THE IMPORTANCE OF THE FOREST PRODUCTS INDUSTRY IN THE WISCONSIN ECONOMY

By

Olalere Oyekola Amosun

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APPROVED BY THE GRADUATE COMMITTEE OF:

Dr. Robert J. Engelhard, Committee Chairman
Professor of Forestry

Mr. Jay H. Cravens
Professor of Forestry and Natural Resources

Dr. Robert W. Miller
Associate Professor of Forestry

Dr. Francis Murans
Associate Professor of Business and Economics

ABSTRACT

The aggregated forest products industry is comprised of lumber and wood products, furniture and fixtures and paper and allied products industries. The contribution of the forest products industry in the Wisconsin economy from 1967 to 1977 was examined in terms of employment, payroll, value added, value of shipments, new capital expenditures, costs of materials, number of production workers and wages paid, using data from 1971 Census of Manufactures.

The forest products industry ranked first among the Wisconsin manufacturing industries in investment on machinery; second in employment, payroll, value added, number of production workers and wage paid; third in value of shipments and fourth in costs of materials used.

The industry will continue to experience moderate real growth in the next ten years 1978-1987. The most significant growth will take place in new capital expenditures and costs of materials.

Data for payroll, value added, value of shipments, new capital expenditures, costs of materials and wages paid production workers were adjusted for inflation using 1967 as the base year.

ACKNOWLEDGEMENTS

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INTRODUCTION

Why The Study Is Important

The study is important for the following reasons: (1) provides up-to-date data on forest resources utilization in Wisconsin; (2) provides the public first-hand information on how their forest resources are being used; that is, the study is important from the public awareness point of view; (3) provides information on allocation of forest resources among the various wood-using industries in the state; (4) provides data on which future planning of both forest resources utilization and the forest products industry can be made; and (5) form a basis for further studies.

Objectives

The main objectives of this study are: (1) to quantify the importance of the forest products industry in terms of the traditional measurements; (2) to highlight the efforts of the industry in pollution abatements in the light of mounting criticism of the industry with regard to the environmental pollution particularly associated with pulp and paper production; and (3) to evaluate the industry's importance in the state economy.

Methods

Source of Data

For this study, the three main census of manufactures classification of the forest products industry were used as a data base. These classifications are: The standard industrial classification for lumber and wood products (24); furniture and fixtures (25); and paper and allied products (26). These industries include primary manufactures such as sawmills, pulp mills, paper mills, veneer mills, plywood mills and secondary manufactures such as paper converters, board and boxes mills and wood preserving mills (See Appendix 1).

Standard industrial classification 25 includes data for manufacturers of metal, household furniture, mattresses and bed springs. Combined data for wood and non-wood using industries poses a problem. They are not separated in this study. All are classified as the forest products industry.

The contributions of forest products industry to the economy of Wisconsin is examined in terms of employment, payroll, value added, value of shipments, new capital expenditures, costs of materials, number of and wages paid to production workers from 1967 to 1977.

History

Many of Wisconsin's forest products companies began as lumber producers in the late 19th Century. With depletion of old growth pine in the early 20th Century, the forest products

companies which remained in Wisconsin migrated from lumber production to the manufacture and sales of paper, board, paperboard containers, veneer, pulpwood, pallets and boxes.

Sawmills were widely distributed in Wisconsin in the 19th and early 20th Centuries. Most veneer mills were concentrated in the Lake Michigan, Lake Winnebago and the North Central regions of the state. Some veneer mills were located in Ashland, Baron and Chippewa Counties.

Pulp and paper mills were located along the Wisconsin, Chippewa, Flambeau and Fox Ribers. The rivers were not only useful for the transportation of raw materials but they were also used to carry away industrial discharges and wastes (Appendix 2 and 3).

In 1967, there were 890 lumber and wood products establishments in Wisconsin listed in the Census of Manufactures. Of the 890, 435 were listed as logging contractors, 224 were saw mills and 161 were veneer and plywood mills. There were 162 additional establishments manufacturing furniture and fixtures and 200 manufacturers of paper and allied products. Of these, six were pulp mills and 38 paper mills.

During the next five years, the total number of lumber and wood products establishments decreased by 103, establishments manufacturing furniture and fixtures decreased by 10, and the number of paper and allied products establishments increased by two. In 1977, 905 lumber and wood products sites were reported. This represented a five year increase of 118 but an increase of only 15 in the decade. In 1977, there

were 30 fewer logging contractors, 11 fewer saw mills and 10 more veneer and plywood mills than in 1967. There were 169 furniture and fixtures manufacturers compared to 162 in 1967, and an increase in the number of paper and allied products establishments from 200 to 224 (See Appendix 4, 5, and 6).

Forest Resources

The total land area of Wisconsin is 34.8 million acres. In 1968, the total forest land in the state was reported to be 14.5 million acres, 42.8 percent of the total land area. Over 97 percent of the forest land area (14.2 million acres) was classified as commercial forest land. This was 41.8 percent of the total land area (Thorne and Spencer, 1968).

Imports of sawlogs, veneer logs and pulpwood from the neighboring states has been exceeding domestic production. In 1975 imports of lawlogs exceeded domestic production by 2.4 million board feet, veneer log exceeded domestic by 1.6 million board feet, and pulpwood exceeded domestic production by 9.0 million cubic feet (See Appendix 7). The Wisconsin Forest Productivity Committee in 1979 reported that 4,000 million cubic feet of wood should be harvested from Wisconsin's forests (Wisconsin Forest Productivity Committee Reports, 1979). The need to import is attributed to a lack of sawlog size material and appropriate species.

LITERATURE REVIEW

The Census of Manufactures, published every five years, and the Annual Survey of Manufactures, published each year by the United States Department of Commerce, Bureau of the Census, provide the data base for this thesis. The Census of Manufactures data are more detailed in scope than data in the Annual Surveys. Essentially they provide the same information.

The Wisconsin Conservation Bulletins provide information on the historical development of the forest products industry in Wisconsin and information on the utilization of sawlog (Faber, 1958), veneer log (Faber, 1958), and pulpwood (Kilp, 1954). Panshim gave the account of the historical development of the industry in the United States (Panshim, 1962).

The North Central Forest Experiment Station, United States Forest Service, and the Wisconsin Department of Natural Resources maintain data on the forest resources of Wisconsin. Blyth produces yearly reports on sawlog production in Wisconsin (Blyth, et al., 1976), pulpwood production in the North Central Region and Lake States (Blyth, et al., 1972 and 1979, respectively), and veneer log production and receipts in the North Central Region (Blyth, et al., 1977). Spencer provides detailed data of Wisconsin's Timber Resources 1968 (Spencer, et al., 1972). Adams and Brodie also have published information on Wisconsin's Forest Resources: Present and Potential Uses (Adams and Brodie, 1976). Blyth examines

the utilization of timber by the primary forest products industry in Wisconsin (Blyth, et al., 1973).

Of all the authors writing on the importance of forest products industry to the economy of a state, Clement in his Special Research Project examined the importance of Wood Products in the Texas Economy in detail. He used the 1976 Annual Survey of Manufactures as his data base and quantified the importance of wood products industry using traditional methods such as employment, payroll, value added, value of shipment, new capital expenditures, production workers and wages paid (Clement, 1979). Weaver and Philip, writing on forestry in the Oklahoma economy, also used the traditional methods to examine the importance of forest products industry in the Oklahoma economy. They used the 1972 Census of Manufactures as their data source (Weaver and Philip, 1972). The Wisconsin Forest Productivity Report 1979 includes data on Wisconsin's forest industry for 1976.

Employment statistics are published by the National Commission and by the Employment and Earning States and Areas 1938-1978, United States Department of Labor, Bureau of the Labor Statistics. Those data corroborate the data on employment furnished by the Census of Manufactures and Annual Survey of Manufactures.

Pollution abatement data for 1976 and 1977 were furnished by the Bureau of the Census, Current Industrial Report in Pollution Abatements Costs and Expenditures. Adequate information on pollution abatement in Wisconsin is provided by the

Wisconsin Department of Natural Resources Air Management Bureau in A Citizen Air Management Guide 1972 and Wisconsin 1976 and 1978 Water Quality Inventory Reports to Congress.

RESULTS AND DISCUSSIONS

Economic Importance of the Forest Products Industry

Employment

The term employment in this study refers to all full-time and part-time employees on the payroll of the forest products industry. Persons on paid sick leave, paid holidays and paid vacations are also regarded as being employed. The term excludes proprietors and partners of firms not incorporated.

Level of Employment. Employment in the forest products industry rose from 63,500 in 1967 to 70,800 in 1977. This represented an increase of 11.5 percent over 1967 levels. In 1967 and 1977, the forest products industry accounted for 12.4 and 13.0 percent respectively of all employment by Wisconsin manufacturers. (Table 1) The forest products industry ranked second among all manufacturing industries in employment throughout the decade. (Table 2)

Employment in the Forest Products Industry compared to Employment in Agriculture. Yearly agricultural employment in Wisconsin from 1967 to 1977 was approximately 192,000 people. This represented approximately 4.3 percent of Wisconsin's population and 10 percent of all Wisconsin employment. The forest products industry employment amounted to roughly one-third of the agricultural employment, 3.4 percent of Wisconsin's total employment and 1.5 percent of Wisconsin's population. (1970 population)

Table 1

Number Employed in Wisconsin Forest Products Industry

And the Percentage of All Manufacturer's Employment

1967 - 1977

Number Employed (,000)

Industry \ Year	1967	1970	1971	1972	1974	1975	1976	1977
Lumber and Wood Products	16.7	13.1	12.8	18.6	19.3	18.7	20.9	22.5
Furniture and Fixtures	7.0	8.1	8.8	8.8	9.8	8.0	8.0	9.0
Paper and Allied Products	39.8	39.0	38.3	38.4	40.7	37.5	40.2	39.3
Forest Products Industry	65.5	60.2	59.9	65.8	69.8	64.2	69.1	70.8
All Manufacturing Industries	512.2	500.6	479.8	501.0	552.2	516.5	519.5	541.1
% of Forest Products Industry of all Manufacturing Industry	12.4	12.0	12.5	13.1	12.6	12.4	13.3	13.0

Source: 1. Census of Manufactures, 1967 and 1972
2. Annual Survey of Manufactures, 1977 (Preliminary Reports)
3. Annual Survey of Manufactures, 1970, 1971, 1974, 1975, and 1976

Table 2

Three Leading Wisconsin Manufacturing Industries

With 55,000 Employment

1967 and 1977

Industry	Year	
	1967	1977
	Number Employed (,000)	Number Employed (,000)
Machinery, Except Electrical	107.5	109.7
Forest Products Industry	63.5	70.8
Food and Kindred Products	56.7	60.0

Employment by Logging Contractors. During the 1967-1977 decade, logging contractors employment remained nearly constant at about 1,300 persons. This is 2.0 percent of the total employed in the forest products industry. Sundal's report of approximately 1,498 persons employed in logging in 1975 is noted (Wisconsin Manufacturing, 1977).

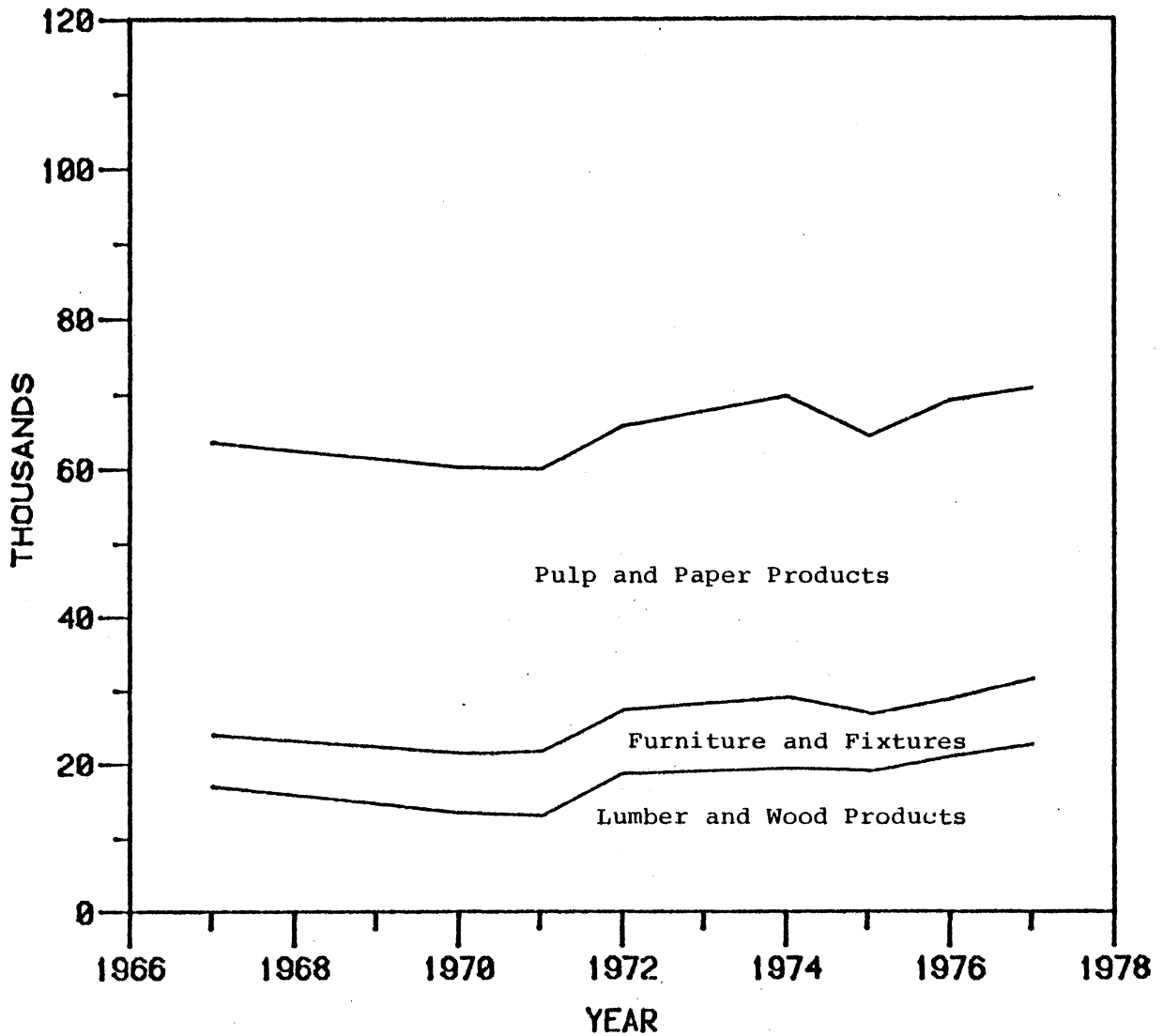
Trends in Employment in the Forest Products Industry. There were decreases in the total number employed in forest products industry to 1971 from number employed in 1967. Employment rose in the industry after 1971 to 69,800 in 1974. A second decrease to 64,200 in 1975 produced the only other reduction in employment in the decade. The decline in the number employed in 1975 could be explained, in part, by the general economic recession. (Figure 1)

Payroll of Forest Products Industry

The term payroll refers to wage payments and salary to all the employees. It also includes all other forms of compensations such as bonuses, vacation pay and sick leave pay before deductions. Payments to proprietors or partners in unincorporated establishments are not regarded as payroll.

Payroll Levels. The total payroll in the forest products industry in 1967 amounted to $419.6 million. The 1977 payroll increased by nearly 125 percent to $941.3 million. Payroll in the industry in 1967 was 11.7 percent of all manufacturing payroll. In 1977, the forest products industry accounted for 12.7 percent of all manufacturing payroll. Among the three industries that made up the forest products industry, paper and allied products had the

Figure 1. TRENDS AND LEVEL OF EMPLOYMENT 1967-1977



largest payroll, $3,533.4 million and employed the greatest number of persons, 313,200. Lumber and wood products payroll was $1,128.8 million, with 142,600 employed. The furniture and fixtures industry's total payroll was $535.1 million and employed 67,500 persons. (Tables 3 and 4)

Payroll in Forest Products Industry compared to All Manufacturing. During the ten year period under study, payroll in forest products industry ranked second among Wisconsin manufacturing in total payroll. Only non-electrical machinery manufacturing industry had a greater payroll. (Table 5)

Payroll Per Employee. While payroll per employee can be determined by dividing the total payroll by the total number employed, the figure would be misleading because the number employed includes both full-time and part-time employees.

Payroll Trends in Forest Products Industry. Payroll in the forest products industry experienced nearly steady growth during the ten year period, 1967-1977. The recession of 1975 when a 7.1 percent decrease in payroll over 1974 was the only exception. The decline was a reflection of employee lay-offs that year. (See Figure 2)

Payroll increases do not indicate real growth in payroll, however; to show the amount of real growth, payroll was adjusted to 1967 values using the consumer price index.[1] (Appendix 8)

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[1]Each year's payroll was adjusted for inflation using that year's consumer price index. For example, to adjust for 1970 payroll will be: $\frac{479 \times 100}{113.5}$ = $422.4. 1967 was the base year = 100.

Table 3

Wisconsin Forest Products Industry Payroll

1967-1977

(Million Dollars)

Industry and Percent \ Year	1967*	1970[I]	1971[I]	1972*	1974[I]	1975[I]	1976[I]	1977**
Lumber and Wood Products	82.3	77.6	82.1	127.2	160.1	165.1	196.1	238.3
Furniture and Fixtures	37.0	53.9	59.1	67.4	78.1	72.5	74.5	92.6
Paper and Allied Products	300.3	347.9	367.6	398.8	475.1	470.6	562.7	610.4
Forest Products Industry	419.6	479.4	508.8	593.4	713.3	708.2	833.3	941.3
All Manufacturing Industries	3577.8	4125.0	4227.0	4727.0	5973.5	6089.9	6611.4	7394.5
% of All Manufacturers	11.7	11.6	12.0	12.6	11.9	11.6	12.6	12.7

Source: 1. *Census of Manufactures
2. [I]Annual Survey of Manufactures
3. **Census of Manufactures (Preliminary Reports)

Table 4

Total Payroll and Number Employed in the

Forest Products Industry

1967-1977

Industry	Payroll (Million Dollars)	Number Employed (,000)
Lumber and Wood Products	1128.8	142.6
Furniture and Fixtures	535.1	67.5
Paper and Allied Products	3533.4	313.2
Forest Products Industry	5197.3	523.3

Source: 1. Census of Manufactures
2. Annual Survey of Manufactures

Table 5

Five Leading Wisconsin Manufacturing Industries in Payroll 1967 and 1977

Industry	1967	1977
	(Million Dollars)	(Million Dollars)
Machinery, Except Electrical	821.2	1630.6
Forest Products Industry	419.6	941.3
Food and Kindred Products	361.9	780.2
Fabricated Metal Products	300.4	741.1
Electric, Electronic Equipment	367.4	672.3

Source: Census of Manufactures, 1967 and 1977

Figure 2. TRENDS OF UNADJUSTED PAYROLL 1967-1977

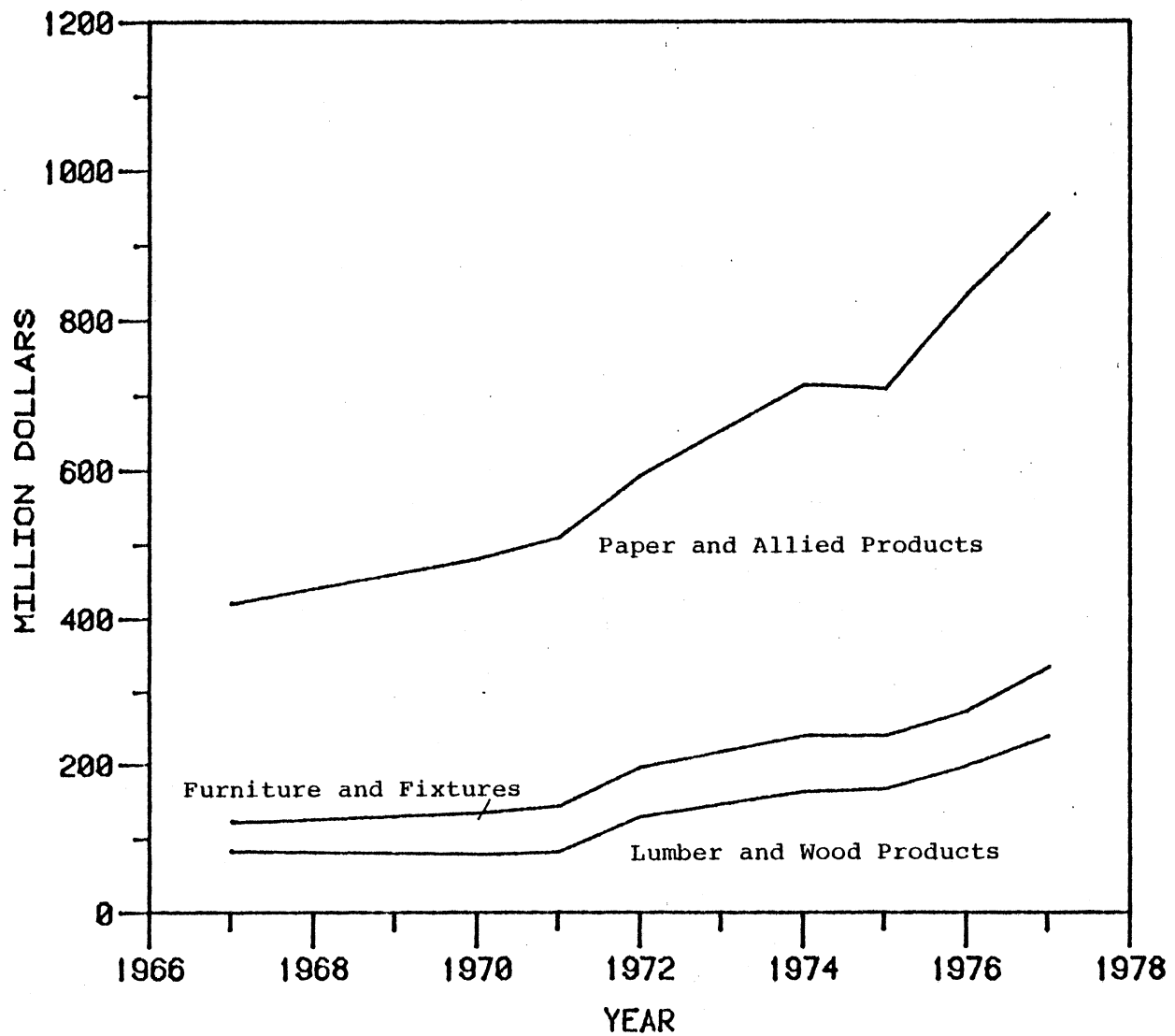


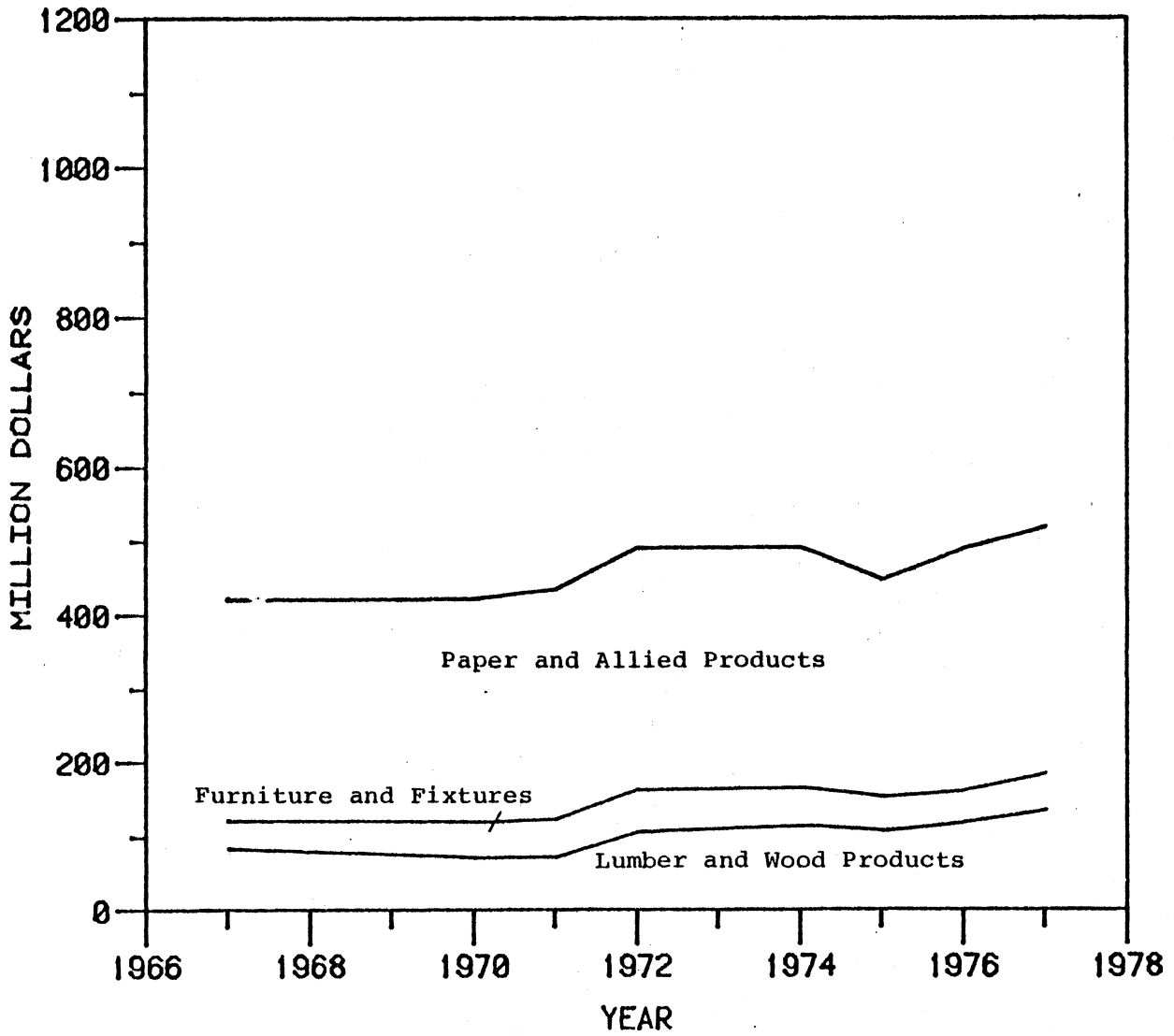
Table 6

Adjusted Payroll in Forest Products Industry

1967-1977

Year	Adjusted Payroll (Million Dollars)
1977	518.5
1976	488.7
1975	447.1
1974	490.2
1972	490.8
1971	433.4
1970	422.4
1967	419.6

Figure 3. TRENDS OF ADJUSTED PAYROLL 1967-1977



Real growth in payroll was only 23.6 percent instead of 125 percent when not adjusted. The adjusted payroll indicates two periods of significant growth in real income, from 1971 to 1972 and after the 1975 recession. (Table 6 and Figure 3)

Number of Production Workers and Wage Paid

Production Level. Production workers are non-supervisory workers. The total number of production workers in the forest products industry in 1977 was 56,700, an increase of 4,300 during the previous ten years. The number of production workers in the forest products industry amounted to 14.8 percent of all the production workers in Wisconsin manufacturing. (Table 7) The forest products industry ranked second among all manufacturing industries in the total number of production workers employed. (Table 8)

Paper and allied products had the greatest number of production workers among the three industries making up the forest products industry. The number of production workers in the paper industry accounted for 60.8 percent of all forest products industry production workers in 1967 and 54.2 percent in 1977. The total number of workers actually declined from 1967 to 1977. The number of production workers in lumber and wood products was 28.1 percent of the forest products industry total in 1967 and 33.3 percent in 1977. This was an increase of over 4,000. Production workers in the furniture and fixtures industry represented 11.1 and 12.5 percents in 1967 and 1977 respectively. (Table 7)

Production workers in logging numbered 1,200 persons in 1967 and 1,100 in 1977, about 2.0 percent of the forest products industry's total.

Production Worker Trends. The trend in the number of production workers in the forest products industry resembles that of the total number employed in the industry because the largest group of employees were classified as production workers in the three industries that made up forest products industry. (Figure 4)

There were decreases in the number of production workers in the forest products industry in 1970 and 1971. The number of production workers increased after the 1971 decline to 57,000 in 1974. There was another drop to 51,400 in 1975 due to the general recession.

Wages Paid Production Workers. Total wages paid production workers in the forest products industry amounted to $317 million in 1967 and $692 million in 1977, an 118.3 percent increase in wages over 1967. Production workers' wages amounted to 13.6 percent of wages paid to all production workers in Wisconsin manufacturing in 1967 and 14.6 percent of all wages paid in 1977. (See Table 9) Among Wisconsin manufacturing industries, total wages paid the forest products industry's production workers ranked second from 1967 to 1977. (Table 10)

Paper and allied products paid the largest amount of wages amounting to $2,614.1 million to its production workers from 1967 to 1977 followed by lumber and wood products with

Table 7

Production Workers and the Percentage of All Wisconsin Manufacturing Industries' Production Workers

1967-1977

Number of Production Workers (,000)

Industry and Percent	1967	1970	1971	1972	1974	1975	1976	1977
Lumber and Wood Products	14.7	11.4	11.3	16.1	16.6	15.7	17.8	18.9
Furniture and Fixtures	5.8	6.5	6.9	6.9	8.1	6.5	6.5	7.1
Paper and Allied Products	31.9	30.9	30.2	30.4	32.3	29.2	31.5	30.7
Forest Products Industry	52.4	48.8	48.4	53.4	57.0	51.4	55.8	56.7
All Manufacturing Industry	374.5	359.8	342.2	360.8	401.0	367.5	370.8	383.3
Percentage of Forest Product Industry to All Manufacturing	14.0	13.6	14.1	14.8	14.2	14.0	15.0	14.8

Source: 1. Census of Manufactures, 1967 and 1972
2. Census of Manufactures, 1977 (Preliminary Report)
3. Annual Survey of Manufactures, 1970, 1971, 1974, 1975, 1976

Table 8

Three Leading Wisconsin Manufacturing Industries

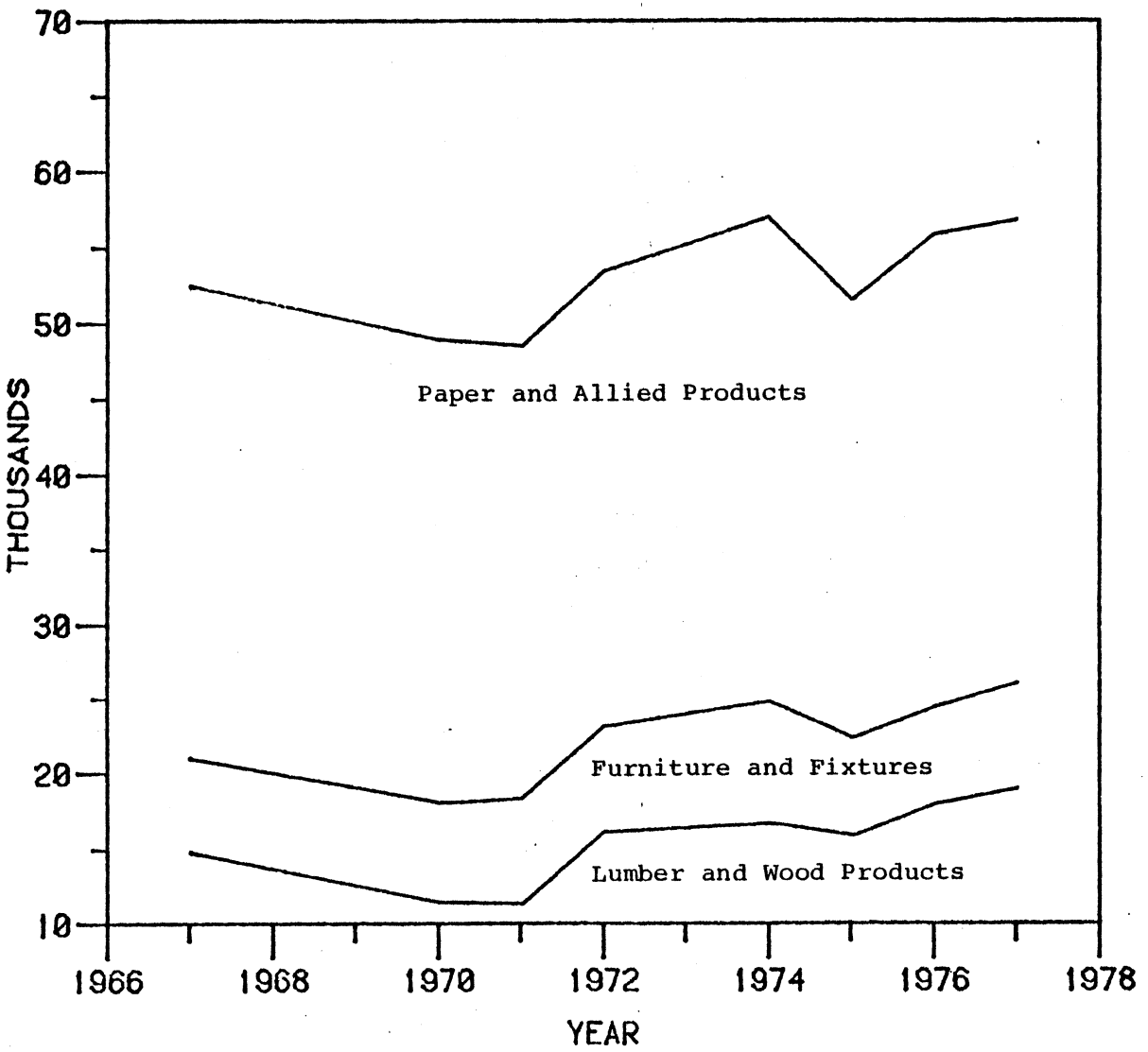
With at Least 40,000 Production Workers

1967 and 1977

Industry	Year	
	1967	1977
	Production Workers (,000)	Production Workers (,000)
Machinery, Except Electrical	79.1	77.6
Forest Products Industry	52.4	56.7
Food and Kindred Products	41.3	44.2

Source: 1. Census of Manufactures, 1967
2. Census of Manufactures, 1977 (Preliminary Report)

Figure 4. TRENDS OF PRODUCTION WORKERS 1967-1977



$865.2 million paid, and then furniture and fixtures with $368.8 million paid. (Table 9)

Average Wages Per Production Worker in the Forest Products Industry. Average wages both unadjusted and adjusted for inflation per production worker in major Wisconsin manufacturing industries are tabulated in Table 11. The average unadjusted wage per production worker in the lumber and wood products industry increased from $4,422 in 1967 to $9,519 in 1977. After the 1977 wages were adjusted for inflation, the average wage was $5,243. This amounted to an 18.7 percent increase in real dollar income. In furniture and fixtures segment average wages were $4,483 in 1967, and $8,789 in 1977, a $4,845 increase. This became an 8.1 percent increase in real wages when adjusted to 1967 values. Production workers in the paper and allied products industry had an average wage of $7,085 in 1967 and unadjusted wages of $14,648 in 1977. The 1977 wages were equal to $8,072 when adjusted for inflation. The adjusted figure represented a 13.9 percent increase in real wages. For the entire forest products industry, the real average wages per production worker rose by 11.2 percent from 1967 to 1977.

In comparing the real average wages per production worker in the aggregated forest products industry to other manufacturing industries in Wisconsin, production workers in the forest products industry ranked fourth in real income growth from 1967 to 1977. Real wages of production workers in transportation equipment manufacturing increased the most, 17.3

Table 9

Wages Paid Production Workers in the Forest Products Industry and the Percentage of All Wisconsin Manufacturing

1967 to 1977

Wages (Million Dollars)

Industry and Percent \ Year	1967	1970	1971	1972	1974	1975	1976	1977
Lumber and Wood Products	65.0	60.3	63.5	99.6	123.6	123.1	150.2	179.9
Furniture and Fixtures	26.0	34.9	39.8	45.2	58.0	50.8	51.7	62.4
Paper and Allied Products	226.0	256.4	270.7	296.4	356.9	341.4	417.0	449.7
Forest Products Industry	317.0	351.6	374.0	441.2	538.5	515.3	618.9	692.0
All Manufacturing Industries	2332.8	2628.1	2681.7	3064.2	3874.8	3839.2	4223.6	4737.7
Percentage of Forest Products of all Manufacturers	13.6	13.4	13.9	14.4	13.9	13.4	14.7	14.6

Source: 1. Census of Manufactures, 1967 and 1972
2. Census of Manufactures, 1977 (Preliminary Report)
3. Annual Survey of Manufactures, 1970, 1971, 1974, 1975, 1976

Table 10

Seven Leading Wisconsin Manufacturing Industries With 200 Million Dollars Wages Paid Production Workers 1967 and 1977

	Year	
	1967	1977
	Wages (Million Dollars)	Wages (Million Dollars)
Machinery, Except Electrical	$559.3	$1028.5
Forest Products Industry	317.0	692.0
Food & Kindred Products	237.1	537.2
Fabricated Metal Products	201.9	508.5
Transportation Equipment	*	459.4
Electric, Electronic Equipment	217.3	396.0
Primary Metal Industry	*	297.2
Printing & Publishing	*	217.5

*Less than 200.0

Source: 1. Census of Manufactures, 1967
2. Census of Manufactures, 1977 (Preliminary Report)

Table 11

Unadjustd and Adjusted Wage/Production Worker and the Percentage Increase in Wisconsin Manufacturing Industries 1967 and 1977

	Wage/Production Worker			
	1967	1977	1977	
	Base Year (Dollars)	Unadjusted (Dollars)	Adjusted (Dollars)	Percent In Real Dollars
Lumber and Wood Products	4422.0	9519.0	5243.0	18.6
Furniture and Fixtures	4483.0	8789.0	4845.0	8.1
Paper and Allied Products	7085.0	14648.0	8072.0	13.9
Forest Products Ind. (1-3)	6050.0	12205.0	6725.0	11.2
Machinery, Except Electrical	7071.0	13254.0	7303.0	3.3
Food and Kindred Products	5741.0	12154.0	6695.0	16.6

Industry	Wage/Production Worker			Percent In Real Dollars
	1967	1977	1977	
	Base Year (Dollars)	Unadjusted (Dollars)	Adjusted (Dollars)	
Fabricated Metal Products	6137.0	12744.0	7023.0	14.4
Electric, Electronic Eqpmt.	6121.0	11314.0	6234.0	1.8
Transportation Equipment	6895.0	14677.0	8086.0	17.3
Primary Metal Industry	7070.0	13209.0	7276.0	2.9
Printing and Publishing	6327.0	12645.0	6965.0	10.1
Rubber, Misc. Plastic Products	5756.0	10304.0	5674.0	-1.4
Leather/Leather Products	4500.0	8760.0	4823.0	7.2
Chemical and Allied Products	6328.0	12020.0	6625.0	4.7
Instrument Related Products	5359.0	9508.0	5246.0	-2.1

Industry	Wage/Production Worker			Percent In Real Dollars
	1967	1977	1977	
	Base Year (Dollars)	Unadjusted (Dollars)	Adjusted (Dollars)	
Miscellaneous Manufacturing Industries	4657.0	7873.0	4342.0	-6.8
Stone, Clay, Glass Products	6742.0	-	-	-
Apparel, Other Textile Products	3457.0	6719.0	3702.0	7.1
Textile Mill Products	4321.0	8650.0	4775.0	10.5
Petroleum and Coal Products	-	17250.0	8500.0	-

percent from 1967 to 1977, followed by the food and kindred products and fabricated metal products with 16.6 and 14.4 percent increases respectively.

If the data for the forest products industry are disaggregated, the real wage increase received by production workers in lumber and wood products segment of the industry was 18.6 percent. This exceeded all increases among Wisconsin manufacturing industries.

Production workers in some industries witnessed real wage decline from 1967 to 1977. Fortunately, the forest products industry was not among this group. Increases in real wages probably indicate that the forest products industry will be able to retain skilled production workers within the industry.

Wages Trends. Figures 5 and 6 show the trends and level of wages paid production workers in the forest products industry from 1967 to 1977 before and after adjustments were made for inflation. Unadjusted wages showed a rising trend throughout the decade, except in 1975 when a small decline was experienced. This was due to a decline in the number of production workers that year. (Figure 5)

When wages are adjusted for inflation, a slightly different trend appears. A real loss in wages appeared in 1970 and 1975. In 1975 the loss was more severe. Although unadjusted wages increased rapidly from 1975 to 1977, the adjusted wages were only slightly higher in 1977 than in 1974. (Figure 6)

Figure 5. TRENDS IN UNADJUSTED WAGES OF PRODUCTION WORKERS 1967-1977

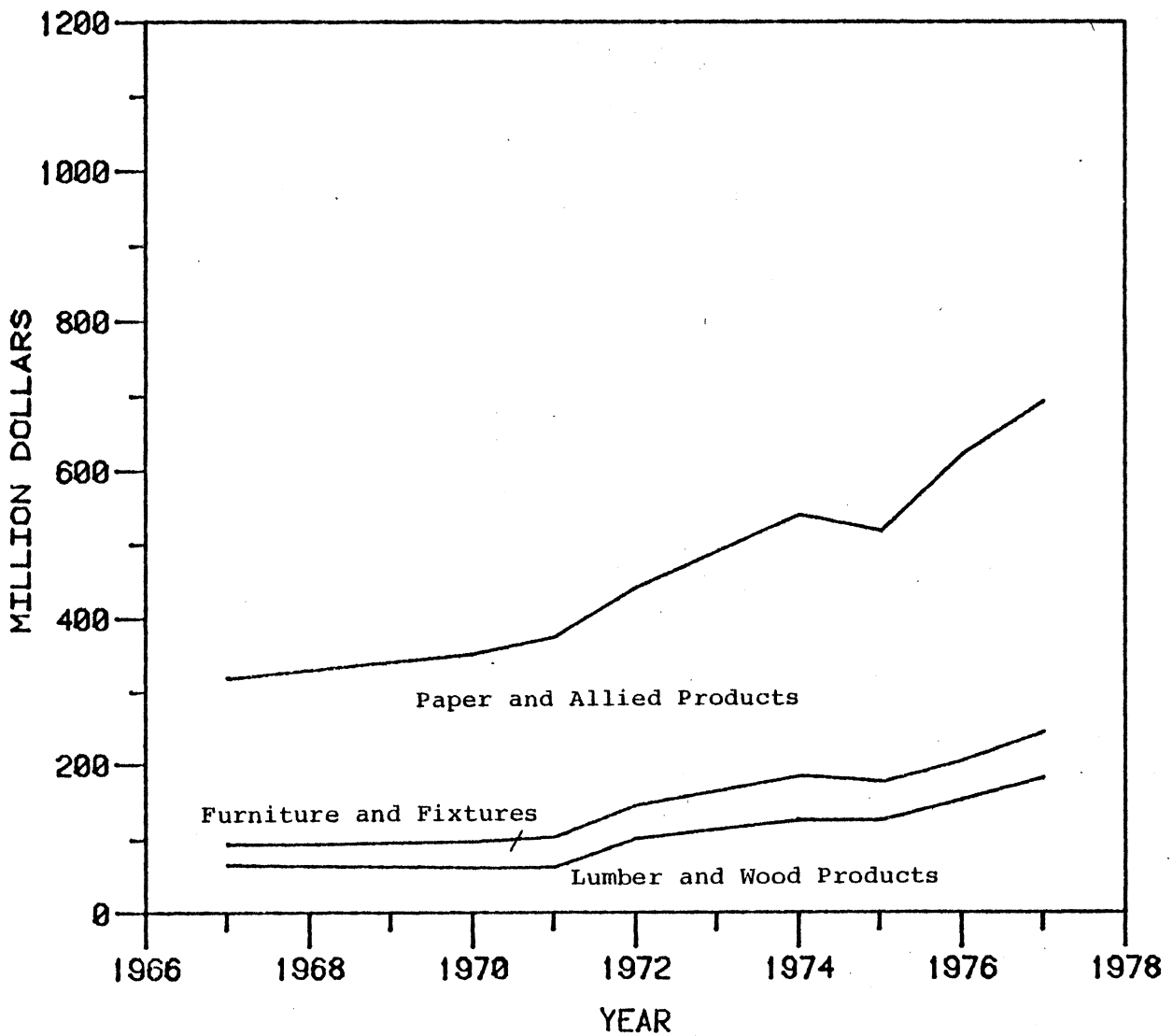
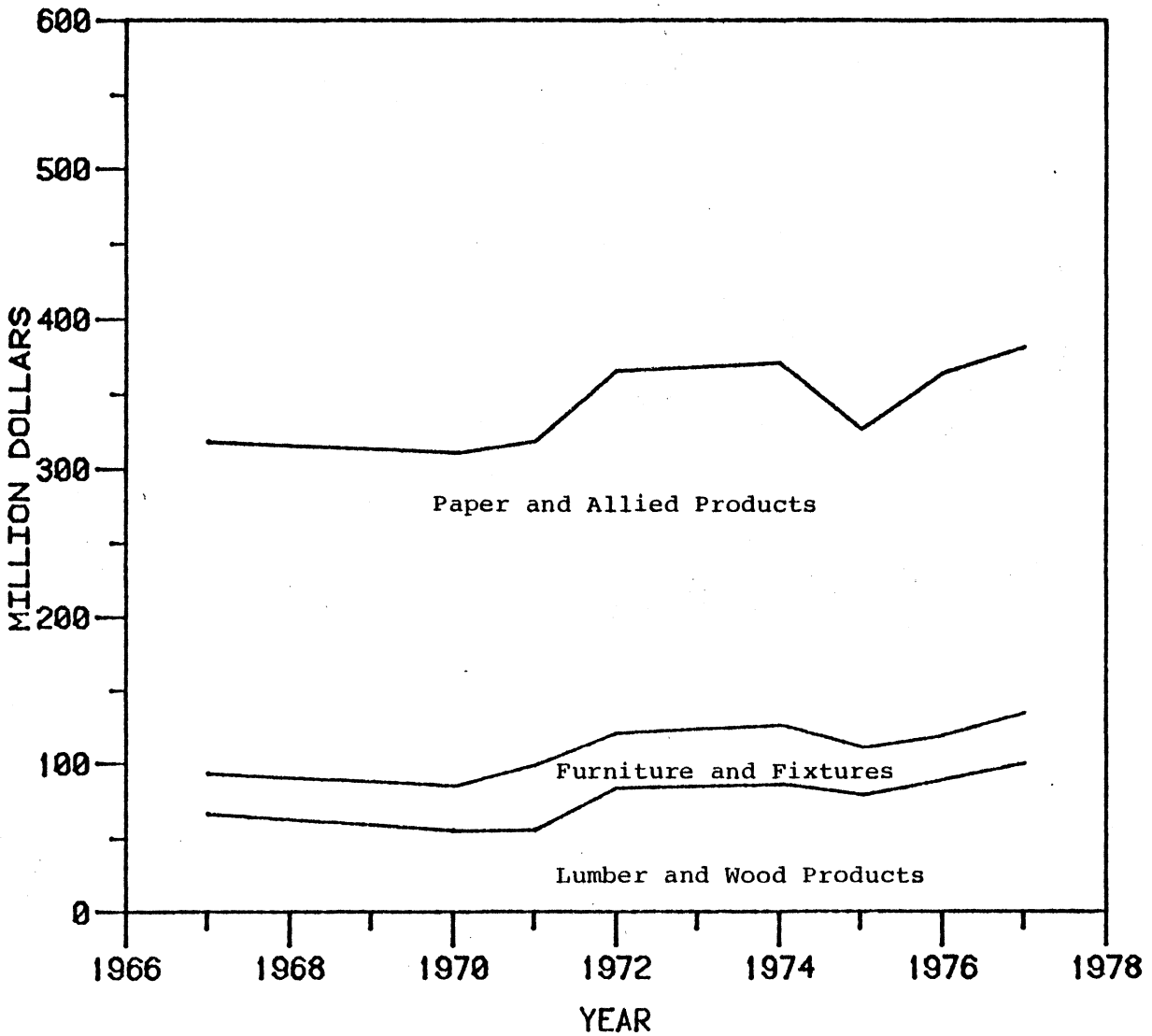


Figure 6. TRENDS IN ADJUSTED WAGES OF PRODUCTION WORKERS 1967-1977



From these trends, it could be concluded that production workers in the forest products industry were better off in terms of income received during the 1967 to 1977 decade particularly production workers in the lumber and wood products industry.

Value Added

Value added is the difference between the cost of materials purchased and used in the production processes and the value of products sold. This value is then adjusted for inventory and on-going (current) jobs in the industry. The adjusted value represented the contribution of the industry to the Gross National Product.

Value Added in the Forest Products Industry. The value added in the forest products industry was $865 million in 1967 and increased to $2,372.1 million in 1977. This represented a 175 percent increase during the decade. The forest products industry accounted for 12.3 percent of Wisconsin's manufacturing industries' total value added in 1967 and 14.2 percent in 1977. (Table 12) The forest products industry ranked third in 1967 in value added and second in 1977 among all Wisconsin manufacturers. (Table 13)

Among the three categories that made up the forest products insutry, paper and allied products produced the greatest amount of value added, 76.7 percent of the forest products industry's total in 1967 and 70.0 percent of the 1977 total.

Table 12

Value Added and the Percentage of All Wisconsin Manufacturing Industries'

Value Added

1967-1977

Value Added (Million Dollars)

Industry \ Year	1967	1970	1971	1972	1974	1975	1976	1977
Lumber and Wood Products	135.8	135.3	144.8	248.1	315.9	305.1	378.2	500.4
Furniture and Fixtures	65.7	96.5	105.7	127.1	148.3	134.4	167.3	211.9
Paper and Allied Products	663.5	738.0	775.6	847.2	1271.5	1221.5	1483.4	1659.8
Forest Products Industry	865.0	969.8	1026.1	1222.4	1735.7	1660.7	2028.9	2372.1
All Manufacturing Industry	7014.1	7874.1	8476.4	9449.9	12544.2	13010.5	14905.5	16761.5
Forest Products as a Percentage of All Manufacturing	12.3	12.3	12.1	12.9	13.8	12.8	13.6	14.2

Source: 1. Census of Manufactures, 1967
2. Census of Manufactures, 1977 (Preliminary Report)
3. Annual Survey of Manufactures, 1970, 1971, 1974, 1975, 1976

Table 13

Nine Leading Wisconsin Manufacturing Industries With

500 Million Dollars Value Added

1967 and 1977

Industry	Year	
	1967	1977
	Value Added (Million Dollars)	Value Added (Million Dollars)
Machinery, Except Electrical	$1590.2	$3676.4
Forest Products Industry	865.0	2372.1
Food & Kindred Products	910.3	2334.9
Transportation Equipmt.	558.1	1622.2
Fabricated Metal Prdcts.	571.8	1500.9
Electric, Electronic Equipment	697.3	1426.0
Primary Metal Industry	*	802.8
Printing & Publishing	*	757.3
Chemical & Allied Products	*	529.0

*Less than $500 million

Source: 1. Census of Manufactures, 1967
2. Census of Manufactures, 1977 (Preliminary Report)

The lumber and wood products industry accounted for 15.7 percent of the forest products industry's value added in 1967 and 21.1 percent in 1977. The furniture and fixtures segment accounted for 7.6 percent of the value added in 1967 and 8.2 percent in 1977. (Figure 7) The value added in logging amounted to 1.1 percent of the forest products industry's value added in 1967 and 1977.

Trends in Value Added. The value added in forest products manufacture shows a sharp increase in the second half of the 1967-77 decade. (Figure 7) The trend remains visible even after data are adjusted for inflation. The paper and allied products segment of the industry accounted for the greatest part of the increase in value added.

It is interesting to note that there was a slight decline in the adjusted value added from 1967 to 1971. (Figure 8) No single segment of the forest products industry seems to be responsible. The entire industry experienced a period of stagnation.

Productivity in the Forest Products Industry. When the adjusted value added is divided by the number employed, the resulting average value added per employee is a measure of employee productivity. Value added is used because it indicates the contribution of the industry to the Gross National Product.

Table 14 indicates adjusted value added per employee in Wisconsin's leading manufacturing industries for 1967 and 1977. In the following discussion, value added refers to

Figure 7. TRENDS OF UNADJUSTED VALUE ADDED 1967-1977

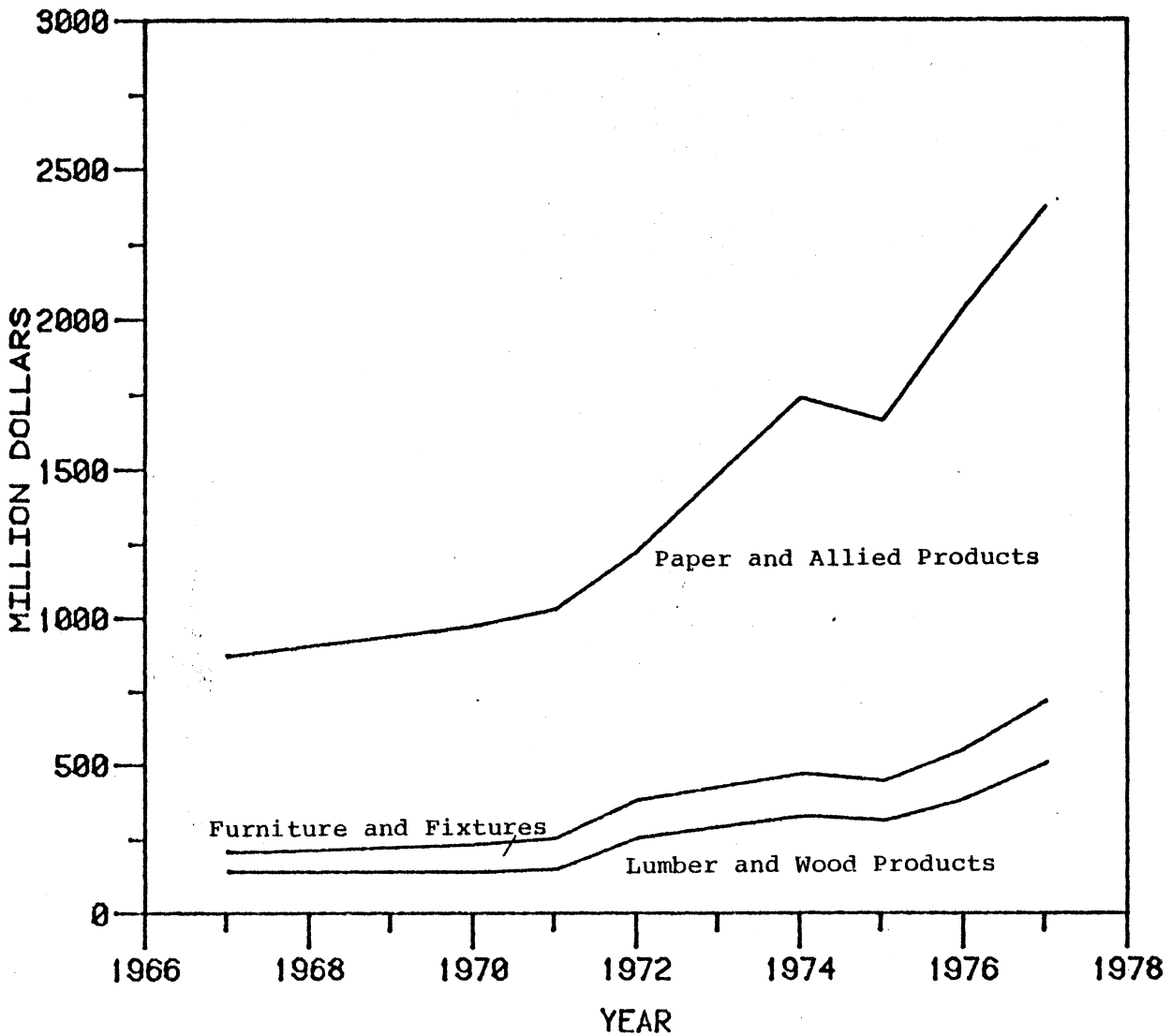
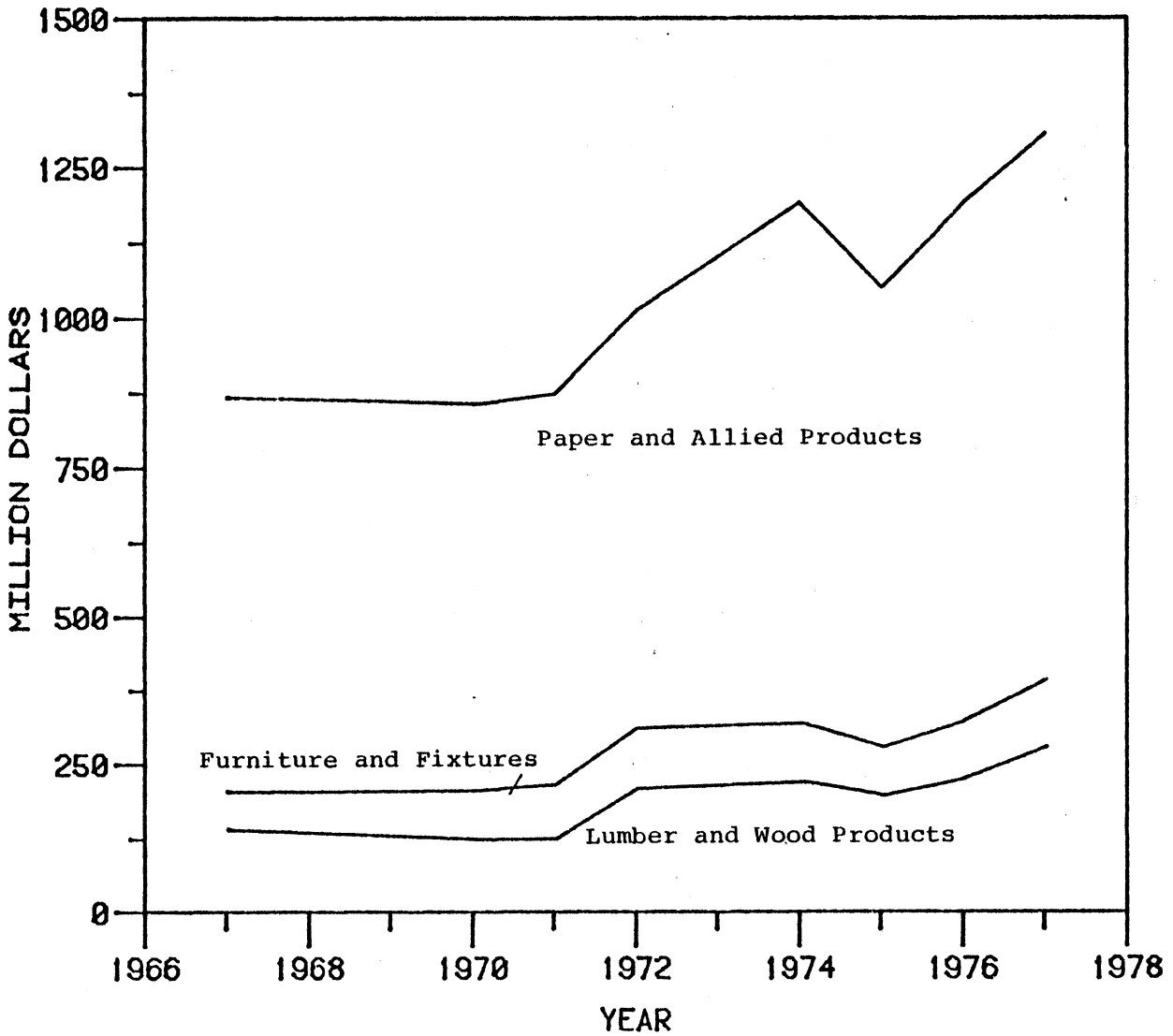


Figure 8. TRENDS OF ADJUSTED VALUE ADDED 1967-1977



adjusted amounts. The value added per employee in the lumber and wood products industry increased from $8,132 in 1967 to $12,253 in 1977. This amounted to a 50.7 percent increase in the decade. In furniture and fixtures value added per employee was $9,386 in 1967 and $12,967 in 1977, an increase of 38.2 percent. Value added per employee in the paper and allied products segment was $16,671 in 1967 and $23,267 in 1977. This represented a 39.6 percent increase. For the entire forest products industry, value added per employee rose from $13,206 in 1967 to $18,459 in 1977, an increase of 39.8 percent.

When value added per employee in the aggregated forest products industry is compared to other manufacturing industries in Wisconsin, value added per employee ranked first during the 1967-1977 decade. Value added per employee in the transportation equipment industry was next with 36.9 percent increase followed by the food and kindred products manufacturers with 33.5 percent increase.

If the data for the forest products industry are disaggregated, the value added per employee (productivity) in lumber and wood products segment of the industry increased by 50.7 percent. This exceeded all productivity increases among the Wisconsin manufacturers. Paper and allied products and furniture and fixtures segments of the forest products industry followed with 39.6 and 38.2 percent increase respectively.

Table 14

Adjusted Value Added Per Employee and the Percentage Increase in Wisconsin Leading Manufacturing Industries 1967 and 1977

Industry	1967 Value Added (Dollars)	1977 Value Added (Dollars)	Percentage Increase (Adjusted) 1967-1977
Lumber & Wood Products	$ 8132.0	$12253.0	50.7
Furniture & Fixtures	9386.0	12967.0	38.2
Paper & Allied Products	16671.0	23267.0	39.6
Forest Products Industry	13206.0	18459.0	39.8
Machinery, Except Electrical	14793.0	18465.0	24.8
Food & Kindred Prdcts.	16055.0	21440.0	33.5
Transportation Eqpmt.	16964.0	23216.0	36.9
Fabricated Metal Pr.	13267.0	15841.0	19.4
Electric, Electronic Equipment	13435.0	15316.0	14.0
Primary Mtl. Industry	12982.0	15968.0	23.0
Printing & Publishing	12004.0	13877.0	15.6
Chemical & Allied Pr.	27095.0	35988.0	32.8
Rubber, Misc. Plastic Products	13179.0	14870.0	12.8
Leather & Lthr. Pr.	9179.0	12017.0	30.9
Misc. Mfg. Industry	11835.0	12543.0	6.0
Instrument Rltd. Pr.	11828.0	13082.0	10.6
Stone, Clay, Glass Pr.	14437.0	-	-

Table 14 (Continued)

Industry	Value Added (Dollars)	Value Added (Dollars)	Percentage Increase (Adjusted) 1967-1977
Textile Mill Products	$11691.0	$13250.0	13.3
Apparel, Other Textile Products	7146.0	8667.0	21.3
Petroleum, Coal Products	-	33500.0	-

Productivity Ratio. The productivity ratio is the adjusted value added divided by the adjusted payroll. The ratio indicates the amount of value added per dollar of payroll.

Table 15 shows the productivity ratio in Wisconsin manufacturing industries in 1967 and 1977. The productivity ratio in lumber and wood products in 1967 was 1.6:1.0 and 2.1:1.0 in 1977; a 31 percent increase. In furniture and fixtures for the same period, the productivity ratios were 1.8:1.0 and 2.3:1.0 in 1967 and 1977 respectively; a 28 percent increase. The productivity ratio in the paper and allied products segment was 2.2:1.0 in 1967 and 2.7:1.0 in 1977, a 23 percent increase. The entire forest products industry productivity ratio increased by 19 percent during the 1967-1977 decade from 2.1:1.0 to 2.5:1.0.

The productivity ratio for the aggregated forest products industry ranked third among Wisconsin's manufacturers. If the forest products industry is disaggregated, the productivity ratio in lumber and wood products segment of the industry had the highest percentage increase of 31 percent, followed by the leather and leather products manufacturers with 29 percent and furniture and fixtures with 28 percent.

These figures indicate that the forest products industry continues to be among the leading manufacturers in terms of value added per dollar of payroll.

Table 15

Productivity Ratio and Percentage Increase in Wisconsin Leading Manufacturing Industries 1967 and 1977

	Productivity Ratio 1967	Productivity Ratio 1977	Percentage Increase 1967-1977
Lumber and Wood Products	1.6:1	2.1:1	31
Furniture and Fixtures	1.8:1	2.3:1	28
Paper and Allied Products	2.2:1	2.7:1	23
Forest Products Industry	2.1:1	2.5:1	19
Machinery, Except Electrical	1.9:1	2.3:1	21
Food and Kindred Products	2.5:1	3.0:1	20
Transportation Equipment	2.3:1	2.7:1	17
Fabricated Metal Products	1.9:1	2.0:1	5
Electric, Electronic Eqpmt.	1.9:1	2.1:1	11
Primary Metal Industry	1.7:1	2.0:1	18
Printing and Publishing	1.8:1	2.0:1	11
Chemical and Allied Products	3.7:1	4.7:1	27
Rubber, Misc. Plastic Products	2.0:1	2.3:1	15
Leather and Leather Products	1.7:1	2.2:1	29
Misc. Mfg. Industry	2.1:1	2.5:1	19
Instrument Related Products	1.9:1	2.1:1	11
Stone, Clay, Glass Products	2.1:1	-	-
Textile Mill Products	2.2:1	2.4:1	9
Apparel, Other Textile Prdcts.	1.7:1	2.0:1	18
Petroleum and Coal Products	-	3.3:1	-

Value of Shipments

The value of shipments is the total value of products manufactured by the industry including receipts for services rendered. The value of products transferred to other plants within the industry are also considered part of the value of shipments.

Value of Shipments. The value of shipments in the forest products industry was $1,919.6 million in 1967 and $5,425.8 million in 1977. This represented an increase of $3,506.2 million or 182.7 percent during the decade. The forest products industry accounted for 12.4 percent of all Wisconsin manufacturing industries' value of shipments in 1967 and 13.9 percent of the value in 1977. (Table 16) The forest products industry ranked third among all manufacturing industries in both 1967 and 1977 (Table 17)

Trends in the Value of Shipments. Except for the 1975 recession, the value of shipments in the forest products industry has shown steady annual growth during the last ten years. (Figure 9) Some of this growth was a result of inflation. In order to eliminate this variable, these data were adjusted using the producer price index for 1967 to 1977. The adjusted value of shipments produced the trend revealed in Figure 10.

The rate of growth for value of shipments adjusted to 1967 values is approximately 46 percent. This is considerably less than the unadjusted value of 183 percent increase. However, a consistent pattern of growth in the value of shipments remains except for 1975.

Table 16

Value of Shipments in Forest Products Industry and the Percentage of Manufacturing Industries' Value of Shipment in Wisconsin

1967-1977

Value of Shipments (Million Dollars)

Industry and Percent \ Year	1967	1970	1971	1972	1974	1975	1976	1977
Lumber and Wood Products	290.2	269.2	301.7	537.0	700.6	696.5	840.4	1078.3
Furniture and Fixtures	125.7	166.7	186.7	224.1	294.1	271.6	313.7	390.9
Paper and Allied Products	1503.7	1711.6	1815.1	1975.6	3036.5	3071.4	3704.6	3956.6
Forest Products Industry	1919.6	2147.5	2303.5	2736.7	4031.2	4039.8	4858.7	5425.8
All Manufacturing Industries	15452.1	17425.5	18830.0	21257.2	29599.3	31321.4	35427.3	39060.0
Forest Products Industry as a Percentage of All Manufacturing	12.4	12.3	12.2	12.9	13.6	12.9	13.7	13.9

Source: 1. Census of Manufactures, 1967
2. Census of Manufactures, 1977 (Preliminary Report)
3. Annual Survey of Manufactures, 1970, 1971, 1974, 1975, 1976

Table 17

Nine Leading Wisconsin Manufacturing Industries With 1000 Million Dollars Value of Shipment

1967-1977

Industry	1967	1977
	Value of Shipments (Million)	Value of Shipments (Million)
Food and Kindred Products	$3338.8	$9055.3
Machinery, Except Electrical	2988.9	7007.7
Forest Products Industry	1919.6	5425.8
Transportation Equipment	1667.9	4788.5
Fabricated Metal Products	1094.5	3098.0
Electric, Electronic Equipment	1137.4	2477.0
Primary Metal Products	*	1461.2
Printing and Publishing	*	1275.9
Chemical and Allied Products	*	1010.2

*Less than 1000

Source: 1. Census of Manufactures, 1967
2. Census of Manufactures, 1977 (Preliminary Report)

Figure 9. TRENDS OF UNADJUSTED VALUE OF SHIPMENTS 1967-1977

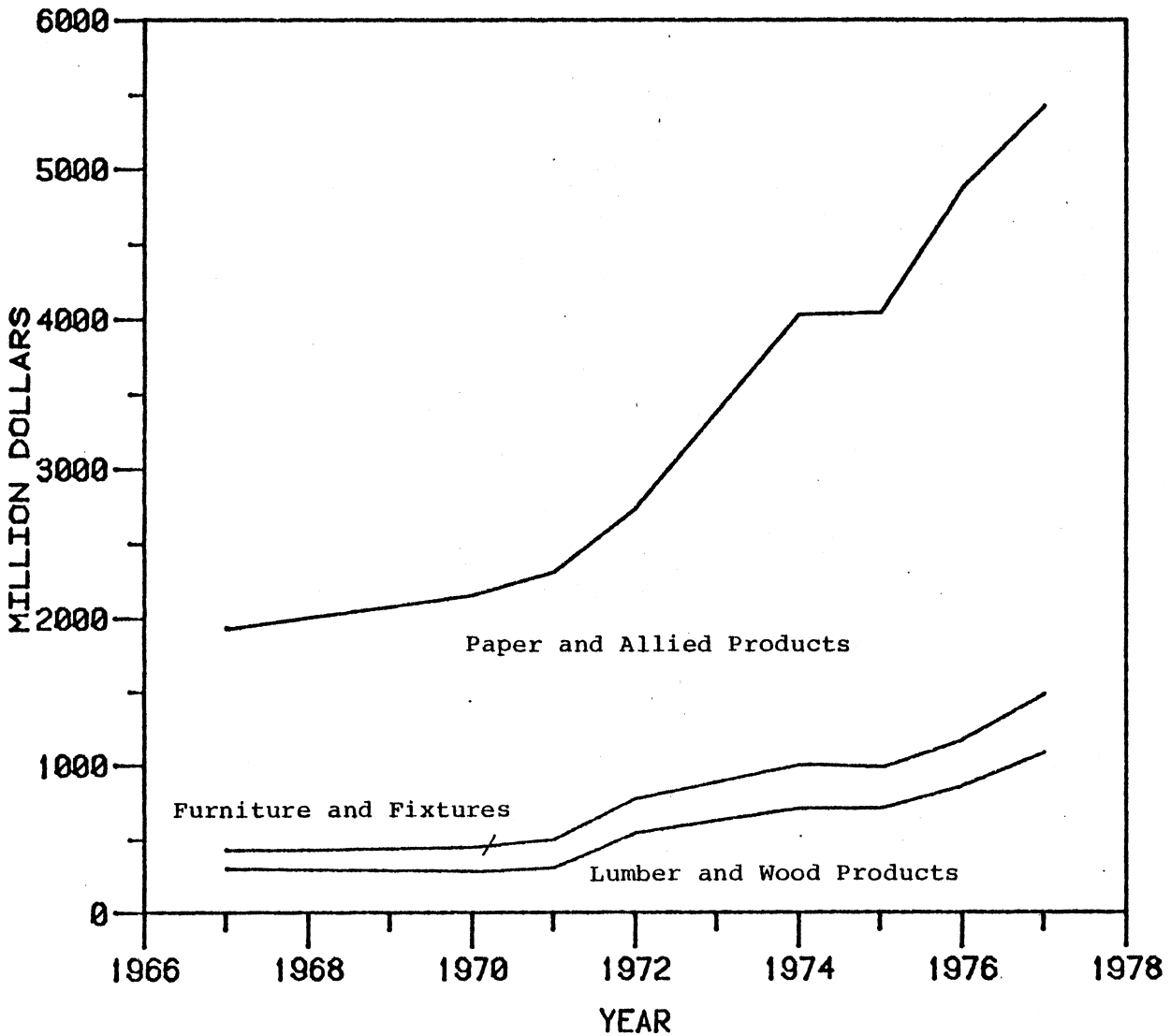
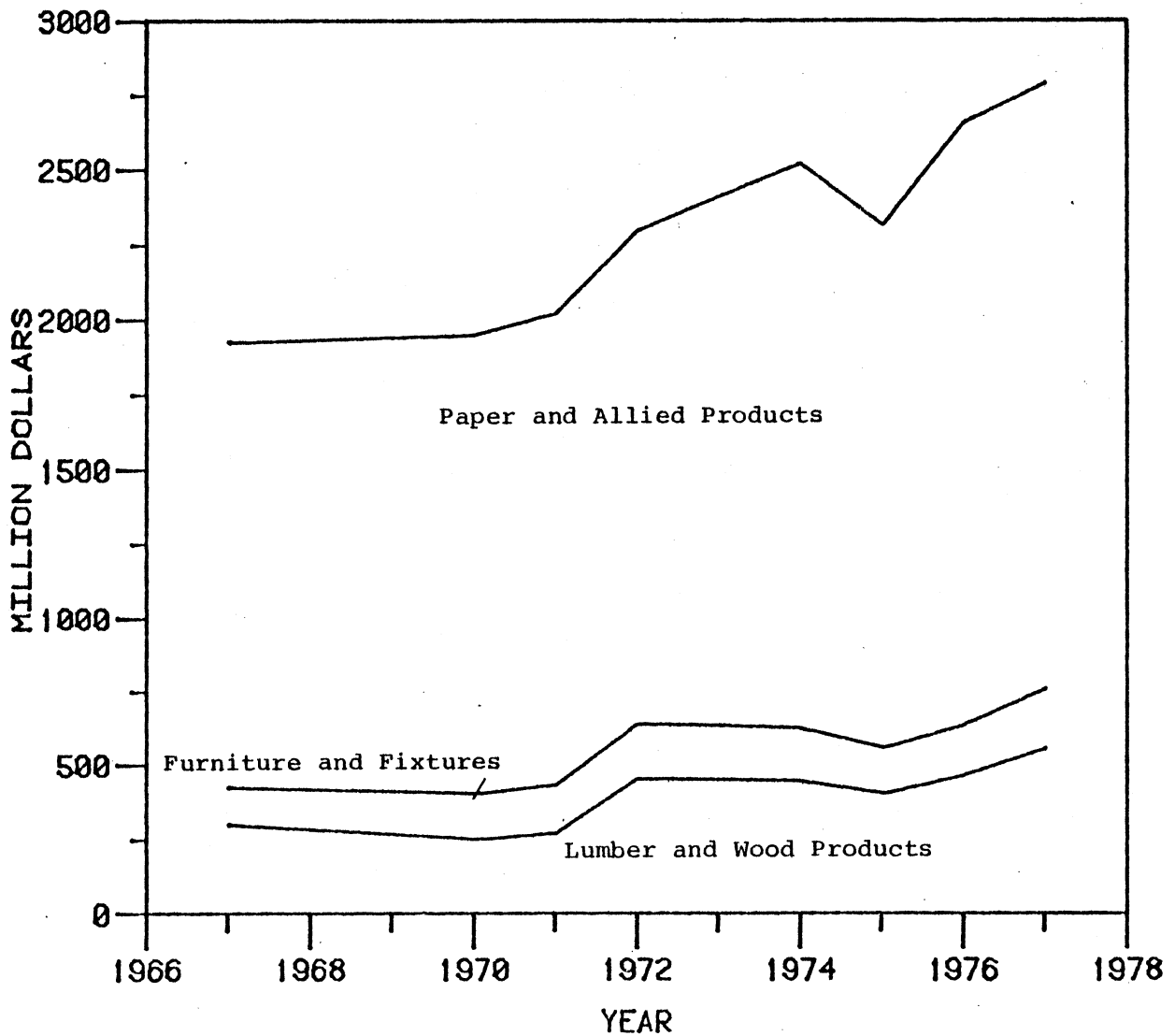


Figure 10. TRENDS OF ADJUSTED VALUE OF SHIPMENTS 1967-1977



New Capital Expenditures

New capital expenditures include expenditures for permanent additions to the industry, expenditures on new machinery and equipment used for replacement. Expenditures for land are not included in these data.

New Capital Expenditures. In 1967, the forest products industry spent $119.6 million for new capital items. Expenditures increased to $352.6 million in 1977. This represented an increase of nearly 200 percent. The forest products industry's expenditures represented 23.6 percent of all Wisconsin manufacturing industries' new capital expenditures in 1967 and 29.7 percent of all manufacturing expenditures in 1977. (Table 18)

The forest products industry ranked first among Wisconsin manufacturers in new capital expenditures in 1967 and 1977. (Table 19)

When capital expenditures for pollution abatement of $53.4 million is subtracted from 1977 capital expenditures, the forest products industry continued to remain in first place among manufacturers.

The paper and allied products segment of the industry spent the largest amount on capital expenditures in both 1967 and 1977. Second was lumber and wood products, followed by the furniture and fixtures portion of the industry. Expenditures by the paper and allied products companies were $109.5 million and $309.9 million in 1967 and 1977 respectively.

Table 18

New Capital Expenditures in the Forest Products Industry and the Percentage of Wisconsin Manufacturing Industries' New Capital Expenditures

1967-1977

Industry and Percent \ Year	1967	1970	1971	1972	1974	1975	1976	1977
Lumber and Wood Products	8.0	10.5	12.4	24.7	24.8	23.3	20.4	33.8
Furniture and Fixtures	2.1	8.3	4.9	6.1	5.1	5.8	4.8	8.9
Paper and Allied Products	109.5	67.1	57.9	69.0	101.2	173.4	227.9	309.9
Forest Products Industry	119.6	85.9	75.2	99.8	131.1	202.5	253.1	352.6
All Manufacturing Industries	506.6	468.1	406.4	535.2	892.9	880.8	913.1	1189.2
Forest Products Industry as a Percentage of All Manufacturers	23.6	18.4	18.5	18.6	14.7	23.0	27.7	29.7

Source: 1. Census of Manufactures, 1967
2. Census of Manufactures, 1977 (Preliminary Report)
3. Annual Survey of Manufactures, 1970, 1971, 1974, 1975, 1976

Table 19

Eight Leading Wisconsin Manufacturing Industries With 40 Million Dollars in Annual New Capital Expenditures 1967 and 1977

Industry	1967	1977
	Capital Expenditures (Million)	Capital Expenditures (Million)
Forest Products Industry	$119.6	$352.6
Machinery, Except Electrical	117.6	200.1
Food and Kindred Products	58.7	179.7
Electric, Electronic Equipment	42.0	83.1
Fabricated Metal Products	*	80.2
Primary Metal Industry	*	71.0
Transportation Equipment	*	50.5
Printing and Publishing	*	42.1

*Less than 40.0

Source: 1. Census of Manufactures, 1967
2. Census of Manufactures, 1977 (Preliminary Report)

This represented 91.5 percent in 1967 and 87.9 percent in 1977 of the forest products industry's new capital expenditures. Lumber and wood products companies spent $8 million and $33.8 million, or 6.7 and 9.6 percent of the industry total expenditures respectively. The furniture and fixtures spent only 1.8 percent in 1967 and 2.5 percent in 1977 of all industry expenditures. (Table 20)

Logging contractors in Wisconsin invested $1.6 million in 1967 and $3.5 million in 1977. This represented about one percent of the total forest products industry new capital expenditures.

Capital Expenditures on Pollution Abatements. In 1976, the forest products industry spent $49.9 million on pollution abatement. (Table 20) Of this amount, nearly one million dollars was spent by the lumber and wood products companies and the furniture and fixtures segment had no expenditures that year. The paper and allied products segment of the industry invested $49 million, or 98 percent, of the industry expenditures.

In 1977, $53.4 million was spent by the forest products industry. The lumber and wood products segment spent $5.6 million, or 10 percent of the total. Furniture and fixtures companies invested approximately one percent of all the expenditures on pollution abatement in the industry. The paper and allied products segment spent $47.5 million, or 89 percent of the total.

Table 20

Capital Expenditures on Pollution Abatements and the Percentage of New Capital Expenditures in Forest Products Industry

1976 and 1977

Industry	Capital Expenditure On Pollution Abatement 1976 (Million)	Capital Expenditure On Pollution Abatement 1977 (Million)	Percentage Of Total New Capital Expenditure 1976	Percentage Of Total New Capital Expenditure 1977
Lumber and Wood Products	$ 0.9	$ 5.6	0.3	1.6
Furniture and Fixtures	0.0	0.3	0.0	0.1
Paper and Allied Products	49.0	47.5	19.4	13.4
Forest Products Industry	49.9	53.4	19.7	15.1

Source: U.S. Department of Commerce: Bureau of the Census. Current Industrial Report: Pollution Abatement Costs and Expenditures, 1976 and 1977.

Capital expenditures on pollution abatements by the forest products industry was approximately 20 percent of total capital expenditures of the industry in 1976 and 15 percent in 1977.

Trends of New Capital Expenditure in the Forest Products Industry. The unadjusted capital expenditures in forest products industry is indicated in Figure 11. Lumber and wood products showed an increase in expenditure from 1967 to 1974, a slight decrease in 1975 and 1976, and an increase in 1977. When the capital expenditures on pollution abatement in 1976 and 1977 were taken into consideration, this trend is not seriously affected. Furniture and fixtures showed an increase from 1967 to 1970, declined in 1974 and thereafter showed the same growth trend as the lumber and wood products segment. Neither the furniture nor the lumber segment spent a significant amount on pollution abatement.

New capital expenditures by paper and allied products companies experienced a decline from 1967 to 1972. Thereafter, there was a rapid growth in capital expenditures to 1977. When the capital expenditure on pollution abatement by the paper and allied products is considered, the rapid growth in capital expenditures experienced in 1976 and 1977 was due, in part, to expenditures on pollution abatement. Nevertheless, growth is still obvious. (Figure 11A)

When the new capital expenditures were adjusted for inflation, the trend remains much the same as indicated by unadjusted data. (Figures 12 and 12A)

Figure 11. TRENDS OF UNADJUSTED NEW CAPITAL EXPENDITURE 1967-1977

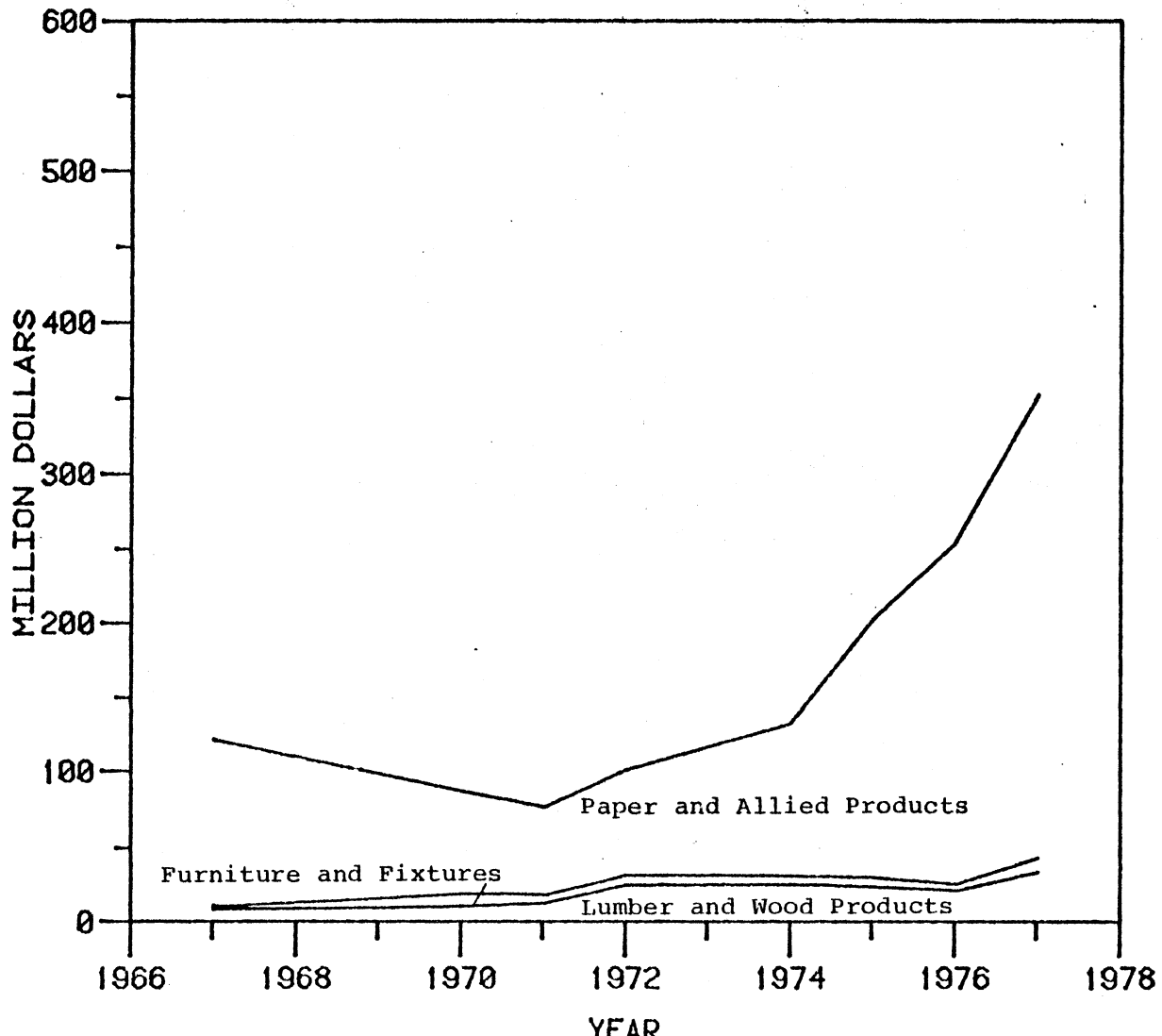


Figure 11A. TRENDS IN CAPITAL EXPENDITURE LESS CAPITAL EXPENDITURE

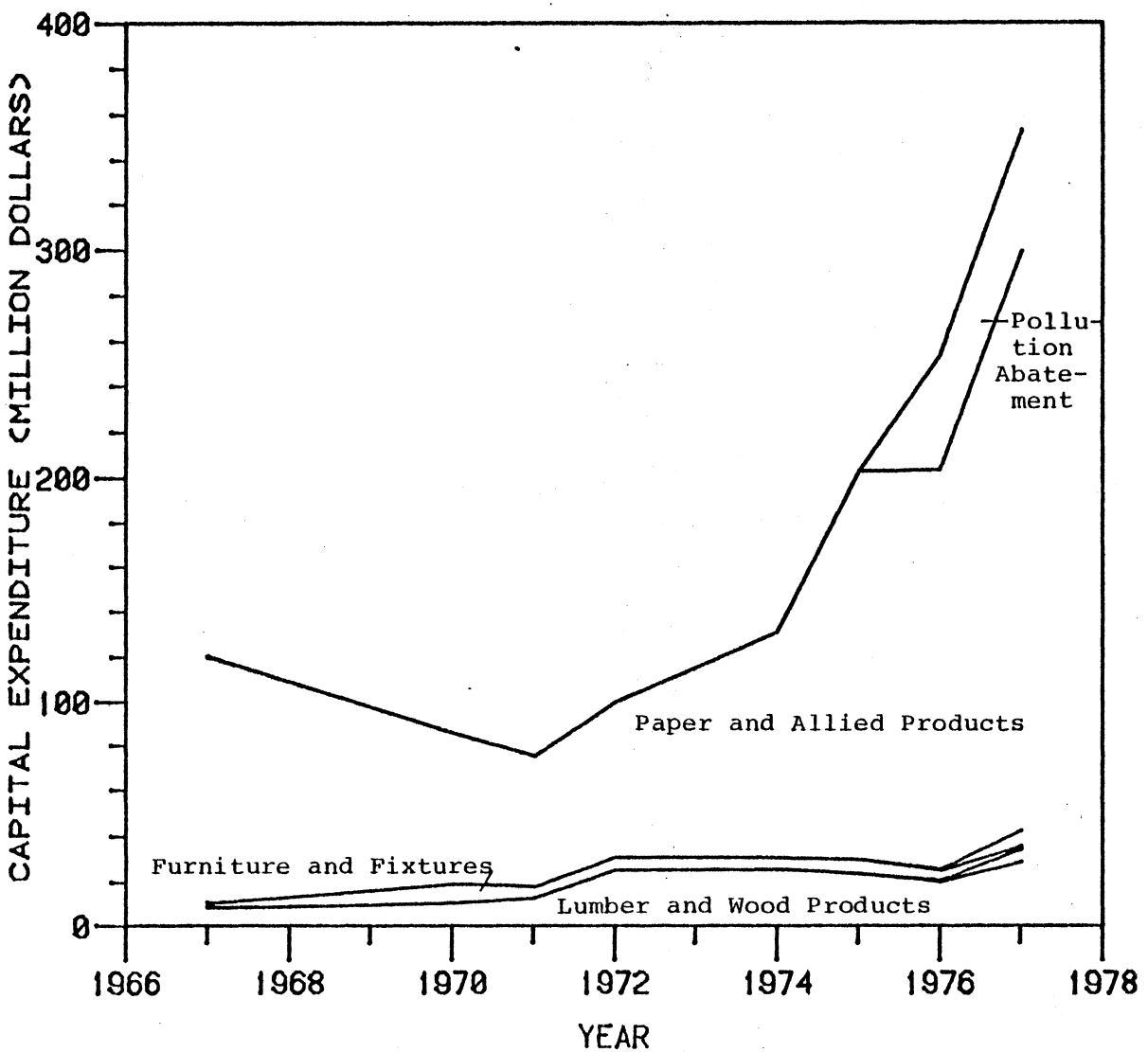


Figure 12. TRENDS OF ADJUSTED NEW CAPITAL EXPENDITURE 1967-1977

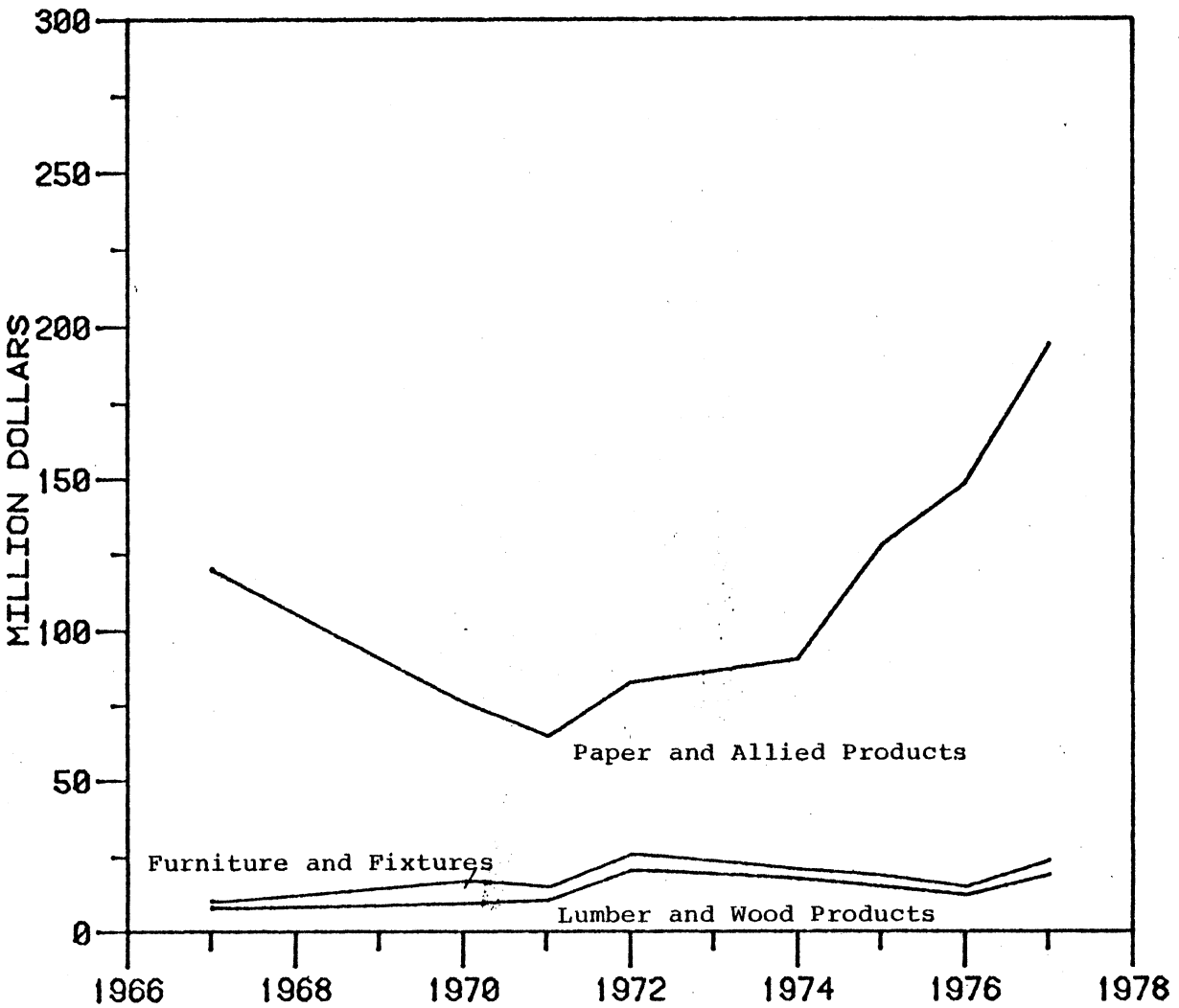
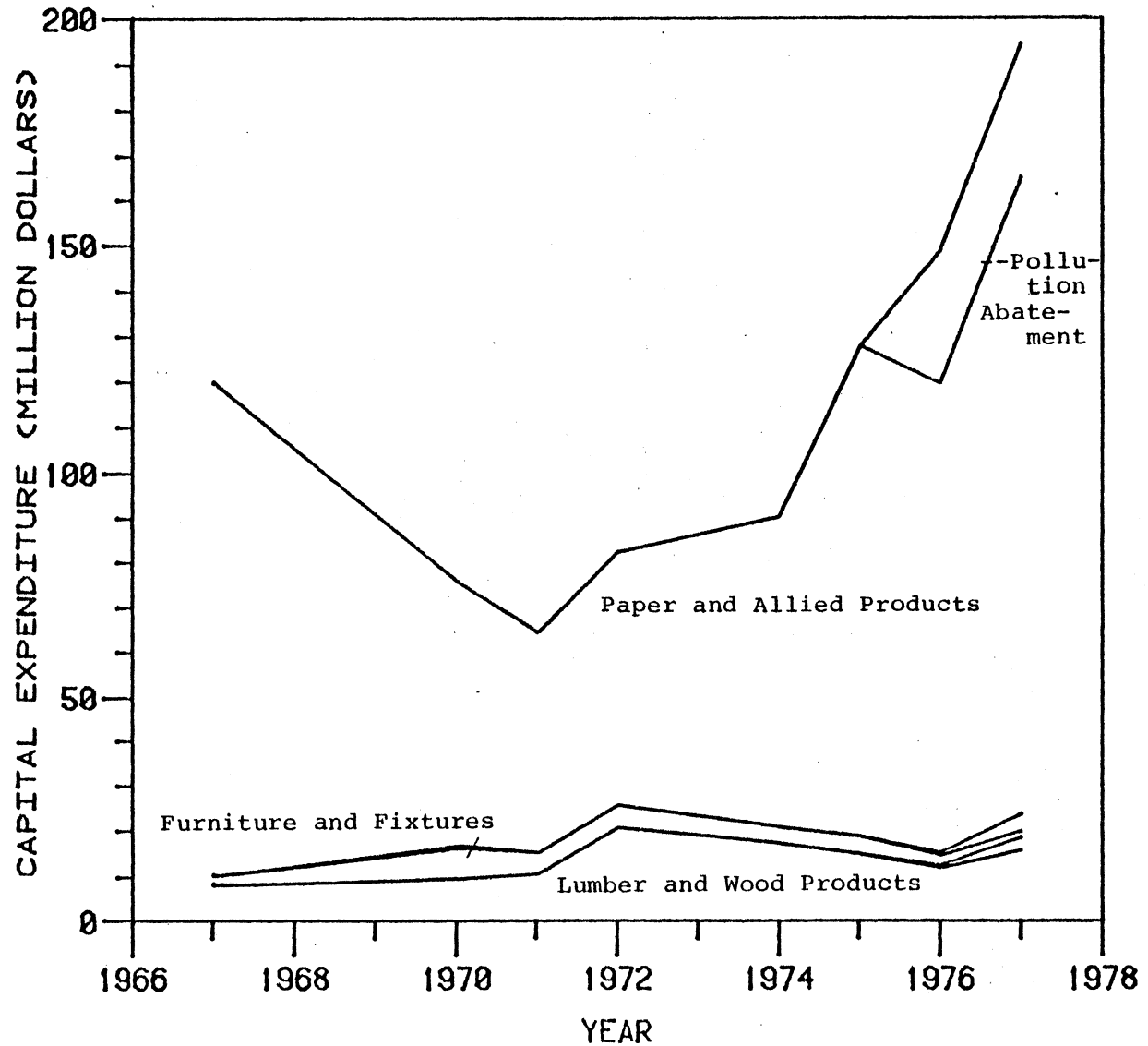


Figure 12A. TRENDS OF ADJUSTED CAPITAL EXPENDITURE LESS CAPITAL EXPENDITURE ON POLLUTION ABATEMENT



Costs of Materials

The costs of materials refer to the amount paid or payable for items consumed in the production of goods and services. Costs include: raw materials, semi-finished goods, supplies, fuel, electricity and many other non-labor inputs.

Costs of Materials in the Forest Products Industry. The costs of materials consumed by the forest products industry in 1967 was $1,064.8 million and $3,090.9 million in 1977. (Table 21) This represented an increase of $2,026.1 million over the ten year period, an increase of 190.3 percent. The costs of materials used by the forest products industry amounted to 12.4 percent of all materials purchased by Wisconsin manufacturers in 1967 and 13.7 percent of all materials purchased in 1977. The forest products industry ranked fourth among all Wisconsin manufacturing industries' costs of materials used in both 1967 and 1977. (Table 22)

Among the three industrial groups making up the forest products industry, paper and allied product manufacturers spent the most for materials during the 1967 to 1977 decade, $849.6 million in 1967 and $2,320 million in 1977. This represented nearly 80 percent of the total expenditures by the forest products industry in 1967 and 75.1 percent of the 1977 industry total. Expenditures by the lumber and wood products group were $154.8 and $588.2 million in 1967 and 1977 respectively; or 14.5 percent and 19 percent of the total forest products industry costs of materials in each of those two years. Materials costs in the furniture and fixtures

Table 21

Costs of Materials in Forest Products Industry and the Percentage of Wisconsin Manufacturing Industries' Cost of Materials

1967-1977

Industry and Percent \ Year	1967	1970	1971	1972	1974	1975	1976	1977
Lumber and Wood Products	154.8	133.8	158.4	289.5	387.2	394.5	485.7	588.2
Furniture and Fixtures	60.4	72.9	82.1	100.4	149.5	135.0	149.4	182.7
Paper and Allied Products	849.6	982.0	1045.0	1135.0	1796.8	1856.5	2236.8	2320.0
Forest Products Industry	1064.8	1188.7	1286.0	1524.9	2333.5	2386.0	2871.9	3090.9
All Manufacturing Industries	8511.3	9615.7	10343.0	11977.5	17563.4	18305.4	20670.1	22556.5
Forest Products Industry as a Percentage of All Manufacturing Industry	12.5	12.4	12.4	12.7	13.3	13.0	13.9	13.7

Source: 1. Census of Manufactures, 1967
2. Census of Manufactures, 1977 (Preliminary Report)
3. Annual Survey of Manufactures, 1970, 1971, 1974, 1975, 1976

Table 22

Eight Leading Wisconsin Manufacturing Industries With

$500 Million Costs of Materials

1967 and 1977

Industry	1967	1977
	Costs of Materials (Million)	Costs of Materials (Million)
Food and Kindred Products	$2438.2	$6716.2
Machinery, Except Electrical	1418.2	3327.5
Transportation Equipment	1117.3	3169.3
Forest Products Industry	1064.8	3090.1
Fabricated Metal Products	530.3	1618.4
Electric, Electronic Equipment	*	1106.0
Primary Metal Products	*	677.9
Printing and Publishing	*	524.7

*Less than $500 Million

Source: 1. Census of Manufactures, 1967
2. Census of Manufactures, 1977 (Preliminary Report)

portion of the industry was $60.4 million in 1967 and $182.7 million in 1977. This was 5.7 percent and 5.9 percent of the industry total in 1967 and 1977 respectively.

Costs of materials in logging represented about one percent of forest products industry's total in 1967 and 1977.

Trends in Unadjusted and Adjusted Costs of Materials. The unadjusted costs of materials in the forest products industry is indicated in Figure 13. Lumber and wood products and furniture and fixtures showed a slight decline in the amount paid for materials from 1969 to 1970. From 1970 to 1977 both industries maintained a reasonably steady growth in materials cost. When these data were adjusted for inflation, the rate of growth was more modest. The industries experienced a noticeable decline in real expenditures in 1975. (Figure 14)

Expenditures for materials by the paper and allied products industry were considerably greater and increased in greater amount than for both furniture and lumber. There were no years in the 1967-1977 decade which showed a decline in amount spent for materials by the paper industry. When the data were adjusted for inflation, the declines in 1970 and 1975 also appeared in the paper industry.

Figure 13. TRENDS OF ADJUSTED COSTS OF MATERIALS 1967-1977

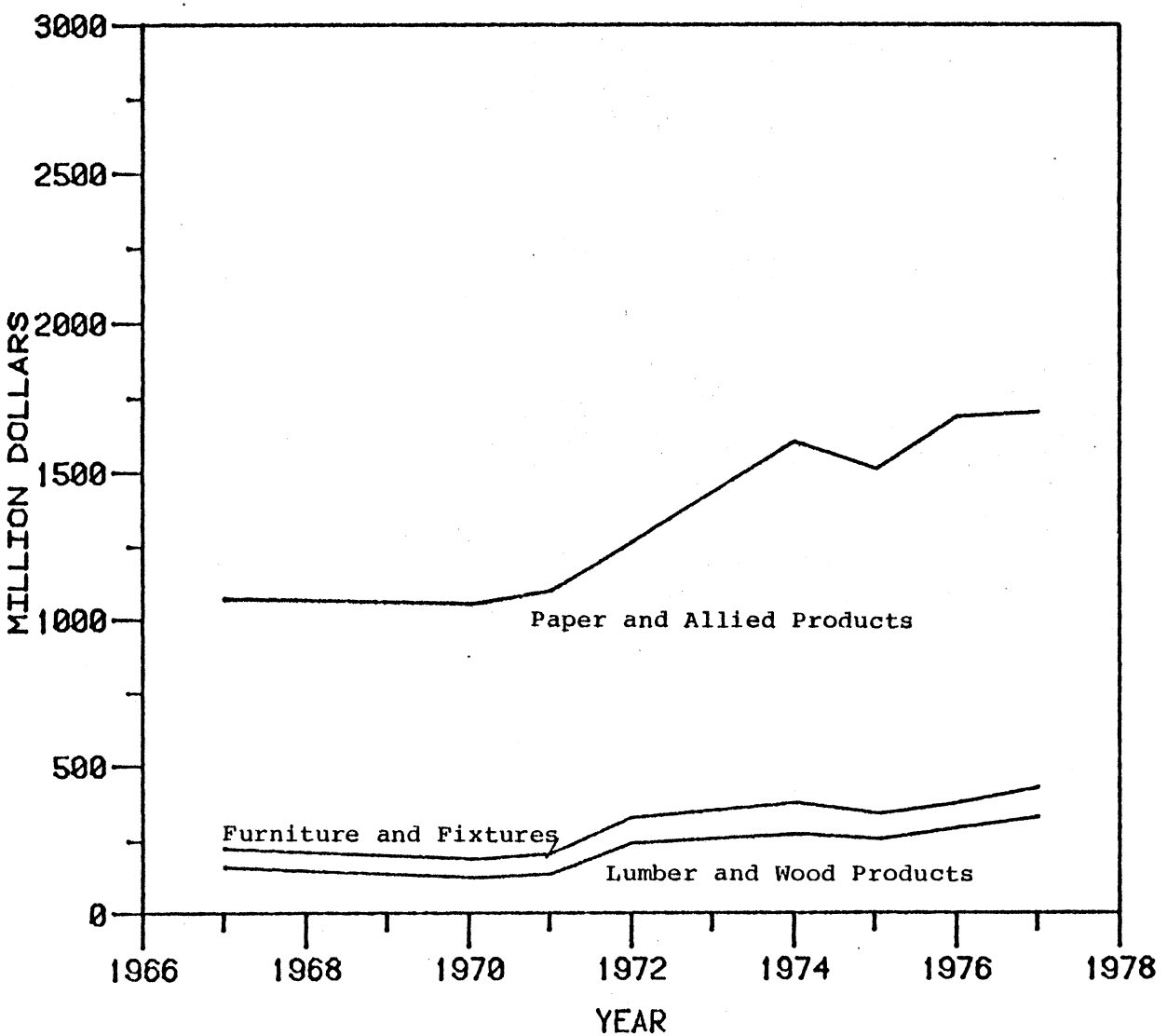
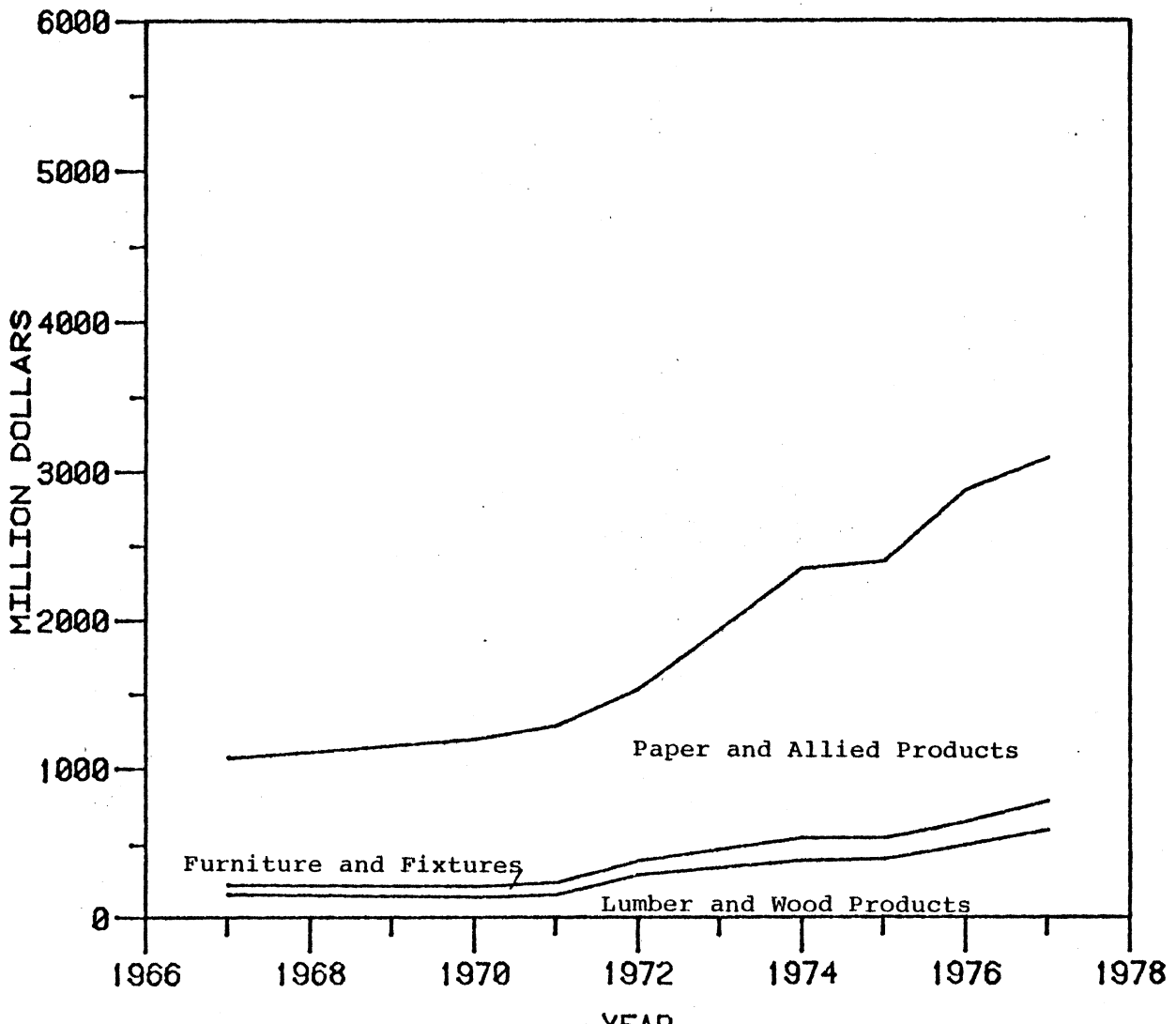


Figure 14. TRENDS OF UNADJUSTED COSTS OF MATERIALS 1967-1977



Future of Forest Products Industry

Annual Rate of Growth

The annual rates of growth for the period 1967 to 1977 were projected for each year from 1978 to 1987 for each of the variables discussed. (Table 23) Projections were made using the formula: $G = \sqrt[n]{\frac{\text{last period}}{\text{first period}}}$, where G = growth rate and n = number of periods. Projected values were calculated from the annual growth rates using the previous year's data multipled by 1 + annual growth rate. (Table 24) An example of the projection using annual growth rate for the number employed in the forest products industry is: $G = \sqrt[11]{\frac{70.8 \text{ thousand}}{63.5 \text{ thousand}}} = 1.0099$.

70.8 thousand x 1.0099 = 71.5 thousand projected employees for 1978. Future values used were adjusted to 1967 dollars (Table 24)

Projected values were also calculated using the linear regression procedures (trend-line analysis). The 1967, 1972, and 1977 data for each of the variables were used to project the values for 1982 and 1987. Projections were made using the following linear equation of the form: $y = mx + b$,

where $m = \text{slope} = \dfrac{\frac{\sum_{i=1}^{n} xiyi}{N} - \overline{xy}}{\sigma_x^2}$

$b = y - \text{intercept} = \overline{y} - \overline{mx}$

$\overline{x} = \text{average of x values} = \dfrac{\sum_{i=1}^{N} xi}{N}$

$\overline{y} = \text{average of y values} = \dfrac{\sum_{i=1}^{N} yi}{N}$

For this analysis, T1 Business Analyst Computer was used.

The results obtained are indicated in Table 25.

Table 23

Annual Rate of Growth of No. Employed & Adjusted Payroll, Value Added, Value of Shipment, Capital Expenditure, Costs of Materials, Production Workers and Wages of Production Workers of Forest Products Industry

1967-1977

Item	Annual Growth Rate (%)
Number Employed	0.9
Payroll	1.9
Value Added	3.8
Value of Shipment	3.5
New Capital Expenditure	4.5
Costs of Materials	4.4
Production Workers	0.7
Wages of Production Workers	1.7

Table 24

Projection of No. Employed, Adjusted Payroll, Value Added, Value of Shipment, Capital Expenditures, Costs of Materials, Production Workers and Wages of Production Workers of the Forest Products Industry Using Annual Rate of Growth 1967-1977

Year	Number Employed (Thousand)	Payroll (Million)	Value Added (Million)	Value of Shipment (Million)	Capital Expen-diture (Million)	Cost of Materials (Million)	Production Workers (Thousand)	Wages of Production Workers (Million)
1978	71.5	$528.6	$1356.9	$2890.9	$203.1	$1777.3	57.1	$387.8
1979	72.3	538.8	1408.7	2991.2	212.4	1854.8	57.5	394.3
1980	72.9	549.3	1462.5	3094.9	221.8	1935.7	57.9	401.0
1981	73.7	559.9	1518.4	3202.4	231.8	2020.1	58.3	407.7
1982	74.4	570.8	1576.4	3313.5	242.2	2108.2	58.7	414.6
1983	75.1	581.9	1636.6	3428.5	253.2	2200.1	59.2	421.6
1984	75.9	593.2	1699.1	3547.4	264.6	2296.0	59.6	428.8
1985	76.6	604.7	1764.0	3670.5	276.5	2396.1	60.0	436.0
1986	77.4	616.4	1831.4	3797.9	289.0	2500.6	60.4	443.4
1987	78.1	628.4	1901.4	3929.7	302.0	2609.6	60.9	450.9

Table 25

Projections of Number Employed and Adjusted Payroll, Value Added, Value of Shipment, Capital Expenditures, Costs of Materials, Production Workers and Wages of Production Workers of Forest Products Industry Using Regression Analysis 1982 & 1987

Year	Number Employed (Thousand)	Payroll (Million)	Value Added (Million)	Value of Shipment (Million)	Capital Expenditure (Million)	Cost of Materials (Million)	Production Workers (Thousand)	Wages of Production Workers (Million)
1982	74.3	$586.2	$1579.7	$3361.9	$201.8	$2107.6	58.6	$425.0
1987	78.5	651.6	1941.7	4055.9	257.2	2665.8	61.0	466.1

Projections

The forest products industry of Wisconsin is expected to experience moderate real growth in the next ten years from 1978-1987. (Figures 15-22) The most significant growth will take place in new capital expenditures (Figure 19) and costs of materials (Figure 20). Growth is not projected to be at the same rate in the number employed (Figure 15), number of production workers and wages paid (Figures 21 and 22) because growth will result more from the employment of new machinery and labor-saving technology.

When expressed in 1967 dollars, the value added by the forest products industry will exceed $1.9 billion in 1987. The industry will probably spend $2.6 billion for materials by 1987, and the value of the industry's shipments will increase by more than a billion dollars in real dollars by 1987.

When data were not adjusted for inflation, more dramatic growths were projected. However, projecting of unadjusted data assumes a similar rate of inflation will prevail in the future as in the past. At this writing, early 1980, inflation has risen to an annual rate of nearly 20%. It would be undesirable to make any projection using unadjusted data, and the results of these projections would probably differ dramatically from what will eventually occur.

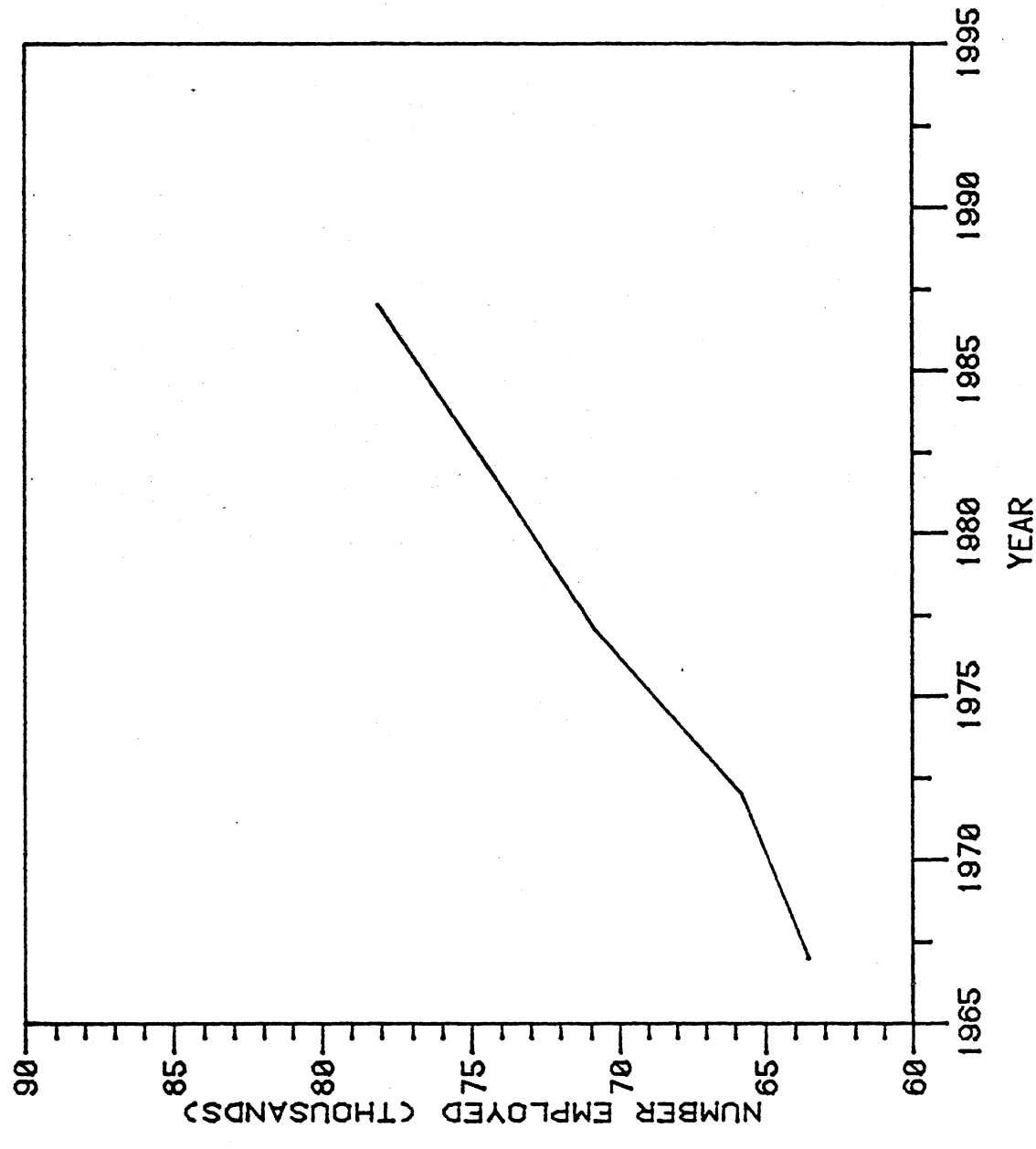

PROJECTION OF UNADJUSTED NO. EMPLOYED 1978-1987
NUMBER EMPLOYED (THOUSANDS)
90
85
80
75
70
65
60
1965
1970
1975
1980
1985
1990
1995
YEAR

Figure 15.

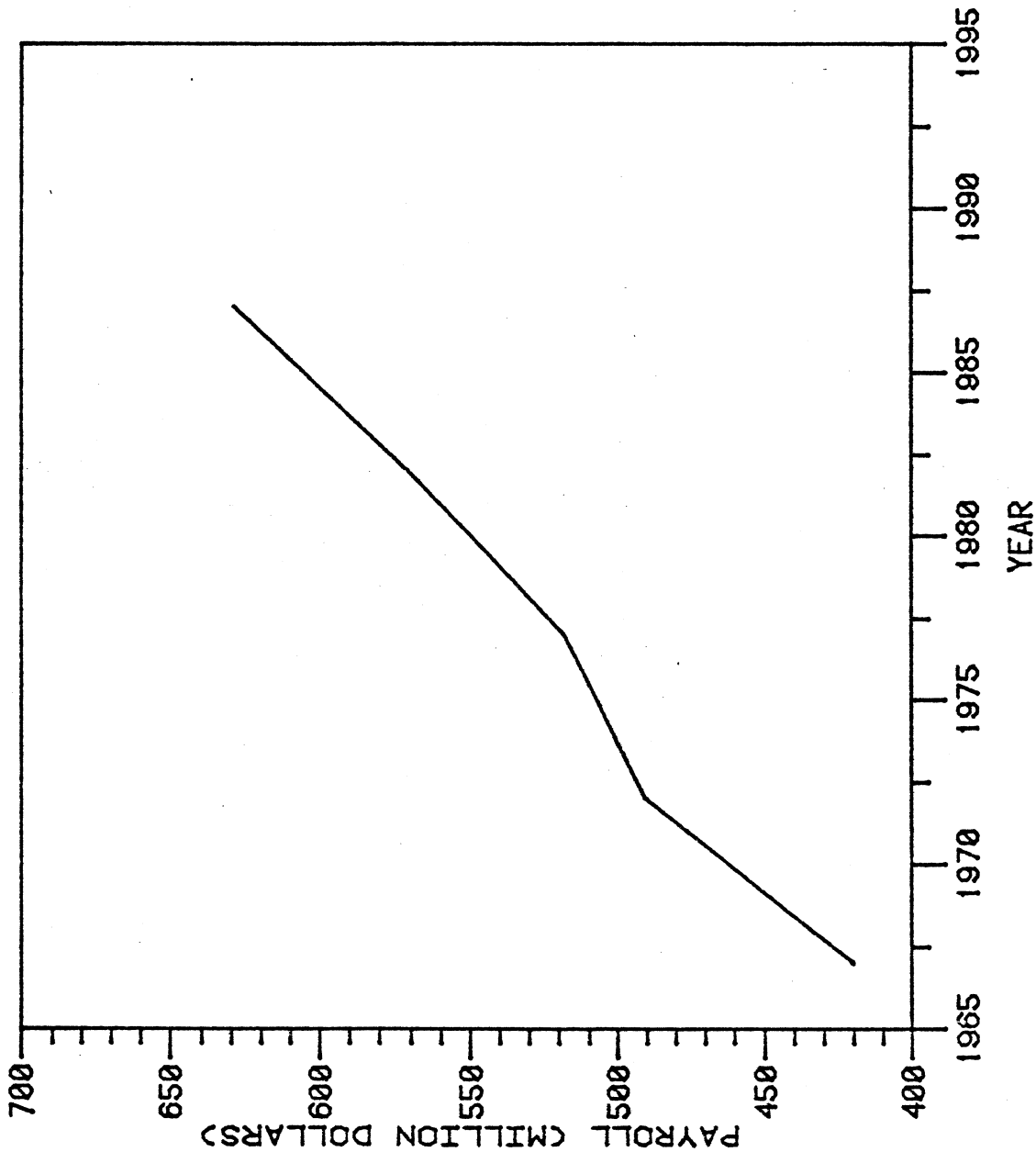

PROJECTION OF ADJUSTED PAYROLL 1978-1987
PAYROLL (MILLION DOLLARS)
700
650
600
550
500
450
400
1965
1970
1975
1980
1985
1990
1995
YEAR

Figure 16.

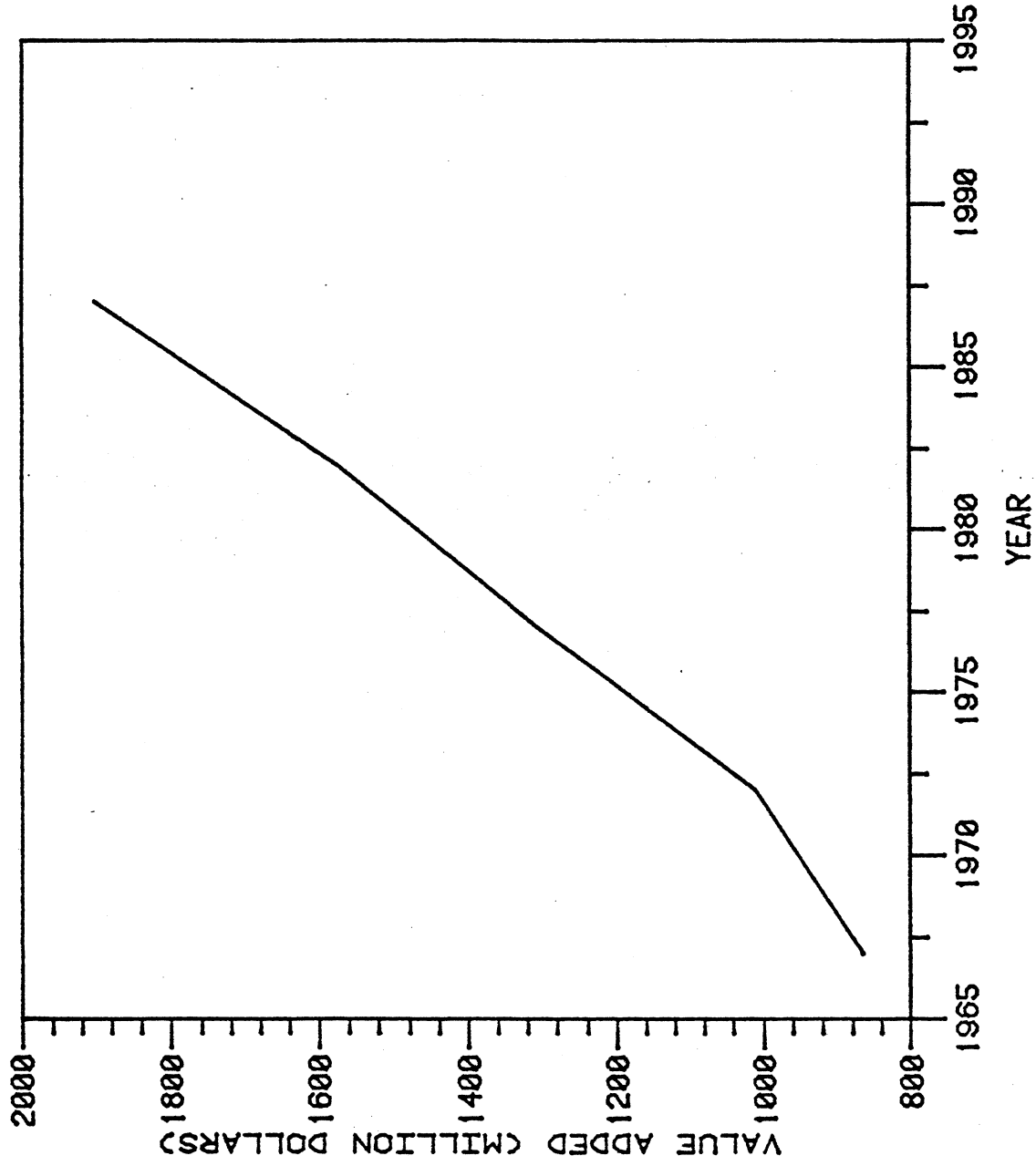


Figure 17. PROJECTION OF ADJUSTED VALUE ADDED 1978-1987

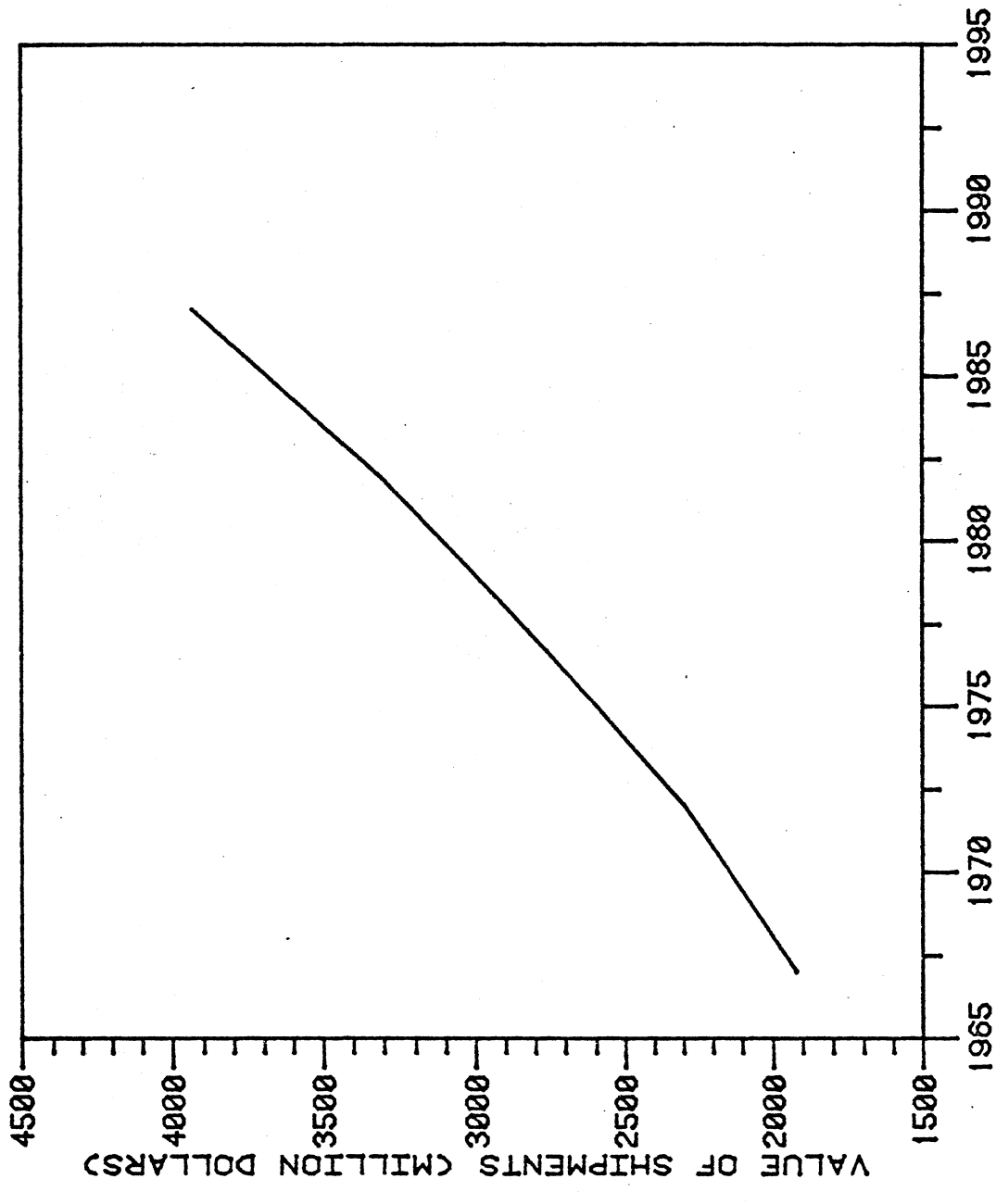

PROJECTION OF ADJUSTED VALUE OF SHIPMENTS 1978-1987
VALUE OF SHIPMENTS (MILLION DOLLARS)
4500
4000
3500
3000
2500
2000
1500
1965
1970
1975
1980
1985
1990
1995
YEAR

Figure 18.

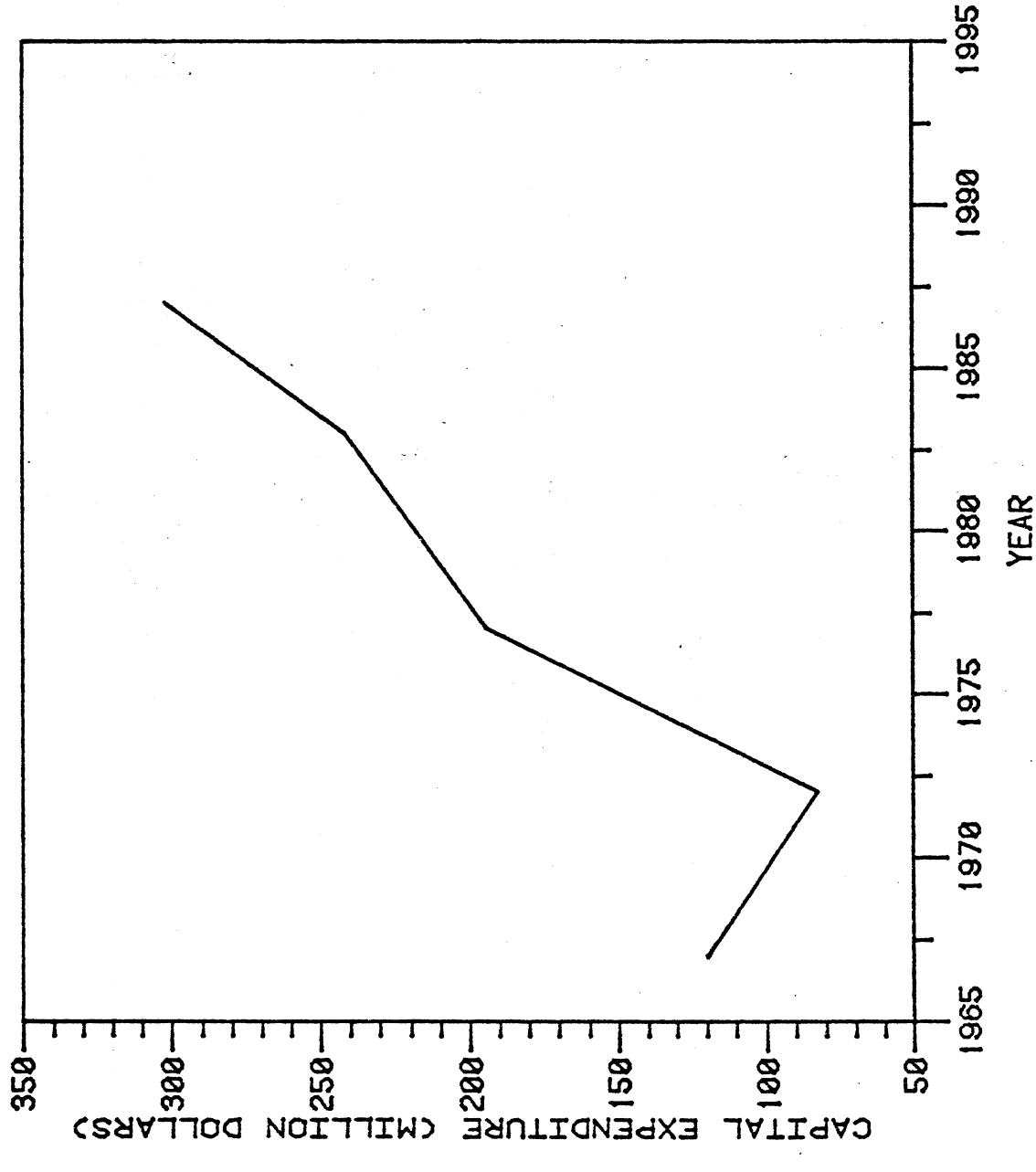
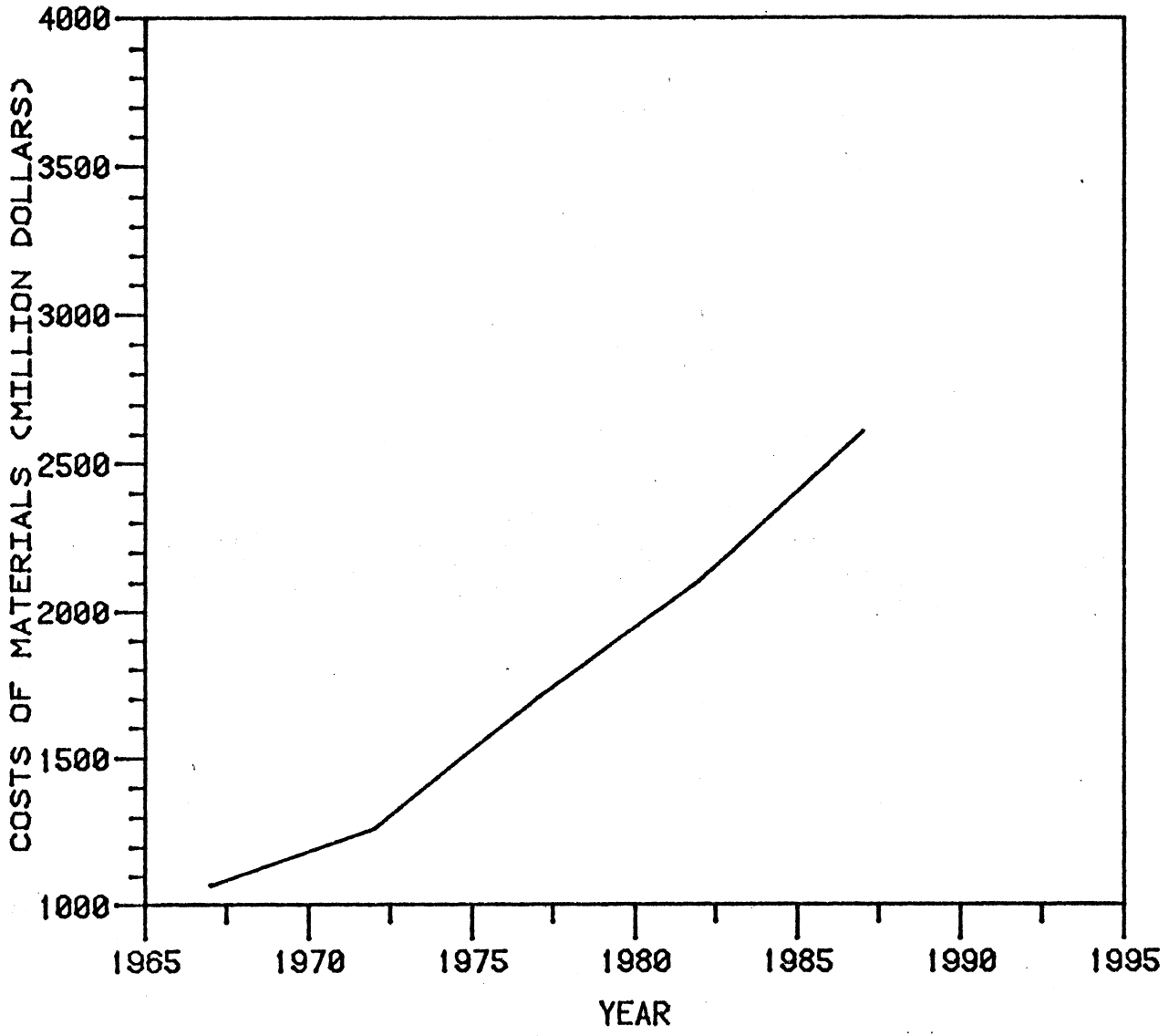

PROJECTION OF ADJUSTED CAPITAL EXPENDITURE 1978-1987
CAPITAL EXPENDITURE (MILLION DOLLARS)
350
300
250
200
150
100
50
1965
1970
1975
1980
1985
1990
1995
YEAR

Figure 19.

Figure 20. PROJECTION OF ADJUSTED COSTS OF MATERIALS 1978-1987



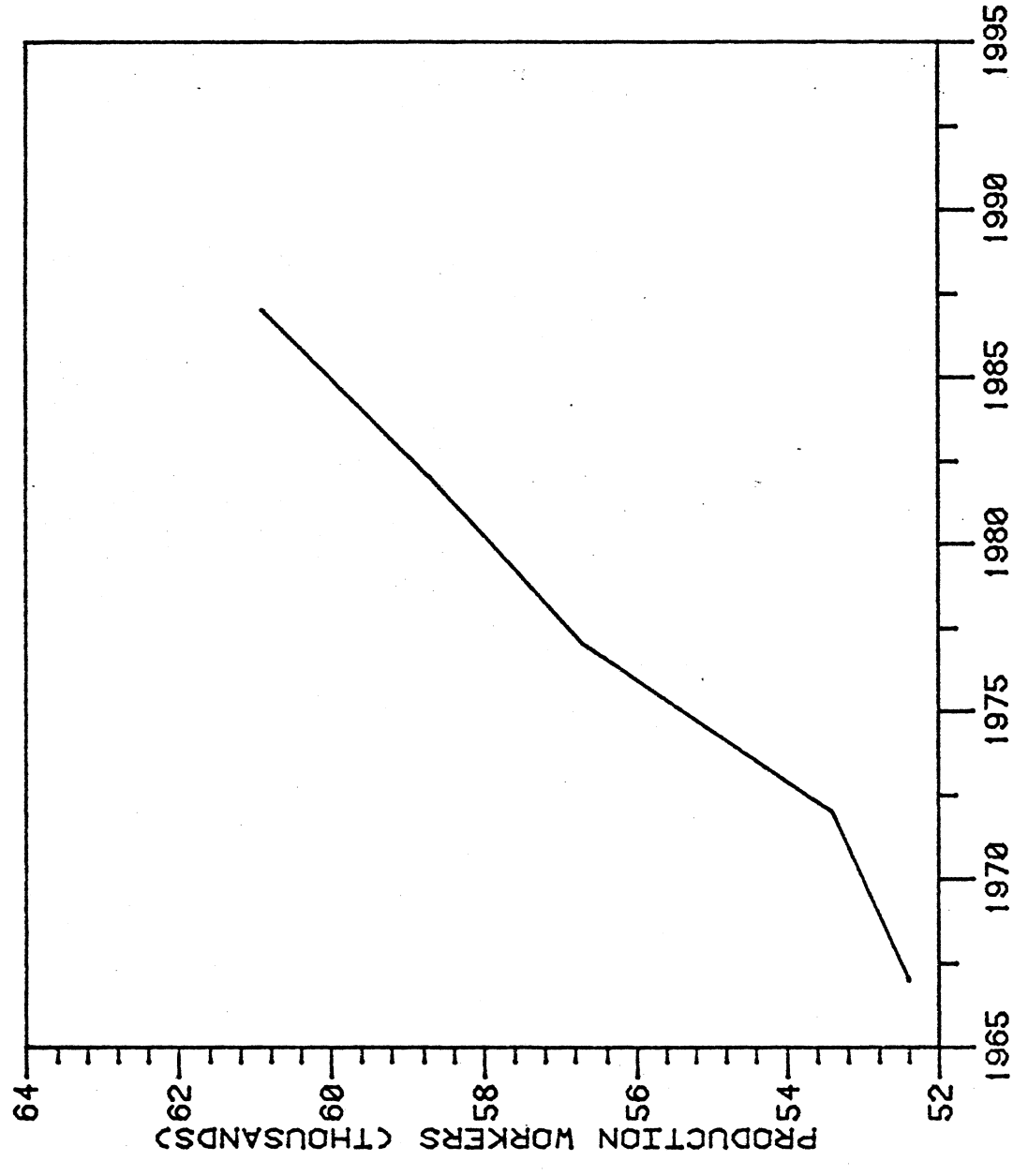
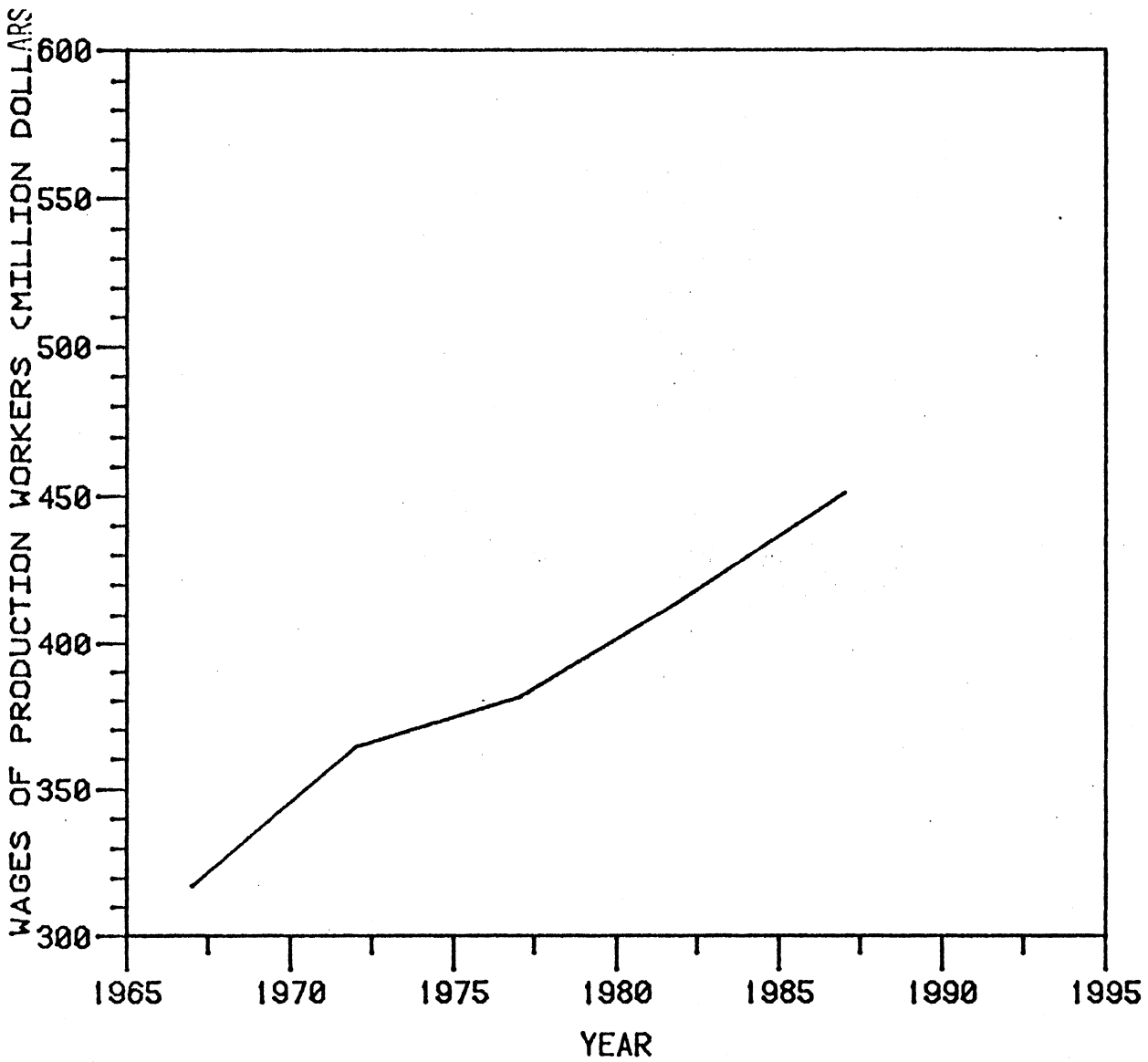


Figure 21. PROJECTION OF UNADJUSTED PRODUCTION WORKERS 1967-1987

Figure 22. PROJECTION OF ADJUSTED WAGES OF PRODUCION WORKERS 1978-1987



SUMMARY

The forest products industry leads all Wisconsin manufacturers in machinery investments. The industry ranked second among all manufacturers in number employed, payroll, value added, number of production workers, and wages. The forest products industry ranked third in value of shipments and fourth in cost of materials.

The industry experienced real growth in all the variables used to measure its contribution to the economy of the state during the ten year period, 1967-1977. This real growth is expected to continue until 1987.

The paper and allied products segments of the industry accounted for most of the industry expenditures on pollution abatement equipment. The industry spent between $45 million and $50 million in 1976 and 1977 respectively on pollution abatements.

APPENDICES

LIST OF REFERENCES

Aberg, W.J.P. Forestry--Its Non-Commercial Side. Wisconsin Conservation Bulletin, March, 1954.

Adams, D.M. and J.D. Brodie. Wisconsin's Forest Resources: Present and Potential Uses. R2844 Research Bulletin. School of Natural Resources, Research Division, University of Wisconsin-Madison, December, 1976.

Blyth, James E. Veneer-Log Production and Receipts, North Central Region 1976. USDA Forest Service Resource Bulletin NC36. North Central Forest Experiment Station, St. Paul, Minnesota, 1977.

Blyth, James E., Eugene F. Landt, James W. Whipple, and Jerold T. Hahn. Primary Forest Products Industries and Timber Use Wisconsin 1973. USDA Forest Service Resource Bulletin NC31. North Central Forest Experiment Station, St. Paul, Minnesota.

Blyth, James E. and W. Brade Smith. Pulpwood Production in the Lake States by County, 1978. Research Note NC247. North Central Forest Experiment Station, St. Paul, Minnesota, 1979.

_____. Pulpwood Production in the North Central Region by County. USDA Forest Service Resource Bulletin NC41. North Central Forest Experiment Station, St. Paul, Minnesota, 1972.

_____. Wisconsin Saw Log Production by County and Species, 1973. Research Note NC201. North Central Forest Experiment Station, St. Paul, Minnesota, 1976.

Clement, Ricardo. Wood Products Industries in the Texas Economy. Special Research Report. School of Forestry, Stephen F. Austin State University, Texas, 1979.

Faber, Edward J. and H.J. Hovind. Logs for Wisconsin's Sawmills and Veneer Mills. Wisconsin Conservation Bulletin. August, 1958.

_____. Pulpwood for Wisconsin's Paper Mills. Wisconsin Conservation Bulletin. February, 1958.

Kilp, F.G. Industrial Forestry in Wisconsin. Wisconsin Conservation Bulletin. March, 1954.

Panshim, A.J., E.S. Harrar, J.S. Bethel, and W.J. Baker. Forest Products: Their Resources, Production and Utilization. McGraw-Hill Book Company, New York, 1962.

Spencer, John S., Jr. and Harry W. Thorne. Wisconsin's 1968 Timber Resources: A Perspective. USDA Forest Service Resource Bulletin NC15. North Central Forest Experiment Station, St. Paul, Minnesota, 1972.

Weaver, G.H. and Philip L. Tedder. Forestry in the Oklahoma Economy. Bulletin B724. Agricultural Experiment Station, Oklahoma State University. May, 1976.

Forest Industries Council: Forest Productivity Project. Washington, D.C. Wisconsin Forest Productivity Report 1979.

National Commission. Employment and Unemployment Statistics: Counting the Labor Force: Readings in Labor Force Statistics. Appendix Volume III.

The Forest Industry Development Sub-Committee of the Economic Development Coordinating Committee: Forest Management and Economic Development. New Direction for Wisconsin. June, 1977.

U.S. Department of Commerce. Bureau of the Census, Washington, D.C. 1970, 1971, 1974, 1975 and 1976 Annual Survey of Manufactures.

_____. Census of Manufactures, 1967, 1972 and 1977 (Preliminary Reports).

_____. Current Industrial Report: Pollution Abatements Costs and Expenditures, 1976 and 1977.

U.S. Department of Labor: Bureau of the Labor Statistics 1979. Employment and Earnings States and Areas, 1939-1978.

Wisconsin Department of Business Development. Wisconsin Manufacturing. April, 1977.

Wisconsin Department of Natural Resources. Air Management Bureau: A Citizens Air Management Guide. 1972.

Wisconsin Department of Natural Resources. Wisconsin 1976 and 1978 Water Quality Inventory Reports to Congress.

Appendix 1

Standard Industrial Classification of Forest Products Industry Groups and Industries Used in This Study

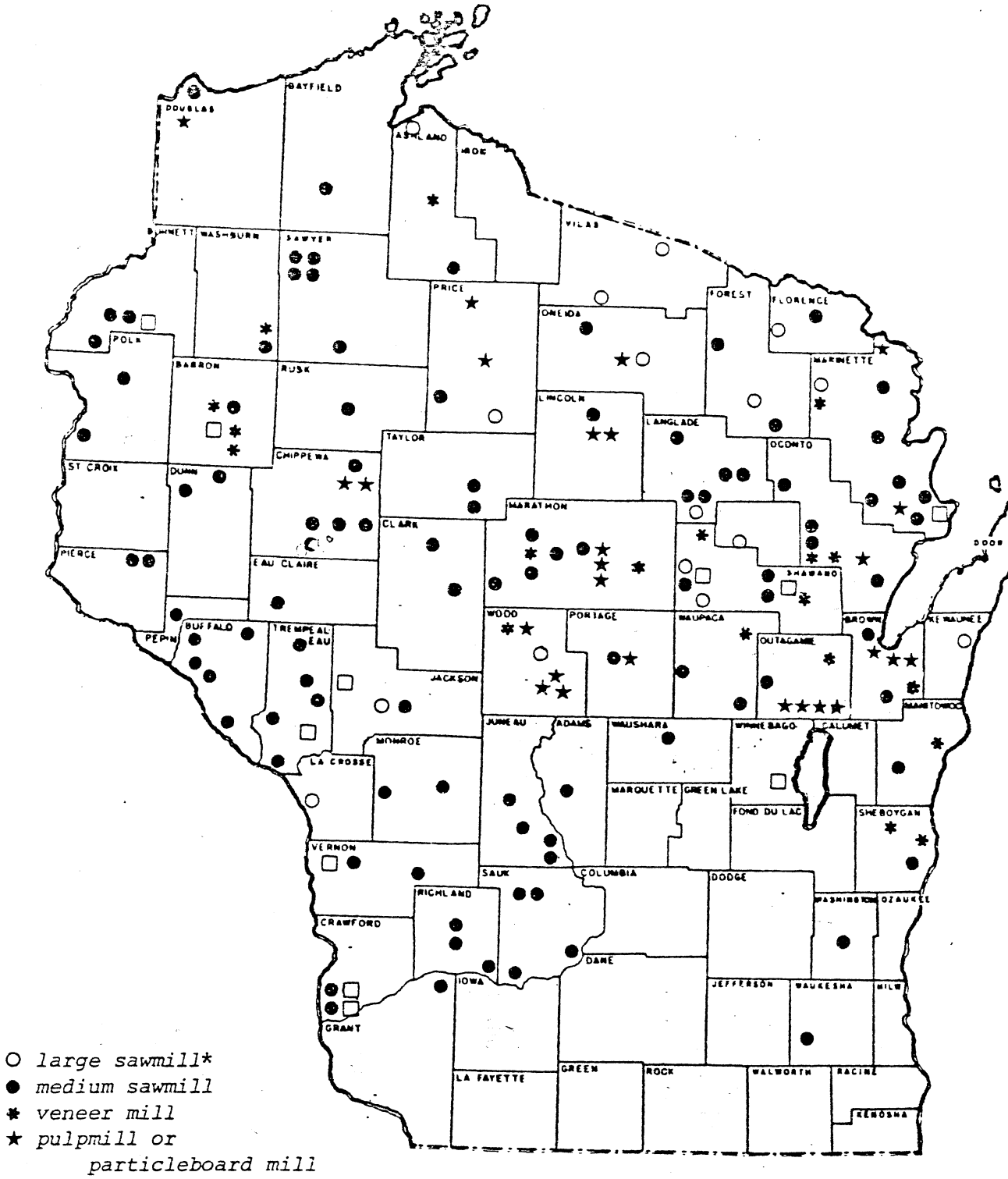
Code Number	Industry Group and Industry
24	Lumber and Wood Products
2411	Logging Camps and Logging Contractors
242	Sawmills and Planing Mills
2421	Sawmills, Planing Mills, General
2426	Hardwood Dimension and Flooring
243	Millwork, Plywood, Structural Members
2431	Millwork
2434	Wood Kitchen Cabinets
2435	Hardwood Veneer and Plywood
244	Wood Containers
2448	Wood Pallets and Skids
245	Wood Buildings and Mobile Homes
2451	Mobile Homes
2452	Prefabricated Wood Buildings
249	Miscellaneous Wood Products
2499	Wood Products, Not Elsewhere Classified
25	Furniture and Fixtures
251	Household Furniture
2512	Upholstered Household Furniture
252	Office Furniture (Wood and Metal)
2531	Public Buildings, Related Furniture

Appendix 1 (Continued)

Code Number	Industry Group and Industry
254	Partition and Fixtures
2541	Wood Partitions and Fixtures
259	Miscellaneous Furniture and Fixtures
26	Paper and Allied Products
2621	Paper Mills, Except Building Paper
2631	Paperboard Mills
264	Miscellaneous Converted Paper Products
2641	Paper Coating and Glazing
2647	Sanitary Paper Products
2649	Converted Paper Products Not Elsewhere Classified
265	Paperboard Containers and Boxes
2651	Folding Paperboard Boxes
2653	Corrugated and Solid Fibre Boxes
2654	Sanitary Food Containers
2655	Fibre Cans, Drums, Similar Products

Appendix 2

Major primary wood-using plants in Wisconsin



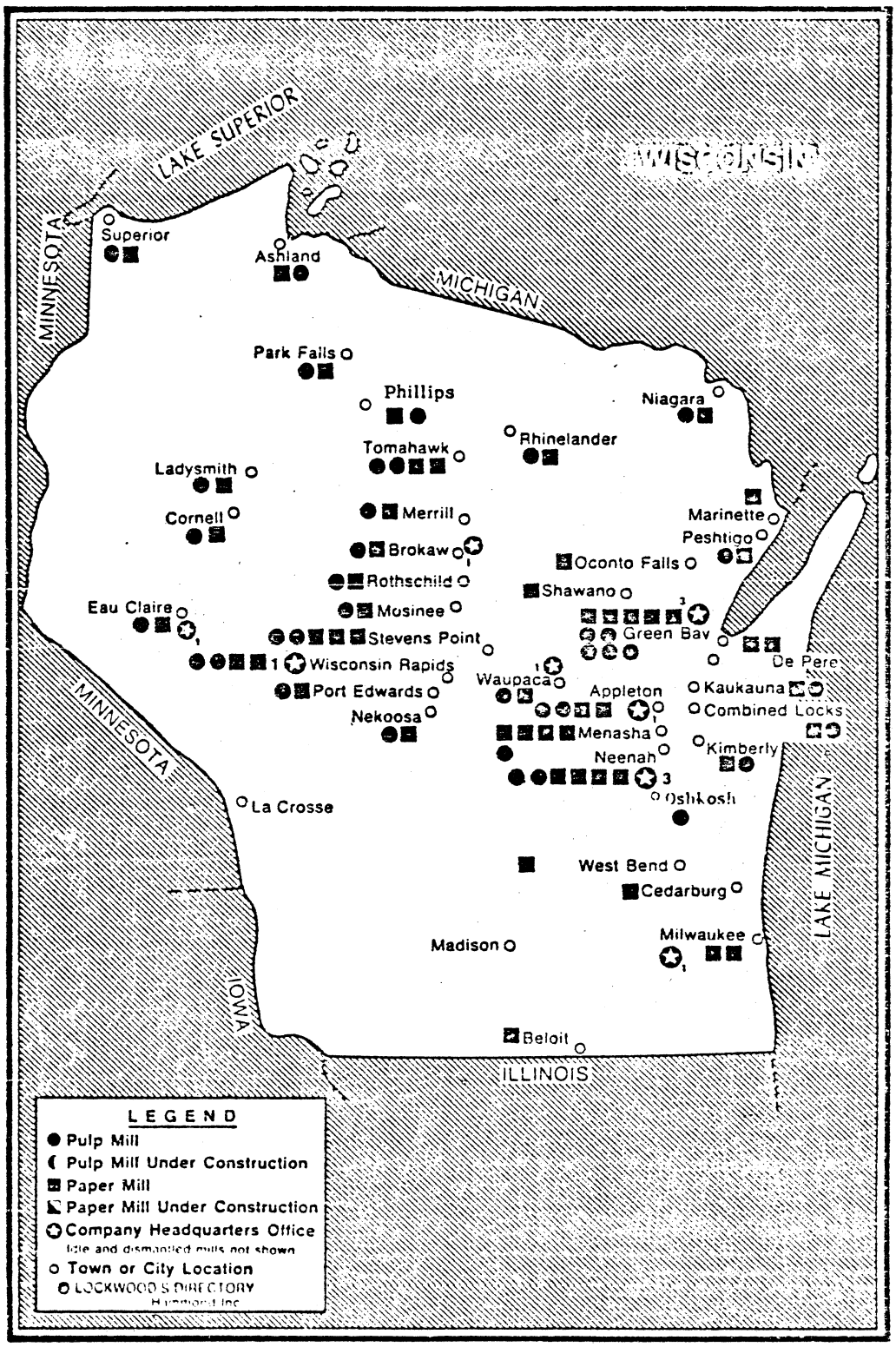
○ *large sawmill**
● *medium sawmill*
✱ *veneer mill*
★ *pulpmill or particleboard mill*
□ *other mill*

*Sawmills are classed by volume of lumber produced: large = 5 million board feet or more; medium = 1 to 4.999 million board feet; smaller sawmills not shown.

Source: Adapted from Blyth, et al., "Primary Forest Products Industry & Timber Use Wisconsin," 1973.

Appendix 3

Pulp and Paper Mills in Wisconsin



Appendix 4

Number of Some Selected Wisconsin Forest Products Industry Mills 1967

SIC Code	Industry	No.of Mills
24	Lumber and Wood Products	890
2411	Logging Camps & Logging Contractors	345
242	Sawmills and Planing Mills	224
243	Millwork, Veneer, Plywood & Related Products	161
244	Wooden Containers	42
249	Miscellaneous Wood Products	118
25	Furniture and Fixtures	162
251	Wood Household Furniture	55
26	Paper and Allied Products	200
261	Pulpmills	6
2621	Paper Mills, Except Building Paper	38
2631	Paperboard Mills	7
264	Miscellaneous Converted Paper Products	81

Source: Census of Manufactures, 1967

Appendix 5

Number of Some Selected Wisconsin Forest Products Industry Mills 1972

SIC Code	Industry	No.of Mills
24	Lumber and Wood Products	787
2411	Logging Camps & Logging Contractors	277
242	Sawmills and Planing Mills	193
243	Millwork, Veneer, Plywood & Related Products	150
244	Wooden Containers	49
249	Miscellaneous Wood Products	91
25	Furniture and Fixtures	152
251	Wood Household Furniture	26
26	Paper and Allied Products	202
261	Pulpmills	8
2621	Paper Mills, Except Building Paper	39
2631	Paperboard Mills	7
264	Miscellaneous Converted Paper Products	80

Source: Census of Manufactures, 1972

Appendix 6

Number of Some Selected Wisconsin Forest Products Industry Mills 1977

SIC Code	Industry	No.of Mills
24	Lumber and Wood Products	905
2411	Logging Camps & Logging Contractors	315
242	Sawmills and Planing Mills	213
243	Millwork, Veneer, Plywood & Related Products	171
244	Wooden Containers	80
249	Miscellaneous Wood Products	93
25	Furniture and Fixtures	169
251	Wood Household Furniture	N.A.
26	Paper and Allied Products	224
261	Pulp Mills	N.A.
2621	Paper Mills, Except Building Paper	37
2631	Paperboard Mills	7
264	Miscellaneous Converted Paper Products	98

Source: Census of Manufactures, 1977 (Preliminary Report)

Appendix 7

Wisconsin Timber Production, Receipts and Exports

1975

(Thousand Board Feet)

Type of Timber	Production	Imports	Exports
Sawlog	334,686	358,441	5,203
Veneer Log	31,962	33,294	11,313
*Pulpwood	104,714	194,500	3,700

*Thousand Cubic Feet

Source: Unpublished Data, North Central Forest Experiment Station, St. Paul, Minnesota, 1975

Appendix 8

Consumer and Producer Price Indices

1967-1977

Year	Consumer Price Index	Producer Price Index
1977	181.5	194.2
1976	170.5	183.0
1975	158.4	174.9
1974	145.5	160.1
1973	129.9	134.7
1972	120.9	119.1
1971	117.4	114.0
1970	113.5	110.4
1967	100.0	100.0

Source: U.S. Department of Commerce: Bureau of the Census. Statistical Abstract of the U.S., 1978

Appendix 9

Hourly Earnings of Production Workers in Wisconsin Manufacturing Industries 1972-1978

All Manufacturing Industries

Year	Earnings
1978	$6.99
1977	6.16
1976	5.69
1975	5.26
1974	4.81
1973	4.45
1972	4.15

Lumber and Wood Products

Year	Earnings
1978	$4.90
1977	4.52
1976	4.23
1975	3.89
1974	3.55
1973	N.A.
1972	N.A.

Appendix 9 (Continued)

Furniture and Fixtures

Year	Earnings
1978	$5.30
1977	4.75
1976	4.33
1975	4.04
1974	3.71
1973	3.49
1972	3.24

Paper and Allied Products

Year	Earnings
1978	$6.94
1977	6.30
1976	5.75
1975	5.24
1974	4.84
1973	4.50
1972	4.20

Appendix 10

Adjusted Payroll, Value Added, Value of Shipments, New Capital Expenditures, Costs of Materials and Wages of Production Workers in Forest Products Industry

1967-1977

Year	Payroll	Value Added	Value of Shipments	New Capital Expenditures	Costs of Materials	Production Workers
1977	518.5	1306.9	2793.9	194.3	1703.0	381.3
1976	488.7	1190.0	2655.0	148.4	1684.4	363.0
1975	447.1	1048.4	2309.8	127.8	1506.3	325.3
1974	490.2	1192.9	2517.9	90.1	1603.8	370.1
1972	490.8	1011.1	2297.8	82.5	1261.3	364.9
1971	433.4	874.0	2020.6	64.1	1095.4	318.6
1970	422.4	854.4	1945.2	75.7	1047.3	309.8
1967	419.6	865.0	1919.6	119.6	1064.5	317.0