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A NOTE ON PRIVATE PENSION PLANS

Since 1875, when the first private pension plan was established in the United States, the number of pension plans has increased dramatically. About 158,000 private pension plans are registered with the Department of Labor, with approximately 10,000 new plans being formed each year. At present, private pension plans cover about 30 million persons, or slightly less than half of the civilian labor force; government pension plans cover roughly another 11 million persons.¹ Consequently, through the accumulation of savings and the provision of retirement income, pension plans in general extend a degree of security to some 40 million persons. The pools of savings channeled through pension plans are an important source of funds in the capital markets.

This paper examines some economic and financial aspects of pension plans. The paper

¹ Government pension plans include those of state and local retirement systems, those covering Federal civilian employees, the Railroad Retirement System, and all other governmental programs, with the exception of the national social security program.

is divided into three parts: the development of pension plans; some of the effects of pension plans on the economy; and an analysis of the investment policy of noninsured corporate pension plans.

BACKGROUND

A number of separate and distinct factors, including Congressional legislation, an economic depression, a large-scale war, and a Supreme Court ruling, affected the development of pension plans in the United States. During the Great Depression, the Federal Old Age and Survivors' Insurance program established a retirement plan for all workers under age 65 in covered employment in commerce and industry (except railroads). The introduction of a national social security plan contributed to increased public acceptance of the concept of private pension plans.

During World War II, the use of pension plans became widespread, in part because employer contributions to pension plans were used as an additional form of employee compensation during a period of wage controls.

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Moreover, employers could deduct contributions to pension plans from high wartime income taxes. By 1945, private retirement plans covered 6.4 million persons, or 50 percent more persons than were covered five years earlier.²

Another major development occurred in 1949 when the Supreme Court refused to review a lower court decision that required employers to bargain on the issue of pension plans.³ The extent to which labor unions and collective bargaining have influenced the number and coverage of pension plans is of course unknown. Nevertheless, the number of persons covered by private pension plans increased from 9.8 million in 1950 to 21.2 million in 1960. In recent years, the rate of growth in the number of persons covered by private pension plans has moderated.

Pension plans were extended to self-employed persons by the Self-Employed Individuals' Tax Retirement Act of 1962 (the Keogh Act), which was designed to encourage self-employed persons to establish voluntary retirement plans. These plans cover both self-employed persons and their employees. More than 7 million self-employed persons could potentially establish retirement plans under this legislation. In 1965, nearly 50,000 self-employed individuals contributed to Keogh plans, an increase of 28 percent

over the number contributing in 1964.⁴ Available data suggest that the number of Keogh plans has continued to grow rapidly since 1965. According to the Institute of Life Insurance, there were 29,720 *insured* Keogh plans at yearend 1967, nearly double the number of insured plans at yearend 1966.⁵ Comparable data are not available for *non-insured* Keogh plans. A recent liberalization of tax deductions allowable under the Keogh law is expected to stimulate further growth in the number of retirement plans for the self-employed.

EFFECTS ON THE ECONOMY

Individuals' Savings. Pension funds affect both the amount and the nature of individuals' savings (the composition of financial assets held by individuals). For many individuals, saving through pension funds is compulsory because individuals are required by company policy to participate in retirement plans. Such savings are typically contractual, long term, and not readily accessible.

Savings accumulated through pension plans, measured by the amount of pension fund reserves, increased from \$10 billion in 1945 to \$182 billion in 1967. Looking at it in another way, pension fund reserves were equivalent to 11 percent of total financial assets held by households in 1967, an increase of more than 8 percentage points over the 1945 level.

Interestingly, the growth in savings through pension plans does not appear to have re-

² *Public Policy and Private Pension Programs*, U. S. President's Committee on Corporate Pension Funds and Other Private Retirement and Welfare Programs (Washington, D. C., January 1965), Table I.

³ *Inland Steel Co. vs. National Labor Relations Board*, 170 F. 2d 247 (7th cir. 1948), Cert. Denied, 336 U. S., 960 (1949).

⁴ U. S. Treasury Department, *Statistics of Income 1965 Individual Income Tax Returns*.

⁵ *The Tally*, Institute of Life Insurance, May 1968.

duced some other forms of savings.⁶ In fact, coverage by pension plans seems to stimulate additional savings,⁷ because, as a general matter, people with some savings try to gain additional savings. That is, the more savings individuals have, the more individuals tend to want to accumulate. The results of one study indicate that the amount of additional savings varies with the amount of vested rights and the size of pension contributions,⁸ suggesting that some individuals consider only the vested portion of the pension plan as a form of saving. In 1967, 70 percent of all private pension plans had some form of vesting.⁹ Of these, nearly one-third had full vesting with 10 years or less of employee service.

Saving through pension plans does pose some element of risk. For example, between 1955 and 1965, about 4,300 pension plans involving 225,000 people were terminated.¹⁰

⁶ Phillip Cagan, *The Effect of Pension Plans on Aggregate Saving: Evidence from a Sample Survey*, Occasional Paper 95, National Bureau of Economic Research (New York, 1965), p. 82.

⁷ George Katona, *Private Pensions and Individual Saving*, Monograph No. 40, Survey Research Center Institute for Social Research, The University of Michigan (Ann Arbor, 1965), p. 90.

⁸ Cagan, *op. cit.*, p. 84.

⁹ Detailed Statement of Thomas R. Donahue, Assistant Secretary of Labor, before the Subcommittee on Labor of the Senate Committee on Labor and Public Welfare on the Pension Benefit Security Act (S. 3421) and the Welfare and Pension Plan Protection Act (S. 1024) (July 25, 1968), Exhibit C, p. 7.

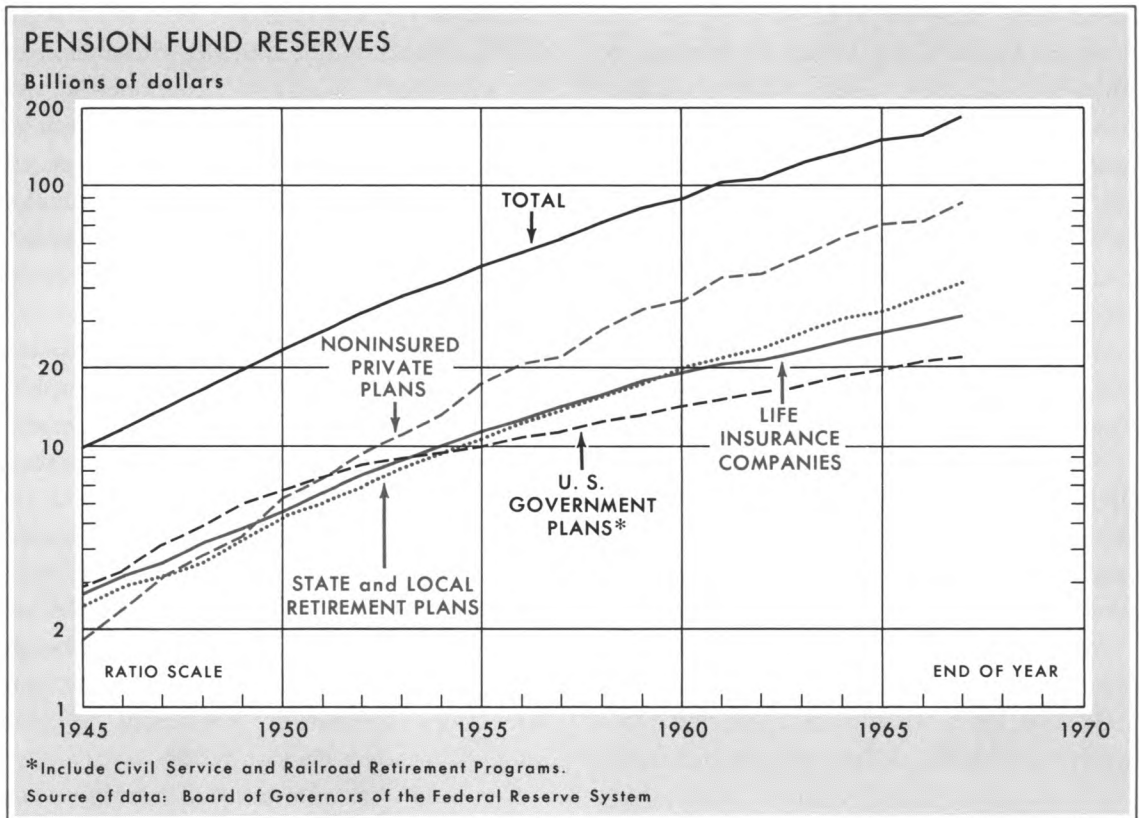
¹⁰ Highlights of the Testimony of Thomas R. Donahue, Assistant Secretary of Labor, before the Subcommittee on Labor of the Senate Committee on Labor and Public Welfare on the Welfare and Pension Plan Protection Act (S. 1024) and the Pension Benefit Security Act (S. 3421) (July 25, 1968), p. 16.

Forty-four percent of those terminated were due to financial difficulties or dissolution of the employer's business. Experience shows that employees may lose some of their savings if there are insufficient assets to meet all vested benefits when pension plans terminate. Even if a pension plan does not terminate, however, employees may not necessarily receive the pension indicated.¹¹

Investment Policies. In addition to the influence on individuals' savings, pension funds, as institutional investors, are important suppliers of funds to the capital markets. As previously noted, total pension fund reserves (assets) amounted to \$182 billion in 1967, compared with \$10 billion in 1945 (see chart). The increased value of total reserves not only reflects the greater number of persons covered under pension plans, but also more aggressive investment policies adopted by some pension funds.

The bulk of private pension fund reserves has traditionally been invested in a wide array of debt instruments, such as Federal and state and local government obligations, corporate bonds, and mortgages. In contrast, the reserves of U. S. Government retirement funds—Civil Service and Railroad Retirement—are primarily invested in U. S. Government debt obligations.

¹¹ For example, as reported in Congressional testimony, if "you [the employee] remain in good health and stay with the same company until you are 65 years old, and if the company is still in business, and if your department has not been abolished, and if you haven't been laid off for too long a period, and if there's enough money in the fund, and that money has been prudently managed, you will get a pension." See Donahue (Detailed Statement) *op. cit.*, p. 2.



Investments in equities (corporate stocks) are becoming more important in the portfolios of private pension funds. For example, equity investments of noninsured private pension funds represented 61 percent of total assets in 1967, compared with 11 percent in 1945.¹² (Not surprisingly, the major retirement systems of states increased their holdings of equity investments from less than 3 percent of total investments in 1961 to nearly 7 percent in 1967.¹³ Recent legal changes have

allowed some state retirement systems greater latitude in equity investments.)

Until very recently, insured private pension fund reserves in most states were commingled with other assets of insurance companies. However, life insurance companies in most states can now maintain separate investment accounts for insured private pension plans, resulting in a wider range of investment opportunities for insured pension plans than for insurance companies in general. Although data are not available covering only the investments of insured pension fund reserves, it is known that, in 1967, equity investments accounted for nearly 7 percent of total financial assets of insurance companies, an in-

¹² *Flow of Funds Accounts, 1945-1967*, Board of Governors of the Federal Reserve System, February 1968.

¹³ *State and Local Pension Funds 1968*, Investment Bankers Association of America (Washington, D.C., 1968), p. 7.

crease of about 5 percentage points over the 1945 figure.¹⁴

The change in the composition of pension fund portfolios influenced the growth rate of pension fund reserves. As shown in the chart, in recent years, the reserves of noninsured private pension funds increased at a faster rate than those of state and local government retirement programs, life insurance companies, and the U. S. Government pension programs. At yearend 1967, reserves of noninsured private pension funds amounted to \$87 billion, almost one-half of the total reserves of all pension funds. State and local government retirement plans accounted for slightly less than one quarter of total reserves, followed by life insurance companies and U. S. Government retirement programs. In contrast, in 1945, U. S. Government retirement programs accounted for the largest dollar volume, followed by life insurance companies, state and local government plans, and noninsured private pension plans.

NONINSURED PRIVATE PENSION FUNDS

Private pension funds are obviously assuming a more important role as financial institutions and in the capital markets. Accordingly, it may be helpful to take a closer look at the investment policies of such funds. The reserves of noninsured private pension funds are almost completely accounted for by the reserves of noninsured corporate pension funds, for example, over 90 percent in 1966. In order to make use of more complete data, the discussion that follows is limited to the 1955-1966 period.

¹⁴ *Flow of Funds Accounts, 1945-1967*, Board of Governors of the Federal Reserve System, February 1968.

In theory, the investment policy of corporate pension funds is a relatively simple matter, since most corporate pension funds enjoy a steady inflow of contributions from employers and employees, and outflows of funds are highly predictable. Both contributions and disbursements are contractual in nature and cannot be changed in the short run. Therefore, investments can be made with the primary objective of providing sufficient income to cover present and future outlays.

The relationship between disbursements and contributions is important. If disbursements exceed contributions, total assets will have to be drawn down by an amount roughly equal to the excess. During the 1955-1966 period, the ratio of disbursements to contributions for noninsured corporate pension funds almost doubled, increasing from 22.8 percent in 1955 to 44.3 percent in 1966. At the same time, however, the market value of total assets of these funds almost quadrupled, increasing from \$17.5 billion in 1955 to \$64.9 billion in 1966. The increased market value of total assets resulted from changes in portfolio policies, rising levels of stock prices, and higher market rates of interest.

Ratio of Disbursements to Contributions

1955	22.8%	1961	34.3%
1956	24.0	1962	38.6
1957	24.4	1963	40.5
1958	23.4	1964	40.5
1959	28.9	1965	41.2
1960	30.8	1966	44.3

Investments. Two outstanding features of recent shifts in portfolio policies are (1) the increased emphasis on common stock investments, and (2) the different types of debt instruments acquired. Net annual purchases

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of common stock by private noninsured pension funds increased from \$0.6 billion in 1955 to \$3.6 billion in 1966. As mentioned previously, corporate pension funds account for the bulk of the assets of private noninsured pension funds. As shown in the table, common stocks replaced corporate bonds as the largest type of investment holding of corporate pension funds during the period under review. In 1966, common stocks accounted for nearly 55 percent of the market value of all assets of corporate pension funds, an increase of almost 24 percentage points over the 1956 proportion. The market value of common stocks held by pension funds increased in each year, except 1962 and 1966, when stock prices declined sharply (see table). (These declines in the stock market also help to explain the small increase in the market value of total assets in 1962 and the decline in 1966.) More importantly, rising stock prices are reflected in the substantial excess of market value of common stocks over book value (see table) and explain the increased market value of total assets in recent years.

As common stock investments became more important, the proportion of most debt instruments held by corporate pension funds experienced a marked decline. As shown in the table, holdings of U. S. Government securities and corporate bonds, expressed as a percent of total book value, declined appreciably. Similarly, holdings of preferred stocks (which have characteristics that are similar to some debt instruments) became less important, although the relative importance is not as significant as other types of assets. In contrast, although small in magnitude, mortgage investments became relatively more

important, increasing as a percent of total book value.

The reduced share of debt instruments held by corporate pension funds benefited the market value of total assets. During the period under review, the level of market rates of interest on balance moved irregularly but inexorably upward. The changes in the level of market rates of interest are important for two reasons: (1) higher interest rates on new investments added to investment income of corporate pension funds; and (2) the market value (price) of debt instruments declined (market value of debt instruments varies inversely with market rates of interest). As shown in the table, the market value of corporate bond holdings by corporate pension funds was well below book value (cost) throughout the period under review. Similarly, the market value of U. S. Government securities was depressed, but by a smaller margin than that of corporate bonds. Because the proportion of U. S. Government securities held was reduced, such securities "subtracted" less from the market value of total assets than would have otherwise been the case.

CONCLUDING COMMENTS

A number of important economic implications are associated with the development of pension plans in the United States. Some of the more important points can be summarized as follows. First, over 40 million persons now covered by pension plans have a means of accumulating savings for retirement when money income frequently is reduced. As a general matter, pensions are an important part of the financial resources available to persons reaching retirement age, which in

**Assets of Noninsured Corporate Pension Funds
Yearend 1955-1966**

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Market Value (mil. of \$)												
Cash and deposits	n.a.	\$ 332	\$ 368	\$ 397	\$ 419	\$ 431	\$ 517	\$ 542	\$ 585	\$ 687	\$ 710	\$ 664
U. S. Government securities	n.a.	2,192	1,987	1,968	2,103	2,122	2,134	2,341	2,389	2,433	2,344	2,133
Corporate bonds	n.a.	7,904	9,784	11,236	11,794	13,687	14,815	16,172	17,327	18,845	19,682	19,980
Preferred stock	n.a.	524	550	639	627	638	649	649	622	581	672	663
Common stock	n.a.	5,648	6,024	10,241	13,096	14,968	20,910	20,036	25,481	31,070	36,842	35,556
Mortgages	n.a.	n.a.	n.a.	512	708	924	1,107	1,389	1,654	2,098	2,577	2,774
Other assets	n.a.	n.a.	n.a.	969	1,094	1,304	1,497	1,693	2,009	2,417	2,723	3,133
Total	n.a.	\$17,565	\$19,857	\$25,962	\$29,841	\$34,073	\$41,629	\$42,821	\$50,068	\$58,131	\$65,550	\$64,903
Book Value (mil. of \$)												
Cash and deposits	\$ 343	\$ 332	\$ 368	\$ 397	\$ 419	\$ 431	\$ 517	\$ 542	\$ 585	\$ 687	\$ 710	\$ 664
U. S. Government securities	2,536	2,293	2,032	2,070	2,257	2,142	2,174	2,354	2,426	2,461	2,410	2,165
Corporate bonds	7,225	8,704	10,392	12,143	13,262	14,687	15,719	16,718	18,054	19,455	20,741	22,423
Preferred stock	510	570	611	689	696	696	682	667	627	570	656	697
Common stock	2,958	3,774	4,770	6,456	8,228	10,161	12,624	14,901	17,122	19,679	23,153	26,693
Mortgages	146	230	313	511	710	921	1,103	1,376	1,638	2,080	2,572	2,862
Other assets	511	736	833	967	1,096	1,305	1,483	1,675	1,975	2,353	2,648	3,157
Total	\$14,230	\$16,639	\$19,319	\$23,234	\$26,667	\$30,343	\$34,302	\$38,233	\$42,427	\$47,285	\$52,890	\$58,661
Market Value as Percent of Book Value												
Cash and deposits	n.a.	n.a.	n.a.	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
U. S. Government securities	n.a.	95.6%	97.8%	95.1	93.2	99.1	98.2	99.4	98.5	98.9	97.3	98.5
Corporate bonds	n.a.	90.8	94.2	92.5	88.9	93.2	94.2	96.7	96.0	96.8	94.9	89.1
Preferred stock	n.a.	91.9	90.0	92.7	90.1	91.7	95.2	97.3	99.2	101.9	102.4	95.1
Common stock	n.a.	149.7	126.3	158.6	159.2	147.3	165.6	134.5	148.8	157.9	159.1	133.2
Mortgages	n.a.	n.a.	n.a.	100.2	99.7	100.3	100.4	100.9	101.0	100.9	100.2	96.9
Other assets	n.a.	n.a.	n.a.	100.2	99.8	99.9	100.9	101.1	101.7	102.7	102.8	99.2
Total	n.a.	105.6%	102.8%	111.7%	111.9%	112.3%	121.4%	112.0%	118.0%	122.9%	123.9%	110.6%
Type of Asset as Percent of Book Value												
Cash and deposits	2.4%	2.0%	1.9%	1.7%	1.6%	1.4%	1.5%	1.4%	1.4%	1.5%	1.3%	1.1%
U. S. Government securities	17.8	13.8	10.5	8.9	8.5	7.1	6.3	6.2	5.7	5.2	4.6	3.7
Corporate bonds	50.8	52.3	53.8	52.3	49.7	48.4	45.8	43.7	42.6	41.1	39.2	38.2
Preferred stock	3.6	3.4	3.2	3.0	2.6	2.3	2.0	1.7	1.5	1.2	1.2	1.2
Common stock	20.8	22.7	24.7	27.8	30.9	33.5	36.8	39.0	40.4	41.6	43.8	45.5
Mortgages	1.0	1.4	1.6	2.2	2.7	3.0	3.2	3.6	3.9	4.4	4.9	4.9
Other assets	3.6	4.4	4.3	4.2	4.1	4.3	4.3	4.4	4.7	5.0	5.0	5.4
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Type of Asset as Percent of Market Value												
Cash and deposits	n.a.	n.a.	n.a.	1.5%	1.4%	1.3%	1.2%	1.3%	1.2%	1.2%	1.1%	1.0%
U. S. Government securities	n.a.	12.5%	10.0%	7.6	7.0	6.2	5.1	5.5	4.8	4.2	3.6	3.3
Corporate bonds	n.a.	45.0	49.3	43.3	39.5	40.1	35.6	37.8	34.6	32.4	30.0	30.8
Preferred stock	n.a.	3.0	2.8	2.5	2.1	1.9	1.6	1.5	1.2	1.0	1.0	1.0
Common stock	n.a.	32.2	30.3	39.4	43.9	43.9	50.2	46.8	50.9	53.4	56.2	54.8
Mortgages	n.a.	n.a.	n.a.	2.0	2.4	2.7	2.7	3.2	3.3	3.6	3.9	4.3
Other assets	n.a.	n.a.	n.a.	3.7	3.7	3.8	3.6	4.0	4.0	4.2	4.2	4.8
Total	n.a.	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

n.a. Not available.

NOTE: Details may not add to totals because of rounding.

Source: Securities and Exchange Commission

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turn helps to redistribute income downward.¹⁵ In addition, when such plans have vested benefits, pension plans increase labor mobility.¹⁶ On the other hand, the lack of vested benefits acts as a deterrent to mobility, especially for highly skilled professional, technical, and other white-collar workers. Finally, pension

¹⁵ See U. S. Department of Labor, "Private Pension Plan Benefits," Bulletin No. 1485 (Washington, D. C., 1966), p. 12; U. S. Department of Health, Education, and Welfare, "The Economic Status of the Retired Aged in 1980: Simulation Projections," *Social Security Administration Research Report No. 24* (Washington, D. C., 1968); and Peter O. Steiner, "The Size, Nature, and Adequacy of Resources of the Aged," *American Economic Review*, May 1954.

¹⁶ "Public Policy and Private Pension Programs," *op. cit.*, pp. 27-29, 40-42.

funds are playing a greater role in the capital markets, generally, and in the stock market, in particular. For example, during the 1955-1967 period, private noninsured pension funds accumulated more corporate stock than any other type of financial institution.¹⁷ In fact, during that period, private noninsured pension funds accounted for about two-thirds of the total net purchases of common stock by financial institutions. Of course, the market value of the reserves of pension funds has become more sensitive to the vagaries of the stock market.

¹⁷ Securities and Exchange Commission. Financial institutions include open-end investment companies, insurance companies (life, casualty, and property), and private noninsured pension funds.



FREIGHT TRANSPORTATION AND INDUSTRIAL ACTIVITY IN THE FOURTH DISTRICT

The Fourth District contains about 8 percent of the population in the United States, but accounts for about 11 percent of the nation's value added by manufacture. In view of the relatively heavy concentration of industry, it is not surprising that transportation systems in the Fourth District are highly developed. Moreover, the industrial characteristics of the Fourth District appear to have influenced considerably the development and relative use of the various individual modes of freight transportation—rail, highway, water, air, and pipeline—as has the location of customers, and thus the average distances over which commodities are moved.

This article traces the effects of industrial composition in the Fourth District, as well as patterns of freight destinations and distance of shipment, on the use of the modes of freight transportation.¹

¹ Basic data used in this article are from the 1963 *Census of Transportation*, which furnishes information on shipments of manufactured commodities. Pipeline transportation is not discussed because the data only cover manufactured goods.

COMPOSITION OF FREIGHT SHIPMENTS

In 1963, the commodity composition of manufacturers' shipments from the Fourth District differed substantially from that in the United States as a whole, reflecting the dominance of metal-producing and metalworking industries in the District.² As shown in Table I, the five industries that accounted for the

² Analysis of the composition of industrial activity is hampered by inadequate data on value added by manufacture by class of commodity for many Standard Metropolitan Statistical Areas in the Fourth District. In addition, comparison of total value added by manufacture with total freight shipments originated in each of the four Census production areas located in the District suggests little relationship between the two measures of industrial activity at this level (unlike the broad similarities existing between them on the basis of the much larger Census regions discussed in "Regional and Interregional Patterns in Freight Transportation and Industrial Activity," *Economic Review*, Federal Reserve Bank of Cleveland, Cleveland, Ohio, September 1968). Ratios of value added to tonnage shipped, for example, vary widely among the four areas: implied value added per ton shipped was about \$217 in Production Area 11, \$104 in Production Area 12, \$260 in Production Area 13, and \$326 in Production Area 14 (for description of production areas see Table I).

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TABLE I
Commodity Composition of Freight Shipments
United States and Production Areas in the Fourth District*
1963

Class of Commodity	United States	Area 11	Area 12	Area 13	Area 14
All commodities (Thous. of tons)†	1,334,838	31,934	33,502	35,443	12,061
Food products	15.3%	2.4%	‡	7.8%	18.0%
Furniture and fixtures	0.6	1.1	‡	‡	‡
Pulp and paper products	4.6	2.9	‡	‡	11.5
Chemicals and allied products	10.1	20.3	3.5%	12.4	4.5
Petroleum and coal products	28.3	2.4	‡	5.4	‡
Rubber and plastics products	0.7	2.9	‡	0.8	0.9
Stone, clay, and glass products	12.3	5.5	8.9	‡	‡
Primary metals	9.7	34.7	65.5	15.6	23.2
Fabricated metals	2.5	6.2	8.4	2.5	4.3
Nonelectrical machinery	1.7	8.5	1.5	2.7	6.2
Electrical machinery	0.8	0.8	0.8	1.0	3.5
Transportation equipment	2.7	8.1	‡	31.7	13.5
Instruments	0.1	0.1	‡	0.2	0.1

* Production areas in the Fourth District include the following Standard Metropolitan Statistical Areas:

Production Area 11. Cleveland, Ohio; Akron, Ohio; Canton, Ohio; Lorain-Elyria, Ohio; Youngstown-Warren, Ohio; and Erie, Pennsylvania.

Production Area 12. Pittsburgh, Pennsylvania; Steubenville-Weirton, Ohio-West Virginia; and Wheeling, West Virginia-Ohio.

Production Area 13. Detroit, Michigan; Flint, Michigan; Toledo, Ohio-Michigan; and Ann Arbor, Michigan.

Production Area 14. Cincinnati, Ohio-Kentucky-Indiana; Dayton, Ohio; Hamilton-Middletown, Ohio; and Springfield, Ohio.

† Includes commodity classes not shown separately.

‡ Data not shown separately in 1963 *Census of Transportation*.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

greatest shares of manufacturers' shipments in the nation were petroleum and coal products; food products; stone, clay, and glass products; chemicals and allied products; and primary metal products. In contrast, the most important commodities shipped from the four Census production areas in or bordering the Fourth District (for description of production areas see Table I) were primary metal products, transportation equipment, chemicals, fabricated metal products, and nonelectrical machinery. In fact, shipments from the four production areas under review accounted for nearly 32 percent of the nation's domestic freight traffic in primary metals, a similarly high but undeterminable proportion

of shipments of transportation equipment, and more than 22 percent of total shipments of nonelectrical machinery, 18 percent of fabricated metal products, 12 percent of electrical machinery, and 9 percent of chemicals and allied products.

The primary metal industries accounted for 34.7 percent of shipments from the Cleveland area, 65.5 percent from the Pittsburgh area, 15.6 percent from the Detroit area,³ and 23.2 percent from the Cincinnati area. With the

³ Production Area 13 is discussed because it includes Toledo, Ohio, which is located in the Fourth District. Census data on freight shipments from Toledo alone are not available.

exception of the Detroit area, which had a high proportion of its shipments in transportation equipment (31.7 percent), primary metals accounted for the largest share of shipments from each area (see Table I).

Chemicals and allied products accounted for one-fifth of shipments from the Cleveland area, followed by considerably smaller shares of shipments of nonelectrical equipment, transportation equipment, and fabricated metal products.

Although shipments from the Pittsburgh area are dominated by primary metals, stone, clay, and glass products contributed nearly 9 percent of shipments, and fabricated metals slightly over 8 percent. The high share of shipments of transportation equipment and primary metals from the Detroit area was followed in importance by shipments of chemicals and allied products, which accounted for 12.4 percent of shipments. Along with primary metals, food products, transportation equipment, and pulp and paper products, all contributed high shares of freight shipments from the Cincinnati area.

FACTORS IN FREIGHT TRANSPORTATION

The specialization in metal-producing and metal-fabricating activities of manufacturing in the four production areas under review importantly influences the proportion of shipments accounted for by the individual modes of transport. Distance, which is determined by the geographic distribution of freight destinations, is also related to the emphasis on individual modes. These factors are traced below for each of the four production areas in the Fourth District.

The Cleveland Area. As shown in Table IIa, about 12 percent of tonnage shipped from points in Production Area 11 went to points in the same area, limiting the average distance of these shipments to perhaps less than 100 miles. Over 10 percent of shipments from the Cleveland area went to the Detroit-Toledo area (about 110 miles from Cleveland). Less than 6 percent of shipments terminated in the Pittsburgh area (125 miles from Cleveland) and 3 percent in the Cincinnati area (239 miles from Cleveland). Thus, as much as 30 percent of the shipments from the Cleveland area may have remained within the Fourth District, with an average length of haul of considerably less than 300 miles.

Only 4.2 percent of shipments from the Cleveland area went to Production Area 15 (Chicago, Illinois, and Gary-Hammond-East Chicago, Indiana), approximately 340 miles from Cleveland. On the other hand, more than 22 percent of Cleveland area shipments terminated in 20 other production areas located at greater distances than the Chicago area. For example, almost 10 percent of Cleveland area shipments went to the four East Coast industrial centers from New York City to Baltimore, Maryland (average distance of more than 450 miles).

As shown in Table IIa, shipments to points outside the 25 Census production areas made up 42 percent of the tonnage shipped from the Cleveland area in 1963. Although the average distance of shipments to these other points cannot be determined, the distance distributions may be similar to those for the 25 production areas shown in the 1963 *Census of Transportation*. If so, the average distance of shipments from Production

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TABLE IIa
Commodity Composition of Freight Shipments from Production Area 11
1963

Class of Commodity	Percent Distribution by Area of Destination*							
	Area 11†	Area 12	Area 13	Area 14	Total Areas 11-14	Area 15§	20 Other Production Areas	Places Not In Production Areas
All commodities†	12.2%	5.5%	10.4%	3.2%	31.3%	4.2%	22.4%	42.1%
Food products	25.3	8.2	5.6	7.1	46.2	1.6	10.8	41.4
Furniture and fixtures	7.6	2.6	6.9	3.0	20.1	3.2	42.6	34.1
Pulp and paper products	18.2	1.3	2.9	3.9	26.3	3.3	29.1	41.3
Chemicals and allied products	9.1	4.0	5.1	2.9	21.1	2.8	20.7	55.4
Petroleum and coal products	18.0	3.6	4.2	4.1	29.9	1.2	21.5	47.4
Rubber and plastics products	9.5	1.5	11.3	1.7	24.0	1.9	35.6	38.5
Stone, clay, and glass products	5.3	7.3	3.2	0.2	16.0	1.8	34.7	47.5
Primary metals	12.6	6.9	15.2	4.6	39.3	6.0	16.7	38.0
Fabricated metals	10.5	1.7	10.5	4.0	26.7	4.4	25.8	43.1
Nonelectrical machinery	13.4	13.6	9.1	0.8	36.9	4.3	20.1	38.7
Electrical machinery	18.0	1.4	4.5	5.4	29.3	6.1	35.3	29.3
Transportation equipment	3.3	0.7	20.3	2.3	26.6	4.9	39.6	28.9
Instruments	0.7	0.8	0.7	0.1	2.3	2.0	40.4	55.3

* Based upon thousands of tons of freight shipped from Production Area 11 by class of commodity.

† Includes commodity classes not shown separately.

‡ Includes only shipments originated in one city in this area and terminated in another city in this area.

§ This production area, which includes the Chicago, Illinois, and the Gary-Hammond-East Chicago, Indiana SMSAs, is shown separately because of the generally significant proportions of shipments originated within the Fourth District that terminate in this production area. Proportions terminated in the other 20 production areas covered by the 1963 *Census of Transportation* are typically much smaller.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

Area 11 appears to be slightly greater than 300 miles, which, as shown in Table IIb, accords closely with a calculated mean distance of about 329 miles.⁴ At this relatively short distance, highway carriers appear to have an advantage over most other modes of transportation.

As shown in Table IIc, regulated and private motor carriers hauled nearly 55 percent of total tonnage from Production Area 11. In fact, motor carriers moved more than

half of the area's freight for 8 of the 13 major commodity classifications for which data are available.

Generally, where the share of tonnage shipped to Production Areas 11-14 approximated or exceeded the average share (31.3 percent) for all commodities remaining in the Fourth District, the mean distance was less than or close to the mean distance for all commodities (329 miles). Over 46 percent of food product shipments went to Production Areas 11-14 (see Table IIa), with a mean distance of 123 miles from the Cleveland production area. Similarly, over 39 percent of primary metal products shipments went to points in the Fourth District, with a mean

⁴ The calculation of mean distance, D , can be formulated as $D = \sum p(d') / \sum p$, where p is the percent of tons shipped in each distance class, and d' is the midpoint of each class interval for distance indicated in the column headings of Table IIb, and \sum denotes a sum.

TABLE IIb
Commodity Composition of Freight Shipments from Production Area 11
1963

Class of Commodity	Percent Distribution by Distance of Shipment*							Mean Distance (nearest mile)
	Under 100 miles	100 to 199 miles	200 to 299 miles	300 to 499 miles	500 to 999 miles	1,000 to 1,499 miles	1,500 miles or over	
All commodities†	27.4%	21.1%	13.7%	22.5%	9.3%	3.0%	3.0%	329
Food products	57.1	23.9	12.7	5.7	0.6	-0-	-0-	123
Furniture and fixtures	14.0	13.0	25.9	19.9	17.1	5.7	4.4	447
Pulp and paper products	32.8	9.4	16.2	29.5	7.8	2.4	1.9	311
Chemicals and allied products	21.2	16.7	17.2	30.2	9.7	4.4	0.6	338
Petroleum and coal products	27.7	31.8	14.8	15.0	4.7	1.1	4.9	293
Rubber and plastics products	14.4	17.7	9.2	24.0	18.4	5.0	11.3	551
Stone, clay, and glass products	14.8	27.4	9.4	23.8	21.6	2.3	0.7	370
Primary metals	30.7	26.1	14.3	18.4	5.9	2.9	1.7	274
Fabricated metals	19.4	22.6	15.1	26.6	9.2	1.2	5.9	375
Nonelectrical machinery	40.8	10.5	13.8	17.2	9.7	2.4	5.6	340
Electrical machinery	22.7	10.2	7.0	26.4	10.5	8.6	14.6	592
Transportation equipment	11.7	22.0	8.8	32.1	12.3	4.1	9.0	490
Instruments	3.0	15.9	9.2	35.9	12.0	13.9	10.1	632

* Based upon thousands of tons of freight shipped from Production Area 11 by class of commodity.

† Includes commodity classes not shown separately.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

TABLE IIc
Commodity Composition of Freight Shipments from Production Area 11
1963

Class of Commodity	Percent Distribution by Mode of Transport*					
	Rail	Motor Carrier (Regulated)	Motor Carrier (Private)	Air	Water	Not Identified
All commodities†	43.3%	46.5%	8.1%	-0-	1.2%	0.9%
Food products	9.5	22.7	65.9	-0-	1.9	-0-
Furniture and fixtures	24.6	52.2	22.2	-0-	-0-	1.0
Pulp and paper products	19.5	59.4	20.8	0.2%	-0-	0.1
Chemicals and allied products	49.5	37.6	9.5	-0-	3.2	0.2
Petroleum and coal products	50.1	47.7	2.2	-0-	-0-	-0-
Rubber and plastics products	27.1	68.5	3.9	0.1	-0-	0.4
Stone, clay, and glass products	57.6	29.4	4.7	-0-	8.1	0.2
Primary metals	39.6	56.9	3.0	-0-	0.1	0.4
Fabricated metals	17.6	64.9	11.2	0.1	-0-	6.2
Nonelectrical machinery	58.6	36.9	3.0	0.1	-0-	1.4
Electrical machinery	19.9	73.0	3.3	0.4	-0-	3.4
Transportation equipment	65.4	31.6	2.2	0.1	-0-	0.7
Instruments	11.8	81.7	2.9	0.7	-0-	2.9

* Based upon thousands of tons of freight shipped from Production Area 11 by class of commodity.

† Includes commodity classes not shown separately.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

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distance of 274 miles. The mean distances for pulp and paper products, petroleum and coal products, and nonelectrical machinery were near the average, as were the tonnage shares destined for points in the Fourth District.

Conversely, where the proportion of a commodity shipped within the District fell considerably below the overall figure, the mean distance of shipment was likely to be well above the average. For example, only 2.3 percent of shipments of instruments remained within the District. The mean distance of shipments for this commodity was 632 miles, the longest of any industry group. Likewise, furniture and fixtures were shipped a mean distance of 447 miles, and only about 20 percent of the shipments of such goods remained within the Fourth District. Only 16 percent of stone, clay, and glass products shipments stayed within the District, and such shipments were carried an average distance of 370 miles. Chemicals, rubber and plastics, fabricated metal products, electrical machinery, and transportation equipment all had below-average shares destined for points in or near the Fourth District and mean distances above the mean for all commodities (see Table IIb).

If all other influences remain the same, as length of haul increases, a widening spread in total costs per ton-mile should induce a shift between modes of transport, especially from highway to rail. The data can confirm this hypothesis by demonstrating an inverse relationship between percent of tons carried by truck and mean distance or, conversely, a direct relationship between percent of tons hauled by rail and mean distance.

For example, the mean distance of 329 miles for shipments from the Cleveland production area is related to a proportion of about 43 percent carried by rail and 55 percent by regulated and private motor carriers (see Table IIb and Table IIc). Nearly 89 percent of food products was transported by truck over a mean distance of 123 miles and about 60 percent of primary metal products was moved by truck (mean distance 274 miles). Pulp and paper products were moved a mean distance of 311 miles and over 80 percent of such shipments was carried by truck.

Four commodity groups—chemicals and allied products, nonelectrical machinery, transportation equipment, and stone, clay, and glass products—demonstrate the effect of greater-than-average distance upon mode of transport. These commodity groups all showed the expected tendency to ship a greater share of tonnage by rail as length of haul increases. A relatively high share of stone, clay, and glass products was also moved by water (see Table IIc).

The anticipated relationship did not hold, however, for 6 of the 13 commodity classifications shipped from the Cleveland area. For example, 50 percent of petroleum and coal products shipments was carried by rail over a mean distance of 293 miles, compared with 43 percent and a mean distance of 329 miles for all commodities. Because of their bulk, petroleum and coal products can be shipped more economically by rail. In the other categories—furniture and fixtures, rubber and plastics products, fabricated metal products, instruments, and electrical machin-

ery—it appears that low bulk and high value provided motor carriers with a competitive advantage over railroads.

Although more than 76 percent of electrical machinery shipments was moved a mean distance of 592 miles by truck from the Cleveland area, electrical equipment accounted for less than 1 percent (or 265,000 tons) of total shipments from the area. This pattern suggests that a large proportion of these products had low bulk or that point-to-point delivery may have been of considerable importance for producers in this industry, giving truckers a competitive advantage. Thus, the patterns for these six commodity classifications may reflect peculiar product or market characteristics that qualify, but do not necessarily contradict, the general hypothesis that railroads tend to capture rising shares

of freight shipments from motor carriers as length of haul increases.

The Pittsburgh Area. A large proportion (37.1 percent) of Pittsburgh area (Production Area 12) shipments was destined for the four production areas in or bordering the Fourth District, which is not surprising, in view of the dominance of primary metal products in Pittsburgh area shipments (see Table I). Primary metal products are of course basic to the metalworking and other heavy industry activities in the Fourth District. Fourteen percent of Pittsburgh area shipments remained in the area and more than 15 percent was destined for the Cleveland area (see Table IIIa). Thus, about 29 percent of Pittsburgh area shipments was destined for points within 125 miles. Slightly more than 4 percent of Pittsburgh area shipments went to

TABLE IIIa
Commodity Composition of Freight Shipments from Production Area 12
1963

Class of Commodity	Percent Distribution by Area of Destination*							
	Area 11	Area 12†	Area 13	Area 14	Total Areas 11-14	Area 15§	20 Other Production Areas	Places Not In Production Areas
All commodities†	15.2%	14.0%	4.4%	3.5%	37.1%	5.5%	21.7%	35.7%
Chemicals and allied products	7.3	31.1	1.6	2.0	42.0	4.5	13.6	39.9
Stone, clay, and glass products	10.4	2.0	3.0	4.2	19.6	1.6	37.8	41.0
Primary metals	19.0	10.9	5.3	4.2	39.4	7.0	20.2	33.4
Fabricated metals	6.3	27.2	2.3	2.7	38.5	0.9	20.5	40.1
Nonelectrical machinery	11.6	8.9	8.2	0.8	29.5	11.5	33.0	26.0
Electrical machinery	1.1	3.7	0.3	5.3	10.4	7.1	44.7	37.8

* Based upon thousands of tons of freight shipped from Production Area 12 by class of commodity.

† Includes commodity classes not shown separately.

‡ Includes only shipments originated in one city in this area and terminated in another city in this area.

§ This production area, which includes the Chicago, Illinois, and the Gary-Hammond-East Chicago, Indiana SMSAs, is shown separately because of the generally significant proportions of shipments originated within the Fourth District that terminate in this production area. Proportions terminated in the other 20 production areas covered by the 1963 *Census of Transportation* are typically much smaller.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

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the Detroit area (Production Area 13), at a distance of 228 miles, and 3.5 percent went to Cincinnati (Production Area 14), at a distance of 284 miles.

The remaining 63 percent of shipments from the Pittsburgh area was widely dispersed among destinations outside of the four production areas under review. For example, 5.5 percent went to the Chicago area, at a distance of 459 miles, 9.7 percent went to the four East Coast centers from New York City to Baltimore, at an average distance of about 350 miles, and another 12 percent was destined for 16 other production areas. The balance (35.7 percent) of shipments from the Pittsburgh area went to locations outside of the 25 Census production areas. The mean distance of shipments of all commodities from the Pittsburgh area was 317 miles.

A high proportion of chemicals and allied products shipments (42 percent) from Pittsburgh remained within the Fourth District, with over 31 percent moving within the Pittsburgh production area itself. The mean distance for chemicals and allied products was 253 miles, significantly shorter than the average for all commodities. As shown in Table IIIa, an above-average share of shipments of fabricated metal products was also destined for points within the District as well as the Pittsburgh production area. The mean distance for shipments of fabricated metal products was 253 miles compared with 317 miles for all commodities (see Table IIIb). Conversely, only 10.4 percent of electrical machinery products was moved to points in Production Areas 11-14 (mean distance 623 miles). The mean distance for nonelectrical machinery was 407 miles, which is consistent

with a below-average share (29.5 percent) shipped within the four production areas under review. Inconsistent patterns existed for stone, clay, and glass products and for primary metal products, with mean distances of 262 miles and 335 miles, respectively (see Table IIIa and Table IIIb).

About 52 percent of shipments from the Pittsburgh area was carried by rail, 38 percent by truck (regulated and private combined), and 10 percent by water. The relationship between rail and truck was roughly the reverse of that in the Cleveland area, and the share accounted for by water transport was the highest of the four production areas under review. As expected, stone, clay, and glass products and chemicals and allied products, with mean distances below the mean for all goods, had above-average proportions moved by truck (see Table IIIb and Table IIIc). Interestingly, 24 percent of the shipments of chemicals was accounted for by water transport, due largely to the proximity of three major rivers in the Pittsburgh area. Primary metal products demonstrated the effect of greater-than-average distance, with only 30.6 percent of such shipments moved by truck and over 55 percent by rail. Water transport also accounted for a large share of shipments of primary metal products.

Three commodity groups—fabricated metal products, electrical machinery, and nonelectrical machinery—did not show the expected relationship between distance and mode. Almost 70 percent of fabricated metal products was carried by rail, despite a mean distance of only 283 miles, suggesting that a large proportion of these products from the Pittsburgh area was bulky enough to make

TABLE IIIb
Commodity Composition of Freight Shipments from Production Area 12
1963

Class of Commodity	Percent Distribution by Distance of Shipment*							Mean Distance (nearest mile)
	Under 100 miles	100 to 199 miles	200 to 299 miles	300 to 499 miles	500 to 999 miles	1,000 to 1,499 miles	1,500 miles or over	
All commodities†	26.8%	22.3%	18.6%	18.6%	7.3%	3.6%	2.8%	317
Chemicals and allied products . .	42.2	12.9	11.9	24.5	5.6	1.6	1.3	253
Stone, clay, and glass products . .	10.9	26.8	40.0	17.7	3.4	0.2	1.0	262
Primary metals	24.0	24.4	16.9	19.5	7.9	4.2	3.1	335
Fabricated metals	35.4	16.3	22.4	14.8	5.7	2.4	3.0	283
Nonelectrical machinery	15.7	19.1	19.3	27.6	8.9	3.8	5.6	407
Electrical machinery	6.5	14.6	14.3	25.1	17.2	11.6	10.7	623

* Based upon thousands of tons of freight shipped from Production Area 12 by class of commodity.

† Includes commodity classes not shown separately.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

TABLE IIIc
Commodity Composition of Freight Shipments from Production Area 12
1963

Class of Commodity	Percent Distribution by Mode of Transport*					
	Rail	Motor Carrier (Regulated)	Motor Carrier (Private)	Air	Water	Not Identified
All commodities†	51.5%	33.2%	4.8%	—0—	9.8%	0.7%
Chemicals and allied products . .	36.9	33.1	5.6	—0—	24.3	0.1
Stone, clay, and glass products . .	20.7	71.3	6.2	0.1%	—0—	1.7
Primary metals	55.5	29.7	0.9	—0—	13.3	0.6
Fabricated metals	69.6	24.8	3.2	1.0	1.8	0.5
Nonelectrical machinery	40.4	57.1	1.1	0.3	—0—	1.1
Electrical machinery	28.9	61.7	2.8	0.2	2.5	3.9

* Based upon thousands of tons of freight shipped from Production Area 12 by class of commodity.

† Includes commodity classes not shown separately.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

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the railroads highly competitive with motor carriers (unlike the situation in Cleveland where the product mix was apparently less bulky). The nonelectrical and electrical machinery groups both had mean distances considerably above the mean distance for all commodities. Nevertheless, a large proportion of these goods were carried by truck, suggesting that by 1963 the pattern of customer locations had expanded outside the established rail network.

The Detroit Area. Production Area 13 (Detroit, Michigan and nearby SMSAs) shipped 35.8 percent of its manufactured goods to the four production areas in or bordering the Fourth District (see Table IVa). Nearly 27 percent was moved to other points within the same production area, which is a greater proportion of local shipments than for any of the other production areas under review. Shares to the other three areas were modest by comparison, with the greatest (4.2 percent) going to the Cleveland vicinity, 3.4 percent to the Cincinnati area, and only 1.3 percent to the Pittsburgh area.

The Chicago production area, which is approximately 240 miles from Detroit, received 3.7 percent of that area's shipments. About 25 percent of shipments from the Detroit area went to the remaining 20 production areas, and over 35 percent went to places not in production areas. The mean distance of all shipments originating from the Detroit production area was 327 miles.

For six commodity groups—chemicals and allied products, rubber and plastics products, fabricated metal products, nonelectrical machinery, electrical machinery, and trans-

portation equipment—tonnage shares shipped within the Fourth District were less than the average (35.8 percent) for all commodities. As expected, the mean distance of shipments for each of these commodities was above the mean distance for all commodities (see Table IVa and Table IVb). Although the share of food products that stayed within the District was also below average, the mean distance for this commodity group was only 270 miles, apparently due to an unusually large proportion (8.2 percent) of shipments to the Cincinnati area.

For the three other commodity groups—petroleum and coal products, primary metal products, and instruments—shipments to other points within the Fourth District were above the average for all commodities (see Table IVa). In each case, the proportion shipped within the Detroit area was unusually high. In addition, the shares of petroleum and coal products and transportation equipment going to the Cleveland area were exceptionally large. The mean distance of shipment for these three commodity groups was well below the average for all commodities (see Table IVb).

The mean distance of 327 miles for all commodities was related to a share of almost 46 percent hauled by rail, and about 51 percent carried by truck, and 3 percent by water (see Table IVc). This pattern was closer to that of the Cleveland area than to that of the Pittsburgh area. As expected, the primary metal products and instruments group, with mean distances of less than 327 miles, moved above-average shares by truck. In the petroleum and coal products group (mean distance 148 miles), 42.5 percent of shipments was moved by truck, 45.6 percent by water, and

TABLE IVa
Commodity Composition of Freight Shipments from Production Area 13
1963

Class of Commodity	Percent Distribution by Area of Destination*							
	Area 11	Area 12	Area 13†	Area 14	Total Areas 11-14	Area 15§	20 Other Production Areas	Places Not in Production Areas
All commodities†	4.2%	1.3%	26.9%	3.4%	35.8%	3.7%	25.1%	35.4%
Food products	8.4	0.9	9.0	8.2	26.5	2.4	21.1	50.0
Chemicals and allied products	1.1	0.8	12.1	1.0	15.0	5.8	25.3	53.9
Petroleum and coal products	10.2	-0-	26.1	0.5	36.8	0.1	30.4	32.7
Rubber and plastics products	1.3	0.1	21.4	0.2	23.0	6.0	29.9	41.1
Primary metals	6.3	3.2	46.0	1.3	56.8	5.5	9.8	27.9
Fabricated metals	7.3	0.1	19.1	2.7	29.2	4.2	29.8	36.8
Nonelectrical machinery	7.8	0.1	15.3	0.6	23.8	1.4	22.8	52.0
Electrical machinery	1.7	1.2	9.0	4.4	16.3	10.1	46.0	27.6
Transportation equipment	3.0	0.7	11.0	6.4	21.1	2.6	45.5	30.8
Instruments	17.6	-0-	53.6	1.5	72.7	1.0	10.2	16.1

* Based upon thousands of tons of freight shipped from Production Area 13 by class of commodity.

† Includes commodity classes not shown separately.

‡ Includes only shipments originated in one city in this area and terminated in another city in this area.

§ This production area, which includes the Chicago, Illinois, and the Gary-Hammond-East Chicago, Indiana SMSAs, is shown separately because of the generally significant proportions of shipments originated within the Fourth District that terminate in this production area. Proportions terminated in the other 20 production areas covered by the 1963 Census of Transportation are typically much smaller.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

TABLE IVb
Commodity Composition of Freight Shipments from Production Area 13
1963

Class of Commodity	Percent Distribution by Distance of Shipment*							
	Under 100 miles	100 to 199 miles	200 to 299 miles	300 to 499 miles	500 to 999 miles	1,000 to 1,499 miles	1,500 miles or over	Mean Distance (nearest mile)
All commodities†	38.3%	11.4%	15.0%	18.4%	10.9%	1.4%	4.6%	327
Food products	22.5	25.9	27.7	8.3	15.5	0.1	-0-	270
Chemicals and allied products	18.2	11.2	17.9	40.5	9.6	1.2	1.4	344
Petroleum and coal products	54.1	9.8	27.1	8.2	0.8	-0-	-0-	148
Rubber and plastics products	28.2	8.0	8.1	16.5	23.5	5.4	10.3	536
Primary metals	59.3	16.5	16.3	5.8	1.7	0.1	0.3	138
Fabricated metals	30.7	10.0	15.6	21.3	16.8	1.0	4.6	374
Nonelectrical machinery	30.7	9.9	7.9	12.9	27.0	2.6	9.0	494
Electrical machinery	15.2	5.0	22.9	23.5	23.8	7.0	2.6	478
Transportation equipment	15.7	9.7	11.9	28.2	19.0	3.3	12.2	562
Instruments	56.0	23.6	2.2	4.9	7.4	1.3	4.6	241

* Based upon thousands of tons of freight shipped from Production Area 13 by class of commodity.

† Includes commodity classes not shown separately.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

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TABLE IVc
Commodity Composition of Freight Shipments from Production Area 13
1963

Class of Commodity	Percent Distribution by Mode of Transport*					
	Rail	Motor Carrier (Regulated)	Motor Carrier (Private)	Air	Water	Not Identified
All commodities†	45.6%	29.5%	21.6%	0.1%	2.8%	0.4%
Food products	71.3	6.8	20.8	-0-	-0-	1.1
Chemicals and allied products . .	60.6	28.6	8.7	-0-	1.6	0.5
Petroleum and coal products . .	11.8	28.2	14.3	-0-	45.6	0.1
Rubber and plastics products . .	49.6	44.2	5.5	0.1	-0-	0.6
Primary metals	42.0	55.2	2.6	-0-	-0-	0.2
Fabricated metals	33.9	52.6	11.7	0.5	-0-	1.3
Nonelectrical machinery	27.1	59.8	11.2	0.7	-0-	1.2
Electrical machinery	23.2	71.8	2.4	0.2	-0-	2.4
Transportation equipment	61.8	30.4	6.8	1.0	0.6	0.3
Instruments	9.9	75.0	8.4	0.7	0.8	5.2

* Based upon thousands of tons of freight shipped from Production Area 13 by class of commodity.

† Includes commodity classes not shown separately.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

only 11.8 percent by rail. The high proportion of petroleum and coal products shipments accounted for by water reflects the proximity of the Detroit area to the Great Lakes. Despite a mean distance of 270 miles, over 71 percent of food products was hauled by rail.

Of the six commodity groups with mean distances greater than the mean distance for all commodities, only three—chemicals and allied products, rubber and plastics products, and transportation equipment—showed the expected relationship of above-average shares moved by rail and below-average shares carried by truck. Three classifications—fabricated metal products, nonelectrical machinery, and electrical machinery—were moved predominantly by truck, despite mean distances of 374, 494, and 478 miles, respectively. As Table I indicates, these products accounted for relatively small tonnages originated from the Detroit production area, sug-

gesting that the low bulk of a large proportion of these products enabled the trucking industry to offer advantageous terms to manufacturers in the Detroit area. In addition, the rail network from that area in 1963 may have been unable to reach a number of customer locations, so that the inherently greater route-flexibility of trucking was a stronger influence than distance.

The Cincinnati Area. Manufacturers located in the SMSAs of Cincinnati, Dayton, Hamilton-Middletown, and Springfield, Ohio, shipped 24.2 percent of their products to the four production areas in or bordering the Fourth District, the smallest share supplied to the District by any of the four production areas. The proportion of shipments destined for other points within the Cincinnati area (11.8 percent) was also the smallest of the four areas under review. The distribution to the other three centers was as follows: the Detroit

area, 6.8 percent of the shipments from the Cincinnati area; the Cleveland area, 3.8 percent; and the Pittsburgh area, 1.8 percent (see Table Va).

The Chicago production area (324 miles from Cincinnati in 1963, but only 295 miles in 1966, due to improved highways) received 5.4 percent of the goods manufactured in the Cincinnati area. About 20 percent of the area's production went to the remaining 20 Census production areas across the nation, with almost 10 percent destined for the four East Coast centers from New York City to Baltimore. Approximately half of the output of Cincinnati area manufacturers went to places outside of the 25 Census production

areas, the largest proportion of shipments to nonproduction area points from the four District areas. The mean distance of all shipments originating from the Cincinnati production area was 346 miles, which is somewhat longer than for any other District center but is consistent with the below-average proportion of shipments remaining within the District.

Tonnage shares destined for other points within or bordering the Fourth District were less than the average of 24.2 percent for eight commodity categories—pulp and paper products, chemicals and allied products, rubber and plastics products, fabricated metal products, nonelectrical machinery, electrical

TABLE Va
Commodity Composition of Freight Shipments from Production Area 14
1963

Class of Commodity	Percent Distribution by Area of Destination*							
	Area 11	Area 12	Area 13	Area 14†	Total Areas 11-14	Area 15§	20 Other Production Areas	Places Not In Production Areas
All commodities†	3.8%	1.8%	6.8%	11.8%	24.2%	5.4%	20.3%	50.1%
Food products	3.4	1.0	2.5	19.9	26.8	3.9	16.5	52.8
Pulp and paper products	4.3	0.8	2.6	10.5	18.2	10.6	29.8	41.4
Chemicals and allied products	5.1	6.5	3.0	3.8	18.4	7.6	35.8	38.2
Rubber and plastics products	1.7	0.1	1.6	3.6	7.0	3.5	31.3	58.2
Primary metals	6.8	1.1	9.7	18.1	35.7	9.3	12.9	42.1
Fabricated metals	1.1	0.2	6.6	10.4	18.3	5.0	10.1	66.6
Nonelectrical machinery	1.6	1.1	3.4	2.4	8.5	1.7	22.4	67.4
Electrical machinery	1.5	1.0	6.3	1.2	10.0	4.0	37.2	48.8
Transportation equipment	2.9	0.4	16.4	2.3	22.0	1.6	39.4	37.0
Instruments	0.3	1.0	2.5	0.7	4.5	6.4	43.6	45.5

* Based upon thousands of tons of freight shipped from Production Area 14 by class of commodity.

† Includes commodity classes not shown separately.

‡ Includes only shipments originated in one city in this area and terminated in another city in this area.

§ This production area, which includes the Chicago, Illinois, and the Gary-Hammond-East Chicago, Indiana SMSAs, is shown separately because of the generally significant proportions of shipments originated within the Fourth District that terminate in this production area. Proportions terminated in the other 20 production areas covered by the 1963 Census of Transportation are typically much smaller.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

TABLE Vb

**Commodity Composition of Freight Shipments from Production Area 14
1963**

Class of Commodity	Percent Distribution by Distance of Shipment*							Mean Distance (nearest mile)
	Under 100 miles	100 to 199 miles	200 to 299 miles	300 to 499 miles	500 to 999 miles	1,000 to 1,499 miles	1,500 miles or over	
All commodities†	28.1%	15.3%	21.2%	14.0%	16.8%	1.4%	3.2%	346
Food products	40.8	14.4	14.8	18.6	8.9	0.6	1.9	261
Pulp and paper products	14.1	5.9	25.3	23.0	25.9	1.2	4.6	461
Chemicals and allied products	12.4	6.3	30.3	22.6	25.5	0.2	2.7	423
Rubber and plastics products	6.9	6.5	13.4	31.3	32.4	6.4	3.1	549
Primary metals	31.5	19.4	29.4	4.9	12.9	0.1	1.8	267
Fabricated metals	28.0	23.5	25.9	7.9	10.6	0.2	3.9	296
Nonelectrical machinery	36.0	5.9	7.9	15.1	27.4	5.0	2.7	422
Electrical machinery	3.9	10.2	15.0	22.7	35.9	1.1	11.2	625
Transportation equipment	5.8	13.5	18.3	22.1	29.0	4.9	6.4	548
Instruments	1.1	5.8	16.8	15.6	30.0	10.9	19.8	821

* Based upon thousands of tons of freight shipped from Production Area 14 by class of commodity.

† Includes commodity classes not shown separately.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

TABLE Vc

**Commodity Composition of Freight Shipments from Production Area 14
1963**

Class of Commodity	Percent Distribution by Mode of Transport*					
	Rail	Motor Carrier (Regulated)	Motor Carrier (Private)	Air	Water	Not Identified
All commodities†	29.9%	48.3%	15.2%	0.1%	5.9%	0.6%
Food products	42.4	13.1	44.1	-0-	-0-	0.4
Pulp and paper products	37.6	54.5	7.6	-0-	-0-	0.3
Chemicals and allied products	35.4	48.3	15.8	-0-	-0-	0.5
Rubber and plastics products	11.5	83.5	2.5	0.1	-0-	2.4
Primary metals	17.3	71.5	11.2	-0-	-0-	-0-
Fabricated metals	6.9	61.9	30.5	0.1	-0-	0.6
Nonelectrical machinery	21.3	74.5	2.1	0.2	-0-	1.9
Electrical machinery	45.5	41.8	10.6	0.3	-0-	1.8
Transportation equipment	43.6	51.5	3.2	0.4	-0-	1.3
Instruments	0.1	89.9	0.5	0.4	-0-	9.1

* Based upon thousands of tons of freight shipped from Production Area 14 by class of commodity.

† Includes commodity classes not shown separately.

Sources: U. S. Department of Commerce, Bureau of the Census and Federal Reserve Bank of Cleveland

machinery, transportation equipment, and instruments. Except for fabricated metal products, the mean distance of shipment for these groups was, as expected, greater than the average for all commodities. The low mean distance for fabricated metal products appears to be associated with a large proportion of shipments to places not in production areas and with the largest proportion of shipments for any commodity group moved within a distance of 100 to 199 miles, indicating an extensive local market (see Table Va and Table Vb).

The converse of the anticipated pattern is illustrated by the two remaining commodity classifications—food products and primary metal products. In each case, the share of tonnage destined for other points in or bordering the Fourth District was above the general proportion, and the mean distance of shipment was well below the overall figure.

The mean distance of 346 miles for all commodities was related to a share of almost 30 percent hauled by rail, 63.5 percent carried by truck, and nearly 6 percent moved by water (see Table Vc). The proportion of shipments moved by truck was the highest, while that moved by rail was the lowest, for any of the four production areas under review. As expected, primary metal products and fabricated metal products, with below-average mean distances, showed proportions carried by truck that are considerably above the average for all commodities. Although the share of food products carried by private truck was the greatest for any product category in the Cincinnati area, a large proportion of food products was shipped by rail despite a below-average mean distance.

Of the seven commodity groups with mean distances above the average for all groups, four—pulp and paper products, chemicals

and allied products, electrical machinery, and transportation equipment—conformed to the expected pattern of shipping above-average proportions by rail (see Table Vc). The exceptions were rubber and plastics products, nonelectrical machinery, and instruments, all of which shipped predominantly by truck. Instruments, with a mean distance of 821 miles (longest for the Cincinnati area) and more than a 90-percent share moved by trucks, provides a particularly striking illustration of the competitiveness of trucking, when the commodity tends to require little space per unit of weight. The rubber and plastics products group—with a mean distance of 549 miles and 86 percent of tonnage moved by trucks—appears to be a similar example of a commodity that has little bulk and is therefore suitable for shipment by trucks.

CONCLUDING COMMENTS

The data on commodity traffic within and from the Fourth District indicate that shippers tend to move larger quantities of goods by rail as the distance to the customer increases. Exceptions to this general pattern are relatively few and appear to arise mainly when the nature of the commodity permits packaging in either a high weight-to-volume or a high value-to-volume relationship. Other exceptions arise where customer locations have spread beyond established rail terminals possessing efficient freight-transfer facilities, and where other modes of transportation, such as waterways, provide inexpensive and readily available alternatives. Despite the exceptions, however, distance still appears to be the single most important factor in determining the relative use of the various modes of transportation.

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A limited number of reprints are available of the article "How Does Monetary Policy Affect the Economy?" which appeared as a Staff Economic Study in the October 1968 *Federal Reserve Bulletin*. The article is based on a paper presented by Maurice Mann, Vice President and General Economist, Federal Reserve Bank of Cleveland, at the Conference of University Professors, sponsored by the American Bankers Association and held at Ditchley Park, England, September 10-13, 1968. Requests for copies should be directed to the Research Department, Federal Reserve Bank of Cleveland, P. O. Box 6387, Cleveland, Ohio 44101.

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