8,903,600	769,300	47,227,836
Forest land as a percent of total land area	21.1%	58.2%	46.7%	54.9%	35.4%
All privately owned forest land as a percent of total forest area	93.1%	92.3%	89.6%	98.6%	92.1%
Nonfarm privately owned forest land as a percent of total forest area	47.3%	60.4%	68.0%	67.7%	58.2%
Publicly owned forest land as a percent of total forest area	6.9%	7.7%	10.4%	1.4%	7.9%

a 56 eastern counties.
b 19 western counties.
c 6 Panhandle counties.

Sources: Kentucky, Ohio, Pennsylvania, and West Virginia **Soil and Water Conservation Needs Inventory, 1958**, Central States Forest Experiment Station, U. S. Department of Agriculture; Ohio Department of Natural Resources

owner. In contrast, nonfarm tracts, which tend to be much larger on the average, are generally managed specifically for the production of timber products. Such tracts are frequently called "tree farms" since the primary emphasis is on the production of timber products.

Of the 8 percent of forest land in the District that is publicly owned, about 5 percent is in national forests and 3 percent in state, county, and municipally owned tracts. All of the publicly owned lands are under the supervision of trained foresters who endeavor to upgrade the productivity of the tracts in keeping with their inherent potential. Publicly owned tracts may be subject to multiple uses, however, and obviously a site that is intensively used for recreational purposes can not be made to register growth in timber volume comparable to that secured on forest tracts

where such uses are restricted.

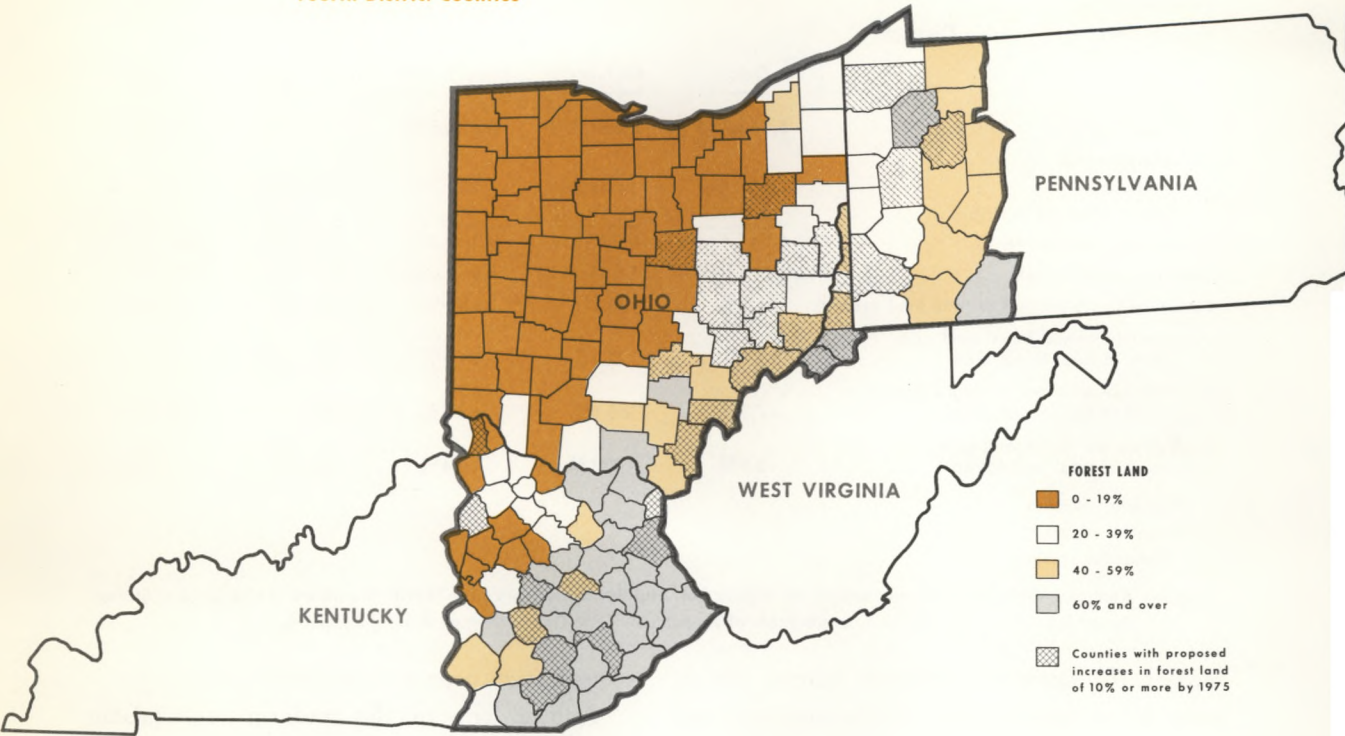
Adding together the nonfarm tracts (about 58 percent of total forest land in the District) and the publicly owned tracts (about 8 percent of the total) it may be roughly estimated that approximately two-thirds of overall timber resources in the Fourth District are under considerably better-than-average management.

DISTRIBUTION AND OUTLOOK

The District's forest land tends to be concentrated in areas that are either unsuited, or less suited than other areas, to the production of cultivated crops. It is in such areas that sufficient land can be acquired at a cost which permits timber production to be economically feasible. That factor helps explain the distribution of forest land within the total land area, as shown in the accompanying map.

FOREST LAND AS A PERCENT OF TOTAL LAND AREA

Fourth District Counties



Source of data: U.S. Department of Agriculture, Soil Conservation Service, Soils and Water Conservation Needs Inventory, Kentucky, Ohio, Pennsylvania, and West Virginia, 1958

Forest land as a percent of the total land area is lowest in the prime agricultural regions of western Ohio and the Central Blue Grass area of Kentucky. A number of counties in those two areas had less than 10 percent of total land area in forest in 1958. Only three counties, however, had less than 4 percent—Bourbon and Fayette Counties in Kentucky, and Fayette County in Ohio. While a further decline in forest land as a percent of total land is likely in many of the more intensively developed agricultural and industrial counties, an increase of 10 percent or more by 1975 in the amount of woodland was indicated for 35 counties by the land inventory

referred to earlier. The counties in which increases in the area of woodland were projected are shown in the accompanying map.³ Special circumstances may modify the outcome of these projections in some counties, but officials associated with the inventory currently expect most of the indicated increases to be realized, thereby strengthening the forest resource base of the District.

³ The location of the counties where a 10 percent or greater increase in woodland area is expected by 1975 is shown in the accompanying map by shading in the form of slanted lines. Such shading is superimposed upon the color which indicates the 1958 classification in terms of the relative importance of woodlands in the total area of the county. (See Key of accompanying map.)

**HARDWOODS DOMINATE
RESOURCE BASE**

Hardwoods abound in the Fourth District, so much so that they are the dominant species in the District's forests. The original hardwood forests, which are said to have occupied over nine-tenths of the land area, were composed of oak-hickory types on the uplands and elm, ash, and cottonwood types on the sites where moisture was in great abundance. These species provided the seed stock for the existing stands of mixed hardwoods in the District.

ANNUAL GROWTH EXCEEDS CUT

Timber production data for the Fourth District alone are not available, but data for 1962 for the four states that are included in the District (Kentucky, Ohio, Pennsylvania, and West Virginia) indicate a wide margin (more than three to one) of net annual growth over annual cut, as shown in Table II. The extent to which growth exceeded cut ranged from about five to one in West Virginia to about two and a half to one in Ohio. Except for Ohio, the margin of growth over cut in the four-state area was considerably above that of both the 25-state Northern Region⁴ and the nation.

Generally speaking, most timber growth is in smaller trees that frequently are of less desirable species, while a major part of timber cut still comes from preferred species of larger diameters. For that reason, the relatively wide margin of annual growth over annual cut holds less promise for the lumber and plywood industries, which utilize only

⁴ The United States is divided into three Forest Regions: North, 25 states; South, 12 states; West, 13 states.

TABLE II

**Net Annual Growth and Cut of Growing Stock on Commercial Forest Land
All Species, 1962**

	Net Annual Growth*	Annual Cut	Annual Growth as a Percent of Annual Cut
	(mil. cu. ft.)	(mil. cu. ft.)	
Pennsylvania	547	177	309%
West Virginia	520	105	495
Kentucky	365	123	297
Ohio	155	61	254
Four-State Total	1,587	466	341
Northern Region	4,836	1,696	285
United States	16,265	10,148	160

*Net annual growth equals the net annual change in volume of sound wood in live saw timber and pole timber trees resulting from natural causes.

Source: Estimates of annual growth and cut taken from "Timber Trends in the United States," U. S. Department of Agriculture, Forest Resource Report No. 7, Feb. 1965

large trees of select species, than for industries such as paper and allied products that are primarily dependent upon wood fiber. Moreover, in the future, a larger proportion of the total new growth of smaller trees will be usable by the paper and allied products industry than was the case earlier. This is because processing methods have been developed that make it possible to use hardwood species as well as the traditional softwood trees for fiber purposes. The paper and allied products industry has, in fact, achieved a significant increase in recent years in the use of hardwoods, up from 14 percent of total timber used in 1950 to 20 percent in 1962.

Recent annual cuts of timber in the four-state area have been of substantial proportions. For example, the 466 million cubic feet cut during 1962 was equal to 27 percent of

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TABLE III
Timber Cut by Product Groups, 1962

	Total Timber Cut (million cu. ft.)	Percent of Total in Each Group					
		Sawlogs	Veneer	Pulpwood	Miscellaneous Industry	Firewood	Log Residues
Pennsylvania	177	34.9%	0.5%	26.4%	15.7%	8.6%	13.9%
West Virginia	105	46.4	0.5	13.5	11.6	13.7	14.4
Kentucky	123	54.4	1.3	4.6	10.6	13.7	15.4
Ohio	61	45.7	2.5	25.5	6.6	8.4	11.3
Four-State Total	466	44.0	1.0	17.6	12.2	11.1	14.1
Northern Region	1,696	34.0	2.3	31.8	8.3	12.9	10.7
United States	10,148	48.6	7.1	23.2	3.7	5.1	12.2

Source: "Timber Trends in the United States," U. S. Department of Agriculture, Forest Resource Report No. 7, February 1965

the total cut in the 25-state Northern Region, which includes the four-state area. Hardwoods accounted for 86 percent of the total quantity of timber cut in the four District states during 1962, a considerably higher proportion than the 67 percent in the Northern Region.

Both supply and demand factors are reflected in the breakdown of timber cut, by area and by product groups, as summarized in Table III. The table shows that sawlogs and pulpwood stand out as major product groups. Together, they account for one-half or more of the total in each of the four states as well as in the Northern Region and in the nation as a whole.

The exceptionally small proportion of timber cut for veneer in the four-state area reflects the limited availability of choice trees suitable for that purpose. On the other hand, the proportion of timber cut in the four-state area for miscellaneous industrial purposes is somewhat higher than in either the Northern Region or in the nation, and probably reflects both the proximity of markets for such prod-

ucts and the availability of hardwood species suitable for such uses. While the proportion of timber cut for pulpwood is not as high in the four-state area as in the Northern Region, it has been increasing rapidly in recent years. In view of the nature of the new growth that is occurring, as mentioned earlier, the proportion of the annual cut for pulpwood is likely to expand in the future.

WOOD-USING INDUSTRIES

Most of the timber cut in Pennsylvania, West Virginia, Kentucky, and Ohio is marketed within the four-state area and thus provides the basis for substantial manufacturing activity. The wood-using industries make up a significant part of the regional economy. Taken together, the three major subgroups of the wood-using industry—(a) lumber and wood products, (b) furniture and fixtures, and (c) paper and allied products—account for about 5 percent of both total manufacturing employment and value added by manufacture in the four states. Moreover, as shown in Table IV, the shares of employment and value

added by the three industries in the four-state area represent a significant percent of the national totals for these industries, or about 11 percent in both cases.

TABLE IV
Employment and Value Added by Wood-Using Industries, 1962

	Four-State Area	U. S.	Four-State Area as a Percent of U. S.
Employment (thousands)			
Lumber & wood products	35	550	6.4%
Furniture & fixtures	45	367	12.3
Paper & allied products	81	580	14.0
Total	161	1,497	10.8
Value added (mil. dol.)			
Lumber & wood products	206	3,606	5.7
Furniture & fixtures	375	2,838	13.2
Paper & allied products	929	7,044	13.2
Total	1,510	13,488	11.2

Source: 1962 Annual Survey of Manufactures, U. S. Department of Commerce

About half (81,000) of the total number employed in the wood-using industries in the four-state area are employed within the Fourth District itself, according to 1962 data assembled from manufacturers' directories.⁵ The largest of the three industries in the District is the paper and allied products industry with 46,000 employees. Next in size is the furniture and fixtures industry with approximately 20,000 employees. The smallest of the three industries is the lumber and wood products industry with total employment of about 15,000. Since the latter industry performs the first processing of the timber produced in the Fourth District, the remainder of the article

⁵Directory of Manufacturers, Kentucky, Ohio, and Pennsylvania.

deals with the lumber and wood products industry. (The furniture and fixtures and the paper and allied products industries will be discussed in subsequent articles.)

LUMBER AND WOOD PRODUCTS INDUSTRIES

The lumber and wood products industry is actually a loose collection of diverse enterprises, including some 12 subindustries as listed in Table V. There is a certain amount of overlapping of function in some of the individual establishments, which makes it difficult to trace shifting trends in the industry. Nonetheless, a number of broad conclusions can be drawn from the limited statistics that are available on a regional basis.

First, there has been marked expansion in

TABLE V
Number of Lumber and Wood Product Establishments

Fourth District*, 1954 and 1962

	1954	1962	Percent Change
Prefabricated building plants	16	46	+187.5%
Logging camp and timber concentrators	31	53	+ 71.0
Miscellaneous wood products	131	155	+ 18.3
Wood preserving	9	9	—0—
Millwork plants	200	164	— 18.0
Veneer and plywood containers	15	12	— 20.0
Sawmills and planing mills	860	642	— 25.4
Boxes and crates	75	52	— 30.7
Veneer and plywood plants	8	5	— 37.5
Hardwood dimension and flooring mills	72	43	— 40.3
Cooperage plants	35	19	— 45.7
Special product mills	45	10	— 77.8
Total	1,497	1,210	— 19.2%

*Excludes West Virginia for which six-county data were not fully comparable.

Source: Directory of Manufacturers, Kentucky, Ohio, and Pennsylvania

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prefabricated building plants and plants producing miscellaneous wood products. This reflects technological and engineering advances in wood utilization that have enabled these plants to serve profitably a specialized market even though the general trend has been toward fewer and more widely diversified operations.

A second development concerns the decline in the number of sawmills and planing mills. For many years it was standard practice to set up a lumber camp and sawmill operation on or near the site where the timber was felled. The same establishment would then handle the timber through several of the initial processing stages. Following this, relatively small specialty establishments would take over subsequent manufacturing operations. The lumber-sawmill itself was usually a portable operation, and limited in size. As the timber supply was depleted in a given area, the portable sawmill would be moved to a new site.

Over time, and especially in recent years, there has been a marked trend toward the use of stationary sawmills in place of portable mills. Stationary mills are larger in capacity than portable mills and operators can make greater use of mechanized materials-handling and sawing equipment. Use of such equipment not only permits a greater degree of efficiency in converting timber into lumber and other wood products, but contributes significantly to the safety of mill employees. The relatively large investment involved in log-handling equipment, debarking machines, wood chippers, and other equipment needed to secure a high percentage of marketable products out of each log is an important factor

in the trend toward permanent installations. Permanent installations also make it more practical to use electrically powered equipment. Concurrent with these developments, of course, has been the rapid expansion in express highways and over-the-road transportation equipment which has broadened the accessibility of such mills to forest areas.

Thus, the substantial decline in number of establishments of other lumber and wood products industries in the District from 1954 to 1962, as shown in Table V, can in large part be attributed to the modernization and diversification that has occurred in recent years.

A third conclusion involves the fact that, along with the trend to fewer but stationary sawmills, there has been increased use of entrepreneurs known as timber concentrators or log suppliers. The latter assemble sawlogs, veneer logs, and pulpwood for resale to sawmills, planing mills, veneer plants, and pulp mills for processing. As shown in Table V, the number of logging camp and timber concentrators has had a large proportionate increase at the same time that the number of sawmills has been declining. The usefulness of a timber concentrator, however, is subject to several limitations, aside from whether or not the sawmill is a portable or permanent installation. The value of the end product and the nature of raw material requirements influence the distance over which a firm draws its raw material. The following tabulation of procurement areas, by type of industry, from a study conducted in Kentucky by the U. S. Forest Service, is indicative of the variation in procurement areas.

Type of Industry	Average Radius of Procurement Area ^a (miles)
Post and prop	29
Charcoal	30
Pulpwood	33 ^b
Sawmill	38
Cooperage	72
Handle	77
Poles and piling	103
Veneer	245

^a Weighted by volume procured.

^b Distance to concentration yard.

Source: "Primary Wood Industries in Kentucky," U. S. Department of Agriculture, Forest Service, Central States Forest Experiment Station

The overall decline in the number of lumber and wood product establishments in the Fourth District states has apparently been offset by increased size of individual establishments, along with a tendency to greater integration of functions within fewer plants.

Employment in the lumber and wood products industry in the four-state area has also declined in recent years, as indicated in Table VI. The rate of decline, however, is close to that which occurred in the nation, suggesting that the reduction is due to industry-wide phenomena, including such fac-

TABLE VI
Employment and Value Added in Lumber and Wood Products Industry, 1954 and 1962

	Four-State Area			United States		
	1954	1962	Percent	1954	1962	Percent
			Change			Change
Employment (thous.)	40.8	35.4	-13%	646	550	-15%
Value Added (mil. dol.)	168	206	+22	3,242	3,606	+11

Source: 1962 Annual Survey of Manufactures, U. S. Department of Commerce

tors as changes in output per man-hour, rather than to purely regional phenomena.

In contrast to the decline in employment, the lumber and wood products industry in the four-state area showed a gain of 22 percent between 1954 and 1962 with respect to value added by manufacture, which compares favorably with a rise of only 11 percent nationally. Available evidence thus suggests that within the four-state area, the record of the lumber and wood products industry is at least as favorable as that for the nation as a whole.

CAPITAL SPENDING PLANS IN THE CLEVELAND AREA

During the second half of 1965, capital spending by manufacturing concerns and public utilities in the Cleveland metropolitan area is expected to exceed actual expenditures made during the second half of last year by about 6 percent, according to returns from a survey conducted in April by this Bank.¹

This increase is in line with recently published results of national surveys, which show that capital outlays in the nation are expected to continue to rise throughout 1965. Although actual percentages of anticipated year-to-year increases in total spending are somewhat smaller in the Cleveland area than in the country as a whole, a general mood of optimism may be sensed from the fact that the level of spending expected during the first half of 1965 in the most recent replies is higher than it had been estimated in last fall's survey. In over one-half the cases where consecutive replies were received, the more recent estimate exceeds the earlier one; the net difference overall amounts to a 14 percent increase in the dollar total, even though there were a considerable number of downward revisions.

Firms participating in the spring survey expect to make capital outlays totaling \$135 million in the first half of this year and \$144

million in the second half. While these dollar totals are not a measure of the absolute level of expenditures made or anticipated by all business firms in the area,² they serve as an indicator of relative size and direction of changes in capital spending.

The distribution—by industry—of the total amounts spent or expected to be spent by participating firms in each of the three half-year periods covered by the spring survey—from July 1964 through December 1965—is shown in Table I. As in the previous survey, the data tend to be somewhat overbalanced by durable goods manufacturing since the replies cover a larger proportion of the durable goods sector than of the nondurable goods sector, in terms of employment. Within the durable goods group, replies for several individual industries represent an even larger proportion of total employment in those industries, notably primary metals and transportation equipment, due to the predominance of large-size enterprises.

This uneven distribution, which should be kept in mind when the aggregate figures for all manufacturing and its two major sectors are considered, does not gainsay the fact that the durable goods industries are expected to supply the major thrust to capital expenditures in the Cleveland area during the remainder of this year. As Table II indicates,

¹ A detailed description of the semiannual survey of capital spending in the Cleveland area can be found in the January 1965 issue of the *Economic Review*, pp. 15-20.

² See January 1965 issue of the *Economic Review*.

TABLE I
Capital Spending Reported by Cleveland Area Firms in April 1965

Percent Distribution by Industry

	1964 (2nd half) (actual)	1965 (1st half) (planned)	1965 (2nd half) (planned)
MANUFACTURING	67.7%	66.5%	67.7%
Durable goods	57.6	59.6	62.9
Primary metals	30.5	27.0	32.5
Metal fabrication	4.7	4.8	3.4
Machinery	4.0	5.4	5.4
Electrical equipment	2.0	2.5	2.2
Transportation equipment	14.7	18.1	17.1
Others	1.7	1.7	2.0
Nondurable goods	10.1	6.9	4.8
Textiles; apparel	4.3	0.7	0.6
Printing and publishing	2.4	2.3	0.5
Chemicals	2.5	3.0	2.7
Rubber and plastics	0.8	0.7	0.6
Others	0.1	0.2	0.3
PUBLIC UTILITIES	32.3	33.5	32.3
TOTAL	100.0%	100.0%	100.0%

Source: Federal Reserve Bank of Cleveland

four of the five major industries in the durable goods sector expect to spend from 13 to 46 percent more in the second half of 1965 than actual amounts spent during the corresponding period of last year, for an average increase of 16 percent for the group. By contrast, spending plans in most of the nondurable goods industries for this year are much lower than last year's actual expenditures, reflecting the fact that sizable expansion projects by some large firms in textiles and printing are nearing completion. Public utilities expect to exceed last year's spending by 6 percent during the second half of the year.

Of every six dollars to be spent by manufacturing firms during the second half of this year, five are earmarked for equipment pur-

chases while one dollar will go toward plant construction, as Table III indicates.³ Most of the individual industries in the nondurable goods group expect even more than five-sixths of their total outlays to be spent for machinery while most of the durable goods industries indicate a division of expenditures somewhat more favorable to plant construction. Compared with actual spending in 1964, plans for 1965 show rising proportions for equipment purchases in the nondurable goods sector — reflecting the equipment phase in the expansion program of several large firms — and declining proportions in the durable goods sector, except for the primary metals industry.

Public utilities — where the distinction between plant and equipment is not clear in all

TABLE II
Capital Spending Plans of Cleveland Area Firms for 2nd Half of 1965

Percent Change from Actual Spending in 2nd Half of 1964

MANUFACTURING	+ 6%
Durable goods	+16
Primary metals	+13
Metal fabrication	-23
Machinery	+46
Electrical equipment	+19
Transportation equipment	+26
Nondurable goods	-50
Textiles; apparel	-84
Printing and publishing	-80
Chemicals	+18
Rubber and plastics	-18
PUBLIC UTILITIES	+ 6
TOTAL	+ 6%

Source: Federal Reserve Bank of Cleveland

³ Percentages shown in Tables III and IV are based on less than the entire sample since some of the replies did not contain necessary detail information.

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TABLE III

Capital Spending of Cleveland Area Firms

Percent Distribution Between Plant and Equipment,
2nd Half of 1964 and 2nd Half of 1965

	Plant		Equipment	
	1964	1965	1964	1965
MANUFACTURING	18%	16%	82%	84%
Durable goods.	14	15	86	85
Primary metals.	16	9	84	91
Metal fabrication	12	24	88	76
Machinery	8	33	92	67
Electrical equipment	34	35	66	65
Transportation equipment	8	18	92	82
Nondurable goods	36	20	64	80
Textiles; apparel	15	6	85	94
Printing and publishing	81	0	19	100
Chemicals	33	32	67	68
Rubber and plastics.	27	9	73	91
PUBLIC UTILITIES	35	25	65	75
TOTAL	24%	19%	76%	81%

Source: Federal Reserve Bank of Cleveland

cases—plan to spend three dollars out of every four on equipment in 1965, which is somewhat more than last year's proportion of equipment to total spending.

Data furnished in the replies on capacity utilization—a concept admittedly difficult if not impossible to quantify—do not suggest that many plants are currently operating at maximum capacity. Nevertheless, capital expenditures for the purpose of expanding present production facilities are planned by many firms. As Table IV indicates, individual industries expect to spend from 30 percent to over 90 percent of their total outlay for expansion in the second half of this year. The distribution of funds between modernization and expansion of facilities does not seem to follow a recognizable pattern either among industries or in the direction of change from 1964 to 1965. Again, the domination of the figures for textiles and printing by the individual

TABLE IV

Capital Spending of Cleveland Area Firms

Percent Distribution Between Replacement and
Expansion, 2nd Half of 1964 and 2nd Half of 1965

	Replacement		Expansion	
	1964	1965	1964	1965
MANUFACTURING	57%	61%	43%	39%
Durable goods.	66	64	34	36
Primary metals.	68	69	32	31
Metal fabrication	41	23	59	77
Machinery	66	41	34	59
Electrical equipment	65	70	35	30
Transportation equipment	60	52	40	48
Nondurable goods	18	35	82	65
Textiles; apparel	2	17	98	83
Printing and publishing	4	8	96	92
Chemicals	51	35	49	65
Rubber and plastics.	28	29	72	71
PUBLIC UTILITIES	26	32	74	68
TOTAL	47%	52%	53%	48%

Source: Federal Reserve Bank of Cleveland

spending decisions of several large establishments completing sizable expansion programs is much in evidence.

The utilities expect to continue to spend more for expansion than for replacement of their facilities in 1965.

Virtually all participants in the survey are planning to finance this year's capital expenditures without recourse to external sources of funds.

It is tempting to compare Cleveland area data on capital spending with national spending plans in somewhat greater detail than was done at the beginning of this report. However, the fact that short-term differences between regional and national figures reflect such factors as coverage, timing, and geographical allocation of outlays by large nationwide corporations, and thus need not necessarily be significant in terms of growth, discourages such a comparison.

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