THE STRUCTURE, CONDUCT, AND PERFORMANCE OF THE MARKETS FOR SAWLOG MATERIAL AND SAWMILL PRODUCTS IN THE NORTH CENTRAL REGION

Thesis for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY

Charles R. Miller

1966

This is to certify that the

thesis entitled

THE STRUCTURE, CONDUCT, AND PERFORMANCE OF THE MARKETS FOR SAWLOG MATERIAL AND SAWMILL PRODUCTS IN THE NORTH CENTRAL REGION

presented by

Charles R. Miller

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Forest Economics

Lee M. James
Major professor

Date March 17, 1966

O-169

THE STRUCTURE, CONDUCT, AND PERFORMANCE OF THE MARKETS FOR SAWLOG MATERIAL AND SAWMILL PRODUCTS IN THE NORTH CENTRAL REGION

ABSTRACT

by Charles R. Miller

The objectives of this study are: (1) to identify and describe the elements of market structure and conduct which have an important influence on market performance, (2) to determine the costs and margins of sawlog producer operations, (3) to evaluate market performance on the basis of operational norms of acceptable performance, and (4) to determine possible changes in market structure and marketing practices which might raise market efficiency.

This report is based on a portion of the field data collected in 1961 for the North Central Regional Research Project NCM-27, "Timber Products Marketing in Selected Areas of the North Central Region." Detailed interviews were held with sawmill operators and sawlog producers in selected areas of nine cooperating states--Michigan, Wisconsin, Minnesota, Ohio, Indiana, Illinois, Iowa, Missouri, and Kansas.

The supply and demand sides of the markets for sawtimber stumpage, sawlogs, and sawmill products are highly atomistic. Except for state and federal forests, no single seller or buyer controls a substantial portion of the regional markets for sawlog material and sawmill products. Characteristics of the forest resource, such as the large number of small, noncontiguous, poorly stocked woodlots which typically contain small sawtimber of mixed species and

heterogeneous quality, contribute to higher logging and milling costs, limit economies of scale, favor small, flexible operations, and largely determine the number and variety of products produced. Entry into the sawlog and sawmill-products markets is easy because of the limited economies of scale in manufacturing and logging, the absence of firm-associated product differentiation, small investment requirements, high firm mobility, simple and easily acquired technology, little control or ownership of forest land by wood-using firms, limited forward integration, and the absence of exclusive marketing agreements.

Market information ranks in importance with forest-resource characteristics and ease of market entry as an element of market structure. The poor quality of market information is indicated by the overwhelming reliance on word-of-mouth communication and by infrequent, dated, and oversimplified market news reporting.

Sawmill firms generally use all of the marketable species and grades of sawlogs found in their wood procurement areas and thus most firms produce a variety of products. Hardwood grade, crating, hardwood construction lumber, railroad ties, and pallets account for about two-thirds of total sawmill output. Most of the volume produced by sawmill firms is sold within the study region to manufacturers, industrial users, and wholesalers. Only the largest mills have an organized sales department and maintain continuous contact with major wholesale markets.

Marketing arrangements between producers and sawmill firms are not highly developed, are usually concerned only with the exchange of particular lots of sawlogs, and ordinarily cover only short-run situations. In general, sawmill firms have greater bargaining power than producers, and private landowners occupy the weakest bargaining positions.

Poor production efficiency is indicated by the lack of cost and return accounting; limited marketing, managerial, and financial economies because of inadequate firm size; excess sawmill capacity; and poor utilization of mill residues. Insufficient research expenditures and inadequate accounting of costs and returns hinder technological advancements and product improvement. The ability to make rational price-product comparisons is severely hampered by inadequate market news reporting and the great number of measuring and grading standards for sawlogs and lack of uniformity in their application. Poor conservation performance has resulted from: the rapid turnover of forest properties and of sawmill and producer firms, inefficiencies associated with small forest holdings, low incomes and high propensities to consume, inadequate investment in new milling equipment, high firm mobility, very easy market entry, and insufficient ownership of forest land by producers and sawmill firms.

THE STRUCTURE, CONDUCT, AND PERFORMANCE OF THE MARKETS

FOR SAWLOG MATERIAL AND SAWMILL PRODUCTS

IN THE NORTH CENTRAL REGION

by

Charles R. Miller

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Forestry

1966

FOREWORD

This thesis is an analysis of the structure, conduct, and performance of the markets for sawtimber stumpage, sawlogs, and sawmill products in the North Central Region of the United States. It is based on a portion of the field data collected in 1961 by the North Central Regional Technical Committee as part of the Cooperative Regional Research Project, NCM-27, "Timber Products Marketing in Selected Areas of the North Central Region." The project was supported in part by regional funds provided under Title I, section 9b3, of the Bankhead-Jones Act, as amended August 14, 1946, and the Hatch Act, as amended August 11, 1955.

Nine state agricultural experiment stations--Michigan, Wisconsin, Minnesota, Ohio, Indiana, Illinois, Iowa, Missouri, and Kansas--participated in the overall project. The Central States Forest Experiment Station and the Lake States Forest Experiment Station of the U. S. Forest Service cooperated.

The author wishes to express his gratitude to the members of the North Central Regional Technical Committee and their assistants who contributed the field data used in this study. The author also wishes to thank Dr. Lee M. James of the Department of Forestry, Michigan State University who has served as his major professor in the preparation of this manuscript. The author is especially indebted to his wife, Judith, without whose encouragement, sacrifices, and invaluable assistance as typist and proofreader, this thesis would not have been written.

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CHAPTER I

INTRODUCTION

The sawmilling industry is defined in broad terms in this study to include firms--sawmill operators and sawlog producers--engaged in the purchase, harvesting, and delivery of sawlogs to sawmills, and firms engaged in the manufacture of sawmill products.[1] Both levels of production include products which are heterogeneous with respect to timber species, quality, and end use. However, the products handled by sawlog producers are technologically similar and, to a large extent, substitutible. Likewise, the majority of products produced by sawmill firms are technologically similar and substitutes in the economic sense, at least in the initial stages of manufacture. Moreover, nearly all sawmill firms produce several different products, and usually one or more of these products are common to most other firms in the industry. It is therefore both logical on theoretical grounds and analytically expedient to view all sawmill firms and all sawlog producers as belonging to two different functional levels of the same sawmilling industry.

The sawmilling industry in the North Central Region consists of somewhere around 35,000 sawmills and sawlog producers. The industry provides employment for 70 to 80 thousand people, almost entirely in

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[1]Sawmill products include lumber, i.e., "the product of the saw and planing mill," timbers, cants, flitches, ties, and products made from lumber at sawmill sites.

rural areas. It also represents a source of income for thousands of small landowners, many of whom have marginal incomes and desperately need whatever they realize from sawtimber sales. The value of sawlogs harvested in the region in 1958 amounted to 62 million dollars, more than any other forest product (20). Despite the importance which the lumber industry plays in the rural economy of the region, an economy which is generally depressed below that of the region's urban areas and of the nation as a whole, there have been no comprehensive studies of the industry. The studies which have been made have been limited in geographic coverage, have usually investigated only a few aspects of marketing, and often were focused at the landowner level.

Objectives

This study attempts to describe the important economic characteristics of the sawmilling industry in the North Central Region, to provide an analytical framework for investigating the efficiency of sawlog and sawmill-products marketing, and to analyze certain aspects of the performance (efficiency) of these markets. More specifically the objectives are:

(1) To identify and describe the elements of market structure and conduct which have an important influence on market performance.

(2) To determine the costs and margins of harvesting sawtimber and hauling sawlogs from the woods to sawmill sites.

(3) To evaluate market performance by comparing the observed performance, or the performance which is likely to evolve

from the observed market structure and conduct, with performance norms that are derived from economic theory or based upon empirical observations of other industries.

(4) To determine possible changes in market structures and marketing practices which might raise market efficiency to the benefit of market participants, including landowners and final consumers.

Theoretical Foundation of the Study

The method of analysis used in this study is that of market structure analysis, also called industrial organization theory. It is based upon the premise that the behavior of firms and the results of their activities can be predicted by the application of economic concepts which explicitly take into account actual market conditions. The central line of reasoning is this: given a particular market structure, the firms operating in the market will adopt certain patterns of behavior, and these behavioral patterns will yield predictable results. The distinguishing feature of market structure analysis, as contrasted to the theories of pure competition, oligopoly, and monopoly, is the emphasis placed upon the empirical verification of actual market conditions and their incorporation in the analysis of market behavior and performance.

Market structure analysis involves three areas of inquiry: market structure, market conduct, and market performance. Market structure is defined by Joe S. Bain (2, p. 7), the primary formulator of industrial organization theory, as : ". . . those characteristics of the organization of a market which seem to influence strategically the nature of competition and pricing within the market." A broader definition of market structure, one that includes structural elements which do not necessarily pertain to the organization of the market, is more useful in studying sawlog and sawmill products markets. Such a definition is given by Caves (8, p. 15), who defines market structure as: ". . . the economically significant features of a market which affect the behavior of firms . . . ." Quoting again from Bain (2, p. 9), market conduct consists of the ". . . patterns of behavior which enterprises follow in adapting or adjusting to the markets in which they sell (or buy)." Market performance, according to Clodius and Mueller (10, p. 517), ". . . refers to the economic results that flow from the industry . . . ." However, not every market attribute that is a result of marketing adjustments should be included as a part of market performance, because this would involve the inclusion of attributes of both market structure and conduct, since they too are results of the market in the sense that they are influenced by other market conditions. Market performance should therefore be defined more precisely as including only those market results which directly affect the welfare of the participants in the market and society as well (68). This latter definition preserves the distinction between structure, conduct, and performance, and it also facilitates the accepted notion that the line of causation is from market structure, through conduct, to performance.

The logic of the relationship between market structure, conduct, and performance can be briefly illustrated by referring to an important element of the structure of sawmill-products and sawlog markets: market information. In a perfectly competitive market, all buyers and sellers have perfect knowledge of present and future prices and costs. All resources, or factors of production, are used so that, in equilibrium, the marginal value, both present and future, derived from each productive factor is just equal to the cost, or price, of each factor. The amounts of all products produced over time are maximized, unit costs are minimized, and productive factors are distributed among various enterprises such that, in equilibrium, the marginal value produced by a given factor is equal in all enterprises.

But what if market information is inadequate or inaccurate? If sawmill operators and sawlog producers make sales infrequently and have contact with only a few buyers, they are not likely to know what market price is from day to day for various species, grades, and end-product uses. Overestimating the price for a certain species would lead to an overemployment of resources in the production of that species and an underemployment in the production of other species. Poor information about price differentials for different grades would likely lead to an uneconomical grade-output mix. Misinformation about product prices would also result in the inaccurate pricing of productive factors such as labor, sawlogs, and stumpage. Considering the alternative uses for the productive factors controlled by sawmill operators and sawlog producers, the overestimation or underestimation of alternative economic opportunities would lead to underinvestment or overinvestment of labor and capital in the production of sawlogs and lumber. Although a causal relationship between market structure ("poor" market information) and conduct, and between conduct and performance has not been substantiated by this example, on theoretical grounds at least, it would be reasonable to hypothesize that poor market information results in the misallocation of resources and less than optimum efficiency.

Several elements of structure, conduct, and performance have been defined by other authors as being significant in the study of markets.[1] Many of these elements, however, are based upon highly oligopolistic markets and are not particularly relevant to the study of sawlog and sawmill-products markets undertaken here. Characteristics most commonly emphasized as strategic aspects of market structure are: (1) degree of seller and buyer concentration, described by their number and size distribution, (2) degree of product differentiation, that is, the extent to which similar products, intended for the same use, are viewed by buyers as being different, and (3) the conditions of entry into the market, that is, the relative ease with which new sellers or buyers can enter a market, as generally determined by the advantages held by established firms such as absolute cost advantages, the relationship between economies of scale and market size, and product differentiation. Additional characteristics of market structure are mentioned by Clodius and Mueller (10). They include: (4) the availability, distribution, and adequacy of market information for use in sharpening price-quantity comparisons and in reducing risk and uncertainty, (5) the degree of vertical integration, (6) the degree of diversification, and (7) the type of proprietorship,

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[1] For an excellent synopsis of market structure analysis and review of literature, see the article by Clodius and Mueller (10).

especially its relevance to sources of funds and managerial ability. Teeguarden (74) and Zivnuska (103), among others, have identified some additional structural elements thought to be important in the study of lumber markets: (8) product characteristics regarding the difficulty of grade description and measurement, (9) the regularity of purchase and sale, (10) the relationship between bulkiness, transportation costs and product value, (11) whether the production process involves weight gains or losses, (12) the continuity and length of the production process, and (13) product durability. A very important structural variable yet to be mentioned is: (14) the size, quality, species composition, density, and contiguity of the forest resource.

Of the structural elements listed above, those that are especially relevant to the sawmilling industry of the North Central Region are examined in detail in Chapter 4. Several related structural characteristics are discussed under one or more headings. Their significance in determining the nature of competition and the results of the market is brought out in subsequent chapters.

The second area of inquiry, market conduct, refers to the behavior of buyers and sellers in adjusting to market conditions. Attention is focused on the main lines of activity that are crucial to achieving a firm's goals. The important dimensions of market conduct are identified by Bain (2) as: (1) methods employed in determining price and output, such as cost-plus pricing, price taking, constant level of output, or output varying with price, etc.; (2) product policy with regard to the number, quality, differentiation, and frequency of change of the products produced; (3) sales promotion policy; (4) means of coordination of price, product, and sales-promotion policies among competing firms; and (5) predatory or exclusionary tactics directed against established rivals or potential competitors.

The importance of each mode of conduct varies from industry to industry because of differences in market structure. For example, in industries where products are not easily differentiated, sales promotion by individual firms is of little consequence. Furthermore, most of the above mentioned dimensions of market conduct deal primarily with the competitive interactions of rival firms which are designed to enhance the position of a firm at the expense of its rivals. This type of behavior is typical of oligopolistic industries but it is generally lacking in highly atomistic industries such as the one under consideration here. Therefore, the discussion of market conduct in this study does not focus on the dimensions of conduct which are commonly accepted as being of analytical importance, but is primarily concerned with describing how the market operates in order to illuminate more clearly the relationship between market structure, conduct, and performance.

The two basic reasons for studying the structure of the sawmilling industry and the patterns of firm behavior are to determine how well the industry functions and how performance might be improved. This of course necessitates the establishment of criteria by which performance can be measured. Of the many possible measures of industry performance, the following nine performance dimensions[1] seem

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[1]The definitions and interpretations of these nine performance dimensions follow those given by Sosnick (68), who recognizes three additional performance dimensions: unethical practices, external effects, and labor relations. Elements of these latter three are included in the above nine performance dimensions.

especially appropriate for this study: (1) production efficiency, (2) technological progressiveness, (3) exchange efficiency, (4) level of output, (5) profit rates, (6) product suitability, (7) participant rationality, (8) conservation, and (9) the amount and quality of sales promotion.

Production efficiency refers to the minimization of procurement, processing, and selling costs, and involves such things as appropriate input proportions, optimum scale and degree of vertical integration, optimum utilization of production capacity, the utilization of by-products, the control of input and output inventories, the equalization of marginal costs among different firms, and minimum turnover of firms and other discontinuities.

Technological progressiveness refers to the rate at which firms develop or adopt new or improved products and production techniques.

Exchange efficiency embraces the minimization of the costs of transferring inputs and products among market participants; included are such relevant issues as the costs of transportation and brokers' commissions, cross hauling, price flexibility, and the distribution of gains from trade.

The level of output and the rate of profit involve notably the issues concerning the restriction of output, as by a monopolist, and the distribution of income.

Relevant to the issue of product suitability are: the general level of product quality, the adherence of products to size and grade standards, and the rate and frequency of product change and improvement over time.

Participant rationality refers to the opportunity for buyers and sellers to be well informed and to exercise freedom of choice. Involved here are product inspection, standards of identity and measurement, the usefulness of product grades to buyers and sellers, the degree of variation within grades, the extent to which grades are used, standardized quotations, price posting, market news, and product testing.

Conservation, as a dimension of industry or market performance, is concerned with questions about the appropriate production techniques and the optimum time pattern of production and investment spending needed to maximize net social benefits over time.

Finally, the issue of sales promotion is concerned with persuasive advertising, false or misleading advertising, labeling, or packaging, and the size of selling costs in relation to sales revenue.

The empirical testing of hypotheses about the effects which market structure and conduct have upon market performance is a difficult but necessary step in market structure analysis. A complete analysis of the effect which market structure and conduct have upon any one of the above dimensions of performance would constitute a formidable study in itself. Due to financial limitations, tests of the relationships between structure, conduct, and performance are limited in this study primarily to deductive inferences, based upon economic theory, about the performance that would probably evolve from the observed market structure and conduct.

Study Areas

Study areas were delineated within each of the nine states participating in the regional project as shown in Figure 1. Within each state, study areas were selected to provide intensive coverage of an area of active lumber production rather than to provide a representative sample of the entire state. Attention was also given to locating study areas so as to obtain a cross section of marketing conditions within the important lumber-producing sections of the nine-state region.

Data-Collection Procedure

Attention was focused on two major operational levels of the industry: wood procurement, and the manufacture and marketing of sawmill products by primary manufacturers. Personal interviews were held with the market agents operating at these two operational levels. In all, three types of market agents were selected to be interviewed: sawlog producers, sawlog dealers, and sawmills. Information about the marketing activities of forest landowners and the buyers of sawmill products was also obtained from the interviews.

Distinctions among the three types of market agents were defined in the following manner. A sawlog producer was defined as an individual (or firm) who harvests purchased sawtimber or sawtimber from his own land and sells it in the form of sawlogs or bolts to other buyers (usually sawmills). About half of the sawlog procurement activity in the region is carried out by sawlog producers, the rest is performed by sawmills and contract loggers. The latter,

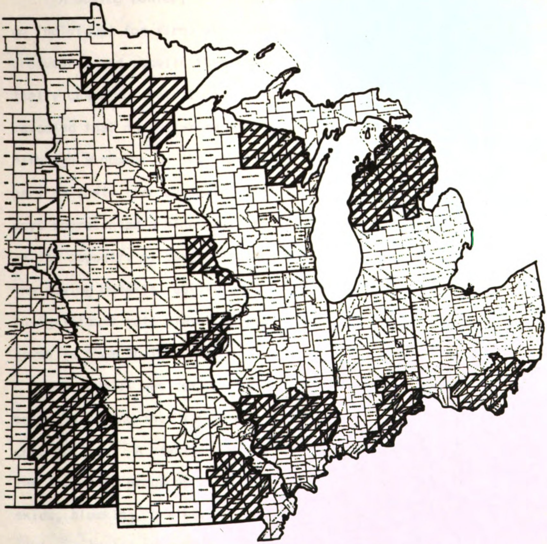

Figure 1. Location of areas in which sawlog producers and sawmill firms were sampled.

unlike producers, do not engage in the purchase and sale of stumpage or sawlogs but are contracted by sawmills and producers to carry out logging and hauling operations.

A sawlog dealer, or intermediate market agent, was defined as an individual (or firm) who purchases sawlogs or bolts (usually from producers) and resells them (usually to sawmills) without substantially changing their form. A thorough search of the study areas revealed that no full-time sawlog dealers were operating in the areas. Although a number of the sawmill operators and sawlog producers spent part of their time as sawlog dealers, their activities as dealers always represented a minor part of their total business. Firms acting in the capacity of sawlog dealers handled less than 0.3 percent of the sawlog material delivered to sampled sawmills. Because of the insignificant role played by sawlog dealers, little attention is given to them in this study.

A sawmill was defined as a firm which processes sawlogs and bolts by sawing them lengthwise into lumber, timbers, cants, flitches or ties. A sawmill may also further manufacture some or all of the lumber it produces into other sawmill products such as pallets, skids, blocking, crates, boxes, or flooring. Firms which processed sawlog material by cutting it into transverse sections, such as the manufacturers of wooden bowls and other novelties, and the manufacturers of staves and cooperage, were not included as part of the sawmilling industry.

Detailed interviews were held in 1961 with sawlog producers and sawmill operators in each of the study areas. No full-time sawlog dealers were found to be operating in the areas, but the part-time dealer activities of producers and sawmills were covered by the interviews. Separate interview schedules for producers and sawmills were developed along parallel lines, and identical schedules were used in all states. In selecting firms to be interviewed, the boundary lines of the study areas were not considered to be fixed. Producers and sawmills located outside the boundaries of study areas were included in the sample when a considerable interdependence existed between their activities and the marketing activity within the study area.

Very little information about the total population of sawmills and producers was available to serve as a basis for selecting and stratifying a sample of these market agents. It was not considered worthwhile to make a preliminary survey to estimate the total number and size distribution of firms to be used in drawing a sample of market agents because of the predominant number of small firms which, as a group, account for only a small share of total industry activity. Instead, it was decided that it would be feasible to interview in each study area all sawmills with an annual production of 500 thousand board feet or more, and as many mills as time would allow of the production class 100-499 thousand board feet annually. No attempt was made to contact sawmills that produced less than 100 thousand board feet annually, but in the course of the field work, 33 of these firms were interviewed. Due to the small number of these firms that were interviewed, data for firms that produced less than 100 thousand board feet annually are not included as part of the total sample, but are used only occasionally in making comparisons among size classes. The sample of sawlog producers was drawn at random from the producers that sold to sampled sawmills; no attempt was made to stratify the sample on the basis of the size of the producer's operation. (However, in compiling and analyzing the data, some information was grouped according to sawlog-production size classes.) The number of producers interviewed in each study area was determined by what the investigator thought was necessary to provide a representative picture of the marketing activities of producers in each area.

The total number of sawmills sampled in each state and size class is shown in Table I. According to Census data on the total number of mills located in the study areas and entire region in 1958 (79, 80), it is estimated that the sample includes about 5 percent of all sawmills in the nine-state region and about 10 percent of the total number in the study areas. The sample of mills that produced 500 thousand board feet or more in 1960 is believed to include all of the mills of this size located in the study areas. In order to simplify the discussion of size classes, sawmills that produced 500 thousand board feet or more in 1960 are referred to as large-scale mills, and those that produced between 100 and 500 thousand board feet are called small-scale mills.

For analytical purposes, the sample of sawmills was classified according to product groups. Most firms produced more than one product, but each was assigned to only one product group on the basis of the product or group of similar products which accounted for the largest portion of the firm's total value of production. The number of sampled mills in each product group is listed for each state in Appendix C, Table I.

Table I. Number of sawmills sampled in the North Central Region, by state and size class of sawmill, 1960

State	100-499 M bd.ft.	500-999 M bd.ft.	1000 M bd. ft. or more	Unclassified[a]	Total[b]
		(Number of sawmills)			
Michigan	22	25	26	5	78
Wisconsin	17	6	19	--	42
Minnesota	24	17	13	--	54
Ohio	31	11	15	1	58
Indiana	24	6	8	--	38
Illinois	12	3	11	--	26
Iowa	8	9	9	--	26
Missouri	45	16	20	1	82
Kansas	12	1	7	--	20
Total	195	94	128	7	424

[a]Includes firms which initiated operations in 1960 and operated less than nine months. Each of these firms had an output at an annual rate in excess of 500 MBF per year.

[b]An additional 33 mills which produced less than 100 M bd. ft. each were interviewed in the following states: Michigan, 8; Minnesota, 2; Indiana, 3; Ohio, 9; Missouri, 8; and Kansas, 3. Data for these mills are not included with the sample but are used only occasionally in making comparisons among size classes.

The total number of producers sampled is shown for each state and size class in Table 2. The sample probably includes about 10 percent of all sawlog producers active in the study areas in 1960.

Table 2. Number of sawlog producers sampled in the North Central Region, by state and size class of producer, 1960

State	1-49 M bd.ft.	50-149 M bd.ft.	150-499 M bd.ft.	500 M bd.ft. or more	Unclas-si-fied[a]	Total
Michigan	24	25	16	9	--	74
Wisconsin	28	12	3	--	--	43
Minnesota	4	3	6	2	1	16
Ohio	31	19	17	1	--	68
Indiana	13	3	4	1	4	25
Illinois	10	11	8	3	--	32
Iowa	3	11	6	1	--	21
Missouri	26	14	15	3	2	60
Kansas	2	6	1	--	--	9
Total	141	104	76	20	7	348

[a]Includes those producers for which production data were not available and producers which had initiated operations in 1960 and operated less than six months.

CHAPTER 2

REVIEW OF LITERATURE

Many of the earlier studies of forest products marketing, both within the study region and throughout the nation, dealt with small forest ownerships. Studies which investigated the reasons behind the so-called small landownership problem have made a major contribution to our understanding of the problems of marketing sawtimber and sawlogs derived from private forest holdings. Much of the earlier effort was directed to the compilation of sawmill directories and other descriptive studies of the inventory of sawmills and of the volume and types of sawlogs purchased and sawmill products produced. Periodic surveys by the U. S. Forest Service of the forest resources in each state have also provided useful information about the inventory of sawmills and other industry data relating to the drain on the forest resource. These surveys include works by Findell et al. (14) in Michigan, Stone and Thorne (70) in Wisconsin, Cunningham, Horn, and Quinney (11) in Minnesota, Hutchinson (25) in Indiana, Hutchinson and Morgan (27) in Ohio, King and Winters (33) in Illinois, King, Roberts, and Winters (32) in Missouri, and Thornton and Morgan (76) in Iowa.

In an article in 1957 which called for a re-orientation of research in forest products marketing, Gregory (16, p. 454) made the following synopsis of the orientation and underlying hypothesis of most studies of forest products marketing:

> Many studies have implicitly assumed that if knowledge of market outlets were more widely disseminated better woodland management would follow. Indirectly, this hypothesis has provided the orientation for most forest products marketing research.

Although the more recent studies have focused on various stages of the so-called marketing chain, the emphasis in forest products marketing research has remained essentially the same. Most of the latest marketing studies have consisted of descriptive reports about market agents, sales outlets, marketing functions, and the amounts and types of products purchased and sold. Some studies have investigated certain structural aspects of marketing, such as forestry cooperatives and concentration yards, but few, if any, have thoroughly analyzed the economic structure of sawlog and sawmill-products markets. The implicit assumption of the majority of marketing studies in forestry appears to have been that a broad description of market agents and outlets and of marketing procedures would provide useful information for market participants or serve as a frame of reference for more intensive analyses of specific marketing problems. Although many studies have purported to be analyses of marketing efficiency, few have explicitly grappled with this question. Most have left it up to the reader to make his own inferences about market performance.

Because of the great number of forest products marketing studies which have been made, this review is limited to only those which are significant because of their analytical approach, their scope, or their contribution to our understanding of sawlog and sawmill-products marketing in the North Central Region.

Market Structure Analysis: Theoretical and Applied Works

The first complete exposition of the theoretical foundation of market structure analysis, or industrial organization theory, was presented by Joe S. Bain in his book Industrial Organization (2). This work consists of a lengthy analysis of the elements of market structure, conduct, and performance and the relationships among them. It concludes with four chapters which describe, interpret the effects of, and present alternatives to public laws and policies which are designed to prevent monopolistic practices or promote workable competition. In a later work, Caves (8) covered essentially the same material as Bain but in much briefer fashion. An excellent synopsis of the elements of market structure analysis was presented in an article by Clodius and Mueller (10) in which they also discussed several characteristics of market structure not explicitly recognized by Bain. The above three works are representative of the more important comprehensive expositions of industrial organization theory, although their treatment of market performance is somewhat less penetrating than that given to market structure and conduct. Perhaps the most thorough analysis of the dimensions of market performance was presented by Sosnick in a paper titled Operational Criteria for Evaluating Market Performance (68). Twelve criteria for measuring the performance of markets are identified in this paper and possible norms for evaluating each dimension of performance are discussed.

Many investigators of forest products marketing have touched upon various elements of market structure, conduct, and performance but few have made a thorough analysis of any one of these three areas of inquiry or used market structure analysis as the theoretical framework for their investigations. Although many studies in forest products marketing have been concerned with what often has loosely been called market structure, few have analyzed the elements of structure which are recognized in market structure analysis. Zaremba's study of the economics of the American lumber industry (102) contains a brief survey of the major structural characteristics of the industry. His study is especially noteworthy, however, for its analysis of lumber demand and consumer economics. Zivnuska (103) reported on trends since 1900 in the number and size of mills and product integration within the lumber, plywood, and pulp and paper industries of the western, southern, and eastern regions of the United States. The physical characteristics of the forest resource and the structure of landownership were identified as the most important factors affecting the differential development of the industries within the three regions.

Mead (43) studied merger activities and trends in the concentration of the Douglas-fir lumber industry from 1940 to 1960. The two primary reasons for the relatively high merger activity were found to be the inability of acquired firms to compete in the open market for timber without the cost advantages of integration and diversification, and the advantages to the acquiring firms of increased control over sawtimber supply and capital gains tax advantages. Mead concluded that merger activity has increased considerably since 1955 but that the degree of concentration in private forest resource ownership, lumber production, and wholesale lumber distribution in the Douglas-fir subregion is low in comparison to concentration ratios in most other industries.

Petit, in his analysis of the American plywood industry, was one of the first to use industrial organization theory as an analytical approach to the study of forest products industries and markets. Petit stressed the relationship of the structure and conduct of the plywood industry to its performance in his article in the Journal of Industrial Economics (55) and a somewhat more technical treatment of his study was presented in the Journal of Forestry (54). Petit concluded that the reduction in industry concentration which had occurred up until 1956 did not lead to improved industry performance but that performance was acceptable on the basis of the criteria he studied--level of output, technological progressiveness, profit rates, advertising and promotional costs, and conservation. However, using sustained yield management of lands supplying timber for the industry as the norm for conservation, performance was judged to be unacceptable in this regard.

Long and Gray (36) made a brief analysis of market structure variables and their relationship to the marketing of sawtimber and lumber in New Mexico. A detailed study of certain aspects of the structure and behavior of the lumber industry in western Oregon was made by Ho (23). The study focused on the problems of small lumber companies. It was revealed that economies of scale in manufacturing do not represent a major disadvantage to small firms. The most important structural factors which impair the competitive capability of small firms were found to be the vertical integration of large lumber companies through forest landownership and the lack of an open market for sawmill residues because pulp mills are integrated with the large lumber manufacturers. Public timber sales practices, involving for the most part large sales and great amounts of financing for access roads, were also identified as an important hindrance to small companies. Many of the problems of small companies were found to be related to the managers' lack of adequate information about many aspects of their operations, partly a result of the isolationist tendencies of these managers.

Perhaps the most thorough analysis to date of the structure, conduct, and performance of lumber and sawlog markets was made recently in the Central Sierra Nevada Region of California by Teeguarden (74). His study was chiefly concerned with industry performance as it related to the market for sawtimber produced by small (less than 5,000 acres) nonindustrial forest landownerships. His evaluation of industry performance was limited to pricing policies, other aspects of exchange, and economic stability. Because of its analytical approach and its focus on the market for timber produced on small private landownerships, Teeguarden's study is especially relevant to the study of sawlog and sawmill-products marketing in the North Central Region. The major conclusions of his study were as follows: (1) In pricing specific lots of sawtimber or in short-run periods, prices may not approximate a competitive norm, but in the long-run prices are believed to approach a competitive norm because entry into the market is relatively easy and no buyer enjoys sufficient market power to persistently exploit the many small stumpage sellers. (2) Pricing is competitive in the finished-lumber wholesale market, but in the local unfinished-lumber market there are few buyers who apparently have such a high degree of market power that some sawmill firms have chosen to defend against it by integrating vertically via arrangements with remanufacturing or marketing establishments. (3) A major advantage of large scale is the feasibility of installing the planing and drying facilities needed to produce a finished line of products for sale through regular wholesale channels, which give access to a larger number of potential buyers and a more stable market than the local market for unfinished lumber. (4) Lumber processors providing market outlets to small forest ownerships constitute the most unstable segment of the lumber industry.

The more important policy implications of the study were the following. (1) Market performance probably could be improved by better market information, especially through efforts to educate private forest landowners as to the opportunities, problems, and methods of marketing stumpage. (2) Policies and programs to encourage greater stability in the demand for stumpage and sawlog material would have to consider: measures to reduce assembly costs by improving transportation systems, increasing per-acre timber volumes, and providing larger stumpage sale units so as to encourage the development of large-size, integrated processing firms; the encouragement of land ownership consolidation and long-term marketing contracts in order to reduce assembly costs and market uncertainties; and marketing cooperatives for forest owners in order to concentrate the sales from many small landownerships and to coordinate long-term supply with mill requirements.

The only study of forest products marketing within the North Central Region to use industrial organization theory as an analytical framework was Edna Douglas's analysis of the Iowa retail lumber industry (12). Her thorough analysis of industry structure and certain aspects of firm behavior led to the identification of both socially desirable and undesirable attributes of industry structure and conduct.

Marketing Studies Within the North Central Region

Forest landownership studies have often investigated stumpage marketing practices and the interrelationships between forest management and marketing. Noteworthy of this type of landownership study were those in Michigan by Schallau (63, 64) and Yoho, James, and Quinney (101), by Farrell (13) in Missouri, and in Wisconsin by Sutherland and Tubbs (72). Many other studies have been primarily concerned with the market outlets for stumpage and marketing practices. Quigley (58) described the forest resources of the Missouri Ozarks, briefly reviewed the available timber markets, and analyzed the opportunities for establishing new pine-using industries. In a later study, Smith (65) described the forest resource, farm woodlot management, stumpage buyers, and the volumes of sawlogs and other forest products sold from farm woodlots in a three-county area of Missouri. A similar study, but with greater emphasis on describing the operations of sawmills and other primary processors, was made by Hutchison and Winters (26) in southern Illinois. A brief survey of marketing practices for sawtimber and other timber products sold from Iowa farm lands, with special emphasis on the terms of sale and product specifications, was reported by Quigley and Yoho (59). McCauley and Quigley (37) presented a directory of timber products buyers in Ohio and a cursory description of buying practices and specifications for sawlogs and other round wood products. A later study in southeastern Ohio by Turner and Mitchell (77) investigated forest management practices on farm woodlands, attitudes and motivations of farmers regarding forestry practices, and characteristics of stumpage sales such as frequency of sale, size, marketing assistance, terms of sale, sources of price information, and number of offers received.

Other studies have been concerned with the marketing of products produced by sawmills and other primary wood-using mills, in addition to the marketing of raw wood material. In the claypan region of Illinois, Holland (24) investigated the number, size, and other characteristics of primary wood processors and other market agents, wood procurement methods, and the types of market outlets for sawmill products. Brundage (6) reported on the number, size, and types of sawmill operations in southern Indiana, characteristics of the sawlog material purchased, and the types of sawmill products produced. Essentially the same kind of information was presented for the Missouri Ozarks by Quigley (57), although greater coverage was given to marketing procedures for raw wood material and manufactured products.

Several studies of forest products marketing have been made recently on a region-wide basis: pulpwood by Manthy and James (40), cooperage timber by Massie and James (42), and posts, poles, and piling by Manthy and James (39). All three of these studies were primarily concerned with describing market agents, marketing functions, and the channels involved in the marketing of forest products, starting with stumpage and continuing through the primary manufacturing stage. Limited attention was given to the structure of the markets for round wood products and manufactured wood products, and the analyses of the marketing processes often did not focus on the competitive relationships among market participants. Massie (41) gave essentially the same treatment, although in less detail, to the major timber products produced in the region. His report included sawlogs but was confined for the most part to a description of producers and sawmill operators and certain aspects of their operations. Except for a comparison of the average costs and returns involved in producing round wood products, little attempt was made in any of these four studies to evaluate market performance.

Few detailed studies have been made of market outlets and specifications for sawmill products produced in the study region. Sutherland (71) made a case study of the use of wood pallets by the Ford Motor Company. He investigated the characteristics of the lumber used, marketing channels, marketing procedures, the functions performed by the pallet manufacturer, and trends in pallet consumption. A similar study of the use of wood pallets in the Minneapolis-St. Paul area was conducted by Warner and Cowan (97). Also in the Minneapolis-St. Paul area, Warner and Tubbs (98) made a study to determine the volumes and characteristics of lumber used by manufacturing industries.

Marketing Studies Outside the North Central Region

The studies reviewed hereafter exclude those carried out in the western states because of the great differences between the West and the rest of the nation as regards the structure of the sawmilling industry.

Under the Northeastern Regional Marketing Projects NEM-6 and NEM-24 a series of region-wide studies of forest products marketing, starting with stumpage and carrying on through the retail yard, were conducted in the Middle Atlantic and New England states. Phase I of NEM-6 reviewed the landownership situation and described the stumpage selling practices of the owners of small woodlands, including the frequency of sales, the values, types, and volumes of products sold, and the terms of sale (51). Phases II and III of NEM-6 investigated the stability of wood-using firms, buyers' specifications for stumpage and logs, the distribution of manufactured wood products by market area and type of buyer, and the use of public or private marketing assistance by the buyers and sellers of timber products (52). State reports based on NEM-6 include studies by Baker and Beyer (3) in Maine, Swain and Wallace (73) in New Hampshire, and Rich and Sisterhenm (60) in Massachusetts. Studies of a similar nature but not connected with NEM-6 include those by Sampson and Crosswhite (62) in Delaware and Judson and Switzer (31) in northeastern Mississippi.

NEM-24, which also consisted of three phases, was limited to lumber rather than covering all major forest products as in NEM-6. Phase I, as reported by Christensen et al. (9), investigated on a region-wide basis the characteristics of lumber sold, channels of distribution, market geography, marketing practices, and lumber pricing. State reports for Massachusetts (4) and for Maine and New Hampshire (96) based on Phase I are also of interest. Phase II consisted of a study of the lumber purchased and services sought by manufacturers of wood products. Reporting on this phase, Whitmore _et al_. (99) described the characteristics of the lumber purchased, sources of supply, purchasing practices, and procurement problems as viewed by lumber buyers. Similar information was also presented in state reports by Foster and Bond (15) in Massachusetts and Wallace (95) in New Hampshire. In a separate study of the markets for lumber produced in West Virginia, Lindell (35) reported essentially the same type of information based on a survey of wood products manufacturers in Ohio, Virginia, and North Carolina. The region-wide results for Phase III have not yet been reported. This last phase of NEM-24 is a study of the marketing practices and the services sought and rendered by lumber retailers. The state report for West Virginia based on this phase of the regional project has been reported by Nelson (50).

The major findings and conclusions of the regional studies NEM-6 and NEM-24 were the following. (1) About two-thirds of the timber sales from small private forest ownerships were made by sellers who had no presale knowledge of the amount of timber involved in the sale or of available market outlets. (2) About half of the sellers had no knowledge of available public or private management and marketing assistance. (3) Only 14 percent of the timber sales received a bid from more than one buyer. (4) Small lumber manufacturers attract the attention of few potential buyers. (5) Small woodland owners and small sawmill firms have similar problems: they both lack the resources to perform many marketing functions and must rely on the buyers of their products to carry out such marketing activities as grading, measuring, and pricing. (6) Small sawmill firms are frequently forced to sell, regardless of the market advantage, because of inadequate storage facilities or financing. (7) Slightly over 90 percent of the hardwood lumber purchased by wood products manufacturers sampled in the Middle Atlantic and New England states was obtained from within the region studied. (8) Failure of lumber to meet grade specifications was the lumber procurement problem most frequently mentioned by buyers. Failure of lumber to meet size and seasoning specifications and delivery problems were also found to be important.

Related Studies

Although most studies in the areas of marketing have been concerned with the marketing process--viewed, for the most part, in terms of material flows--and the channels of distribution, some studies have focused on other subjects such as the utilization potential of the forest resource, manufacturing processes, and the market outlets and specifications for sawmill products.

Callahan and Stoops (7) reviewed the timber resource and other economic characteristics of southern Indiana and analyzed the production and marketing potentialities for sawmill products and other wood products. A similar study was made by Smith and Meyers (66) in Missouri. Also in Missouri, McGinnes (38) presented an excellent description of the manufacturing processes of primary and secondary wood-using industries.

Koch (34) investigated the economic and technological factors relevant to the establishment of integrated hardwood utilization plants and described a plant layout that would be suitable in northern areas of the United States. The feasibility of establishing hardwood utilization centers has also been studied by the Tennessee Valley Authority (75). Economic analyses of the production and marketing of laminated timbers and hardwood dimension stock were carried out in West Virginia by Hamelman (22) and Haas (17), respectively. Haas (18) also studied the use of hardwood dimension stock by the furniture industry. Brock (5) made a penetrating analysis of the roles played by building contractors and architects in determining the amounts and kinds of lumber used in building construction in the Northeast.

CHAPTER 3

THE LUMBER INDUSTRY IN THE NORTH CENTRAL REGION: AN HISTORICAL PERSPECTIVE

The North Central Region is a highly industrialized and heavily populated area. The nine states which make up the region, as defined in this study, accounted for 35 percent of the total value added in manufacture in 1962 and about 27 percent of our country's population in 1963 (81). The region has a highly developed transportation system consisting of numerous highways and railroad lines and several major water routes. An extensive network of railroads serves most towns and cities in the region. Six of the states border on the Great Lakes which serve domestic shipping and international trade with Canada and with other countries by way of the Saint Lawrence Seaway. The Mississippi and Missouri Rivers and their tributary rivers provide important routes of transportation in all states of the region with the exception of Michigan.

The topography of the region is fairly consistent. There are no major mountain ranges; rolling hills or plains characterize much of the land surface. Climatic conditions throughout the region are more variable. Temperatures are considerably lower in the Lake States and precipitation is substantially lower in Kansas and Minnesota than in the other states.

About half of the land area in the region is devoted to raising agricultural crops. Commercial forests occupy about 25 percent of the total area. Pasture and range lands, industrial and urban areas, and other land uses make up the remaining quarter of the land area.

Manufacturing plays a dominant role in the economic activity of the region. Manufacturing industries accounted for 40 percent of all wages and salaries paid in 1958. The wholesale and retail trades and the service trades ranked second and third, respectively, in terms of the amount of wage and salary disbursements. In comparison, income received and wages paid by farmers represented only 5 percent of total personal income (78).

Heavy industries, including the manufacture of machinery, the primary and fabricated metal industries, and the manufacture of transportation equipment, accounted for slightly over half of both value added in manufacture and the number of workers employed by all manufacturing industries in 1962 (Table 3). The forest industries represent a small but significant share of the region's total economic activity. Paper and allied products industries accounted for a little more than 3 percent of the value added in manufacture in 1962. Value added in the manufacture of furniture and fixtures represented slightly over 1 percent of the total. Lumber and wood products manufacturing, which includes firms engaged in the manufacture of sawmill products, accounted for slightly less than 1 percent of total value added (Table 3). Firms engaged in the manufacture of sawmill products accounted for only one tenth of one percent of total value added in manufacture.

Although the sawmilling industry is relatively unimportant in terms of its contribution to the total economic activity of the

Table 3. Value added and employment by selected manufacturing industries, 1962[a]

SIC number	Industry group	Value added	All employees	Value added	All employees
		(Million dollars)	(Thousands)	(Percent)	
35 & 36	All machinery	14,007.5	1,222.7	22.1	22.6
33 & 34	Primary and fabricated metal	10,987.7	945.0	17.3	17.5
37	Transportation equipment	10,748.6	707.5	16.9	13.1
20	Food and kindred products	7,728.5	586.2	12.2	10.8
28	Chemicals and allied products	4,192.5	191.9	6.6	3.5
26	Paper and allied products	2,107.6	179.1	3.3	3.3
25	Furniture and fixtures	835.7	95.7	1.3	1.8
24	Lumber and wood products	531.2	77.4	0.8	1.4
	All other manufacturing	12,410.6	1,409.4	19.5	26.0
	Total manufacturing	63,549.9	5,414.9	100.0	100.0

[a]Includes the nine North Central States plus North and South Dakota and Nebraska. These three states accounted for only 1.4 percent of the 12-state total value added. Food and kindred products accounted for about half of the total value added in each of these three states.

Source: U. S. Bureau of Census. 1964. Annual survey of manufactures: 1962. Wash., D. C.

region, it is of substantial economic importance in rural areas. According to Census data (80), some 9,000 sawmills, nearly all of which were located in rural areas, employed about 16,500 workers in 1958. This figure does not include all part-time workers and doubtlessly fails to include many workers employed by the hundreds of very small sawmills.

The harvesting and transportation of sawlogs provides additional employment for sawlog producers and forest owners. The sale of sawlogs and sawtimber is an important source of income to many forest owners. The sawlog harvest was valued at 62 million dollars in 1958 (20).

In formulating a picture of the present status of the sawmilling industry, its structure, and its relationship to the economy of the region as a whole, it is helpful to review the historical trends which bear upon the present situation. The remainder of this chapter is concerned with a discussion of regional trends in lumber production, the timber resource, and the markets for lumber.

Trends in Lumber Production

The history of the sawmilling industry in the North Central Region goes back to the early part of the nineteenth century. Up until the 1850's, lumber was produced primarily for the homesteading needs of the settlers in the region. Starting around 1860 the concentration of the sawmilling industry shifted from the Northeastern States to the Lake States. Lumber production within the region rose sharply and reached a peak of about 13 billion board feet annually in the late 1880's (Figure 2, part A). The cut of white pine made up over half of annual production up until 1905. During the period of rapidly increasing regional production, national demand for lumber was also growing at a fast pace. Regional production remained at high levels until the early part of this century and then declined rapidly as the virgin timber disappeared.

The share of national lumber production produced in the study region has declined significantly since 1859 (69). In the 1870's, the region accounted for some 60 percent of hardwood lumber production in the nation, about half of the softwood lumber produced, and some 40 to 50 percent of total national production (Figure 2, part B). The region's share of national lumber production has dropped to 20 percent for hardwoods, about one percent for softwoods, and about 5 percent for all lumber produced in 1962.

Since 1939, both the level of lumber production and the share of national output have been fairly constant from decade to decade as indicated by the last three base years in Figure 2, part B. Although production was slightly higher during and immediately after World War II, annual production of both hardwoods and softwoods since 1949 has remained at about the same level, as is shown in the following tabulation (82, 93):

Year	Hardwoods	Softwoods	Total
	(Million board feet)		
1949	1,138	295	1,433
1954	1,315	349	1,664
1956	1,418	256	1,674
1958	1,207	350	1,557
1960	1,194	384	1,578
1962[1]	1,336	279	1,615

[1] Data are for sawtimber harvested rather than lumber production.

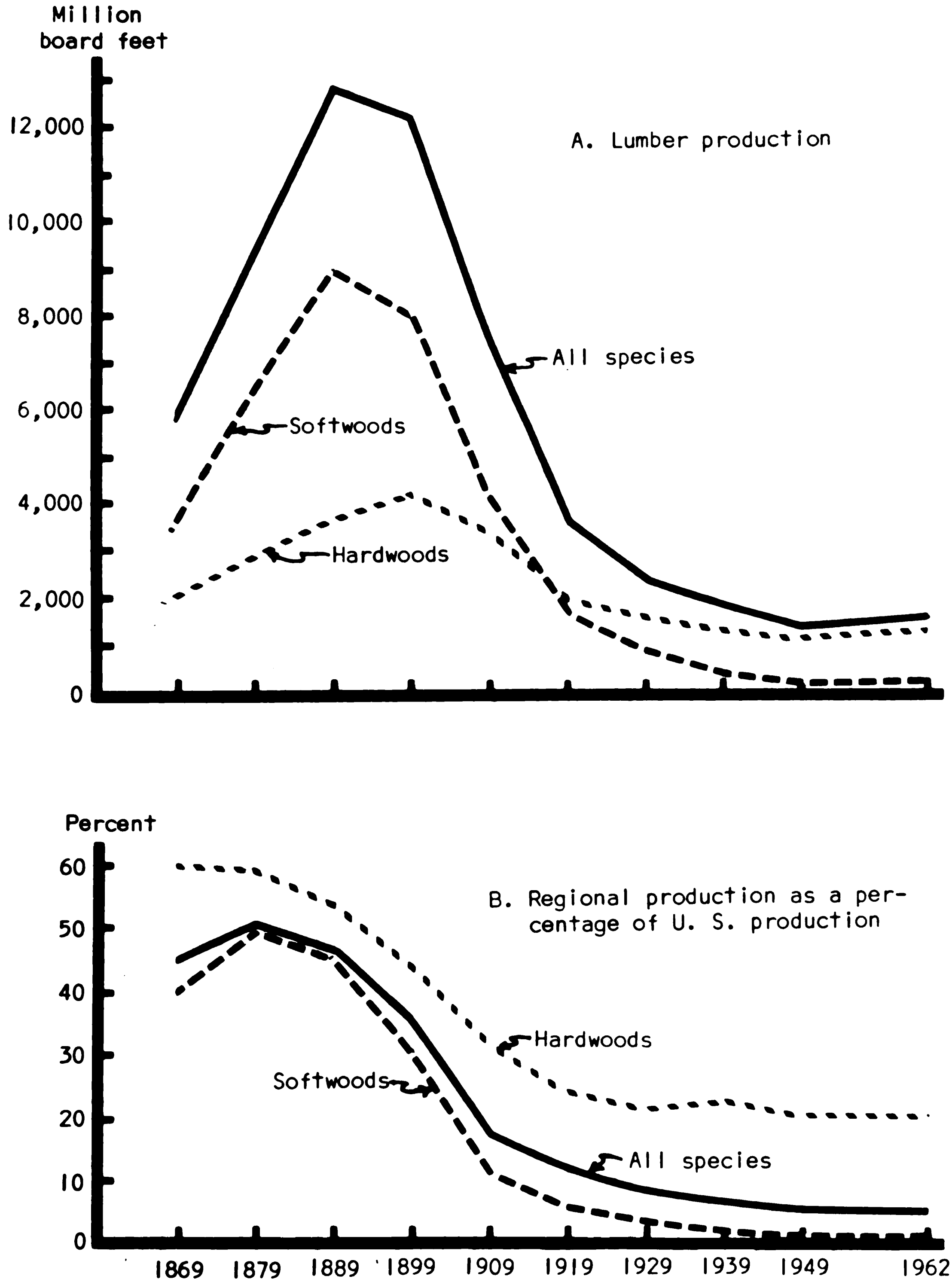

Figure 2. Annual lumber production in the North Central Region; regional production as a percentage of U. S. production, for ten-year intervals 1869-1962. (Source: Years 1869-1939: Steer, Henry. 1948. Lumber production in the United States 1799-1946. Wash., D. C. Years 1949-62: U. S. Bur. of Census. Lumber production and mill stocks, Series M24(62)-1. Wash., D. C. Annual reports.)

National production of both softwoods and hardwoods over this same period has similarly shown no significant upward or downward trend. In the past 30 years, the region's share of national hardwood production has remained around 20 percent while its share of softwood production has amounted to only 1 to 3 percent.

Very little information is available regarding the volume of lumber produced of individual species. Of the total volume of sawtimber harvested in 1962, red and white oaks made up 32 percent of the total; hard maple, 7 percent; yellowpoplar, 3 percent; spruce and balsam fir, 4 percent; and white and red pine, 3 percent (93). Aspen, poplar, and cottonwood--which may have accounted for 10 to 25 percent of total annual production--and other species made up the remaining 51 percent. There is little evidence to indicate that any major changes have occurred in the rate of lumber production for individual species for the past 20 years or more.

Recent Trends in the Forest Resource

The forest resource is perhaps the most important factor that affects the structure and conduct of the sawmilling industry. The species, size, quality, location, density, and other characteristics of the forest cover determine, to a large extent, the size, location, and type of sawmill and producer firms; the costs of logging, hauling, and milling; and the species and quality of lumber and sawlogs produced. This section describes the timber resource of the North Central Region and the more important changes in this resource which have occurred in the past 10 years. Knowledge of the present situation and recent developments in the forest resource are necessary for a more complete understanding of present conditions in the sawmilling industry and of changes which might occur in the next few years.

There are some 83.3 million acres of commercial forest land in the North Central Region[1]. Commercial forest land makes up about one fourth of the total land area. The acreage of commercial forest land has decreased by 3 percent since 1953. However, the volume of growing stock has increased by about 10 percent from 1953 to 1963.

About 72 percent of the commercial forest land in the region is in private ownership. Farm ownerships account for about 41 percent of all commercial forest land, more than any other class of owners. In each of the nine states, farm ownerships rank first in terms of acreage of commercial forest land. Lumber companies and pulp and paper companies own about 1 percent and 3 percent, respectively. Other types of private ownerships account for about one-fourth of all commercial forest land.

State forests account for about 10 percent of total commercial forest land; some 9 percent is found in national forests; county and municipal governments own about 7 percent; and about 2 percent is found on other types of federal ownerships, mostly Indian lands. The three Lake states account for about 93 percent of the commercial forest land in state ownership within the region. Of the acreage found on national forests, nearly 95 percent occurs in the three Lake States plus Missouri. County and municipal ownerships in Minnesota and Wisconsin contain nearly all of the commercial forest land found

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[1]The data presented in this section for years 1962-63 and 1952-53 were taken entirely from Timber Trends in the United States (93) and Timber Resources for America's Future (91), respectively.

in these types of ownerships within the region.

Most of the commercial forest land in the study region, except for that in public ownership, is parceled among thousands of small ownerships. The following tabulation shows the number of private forest owners and the acreage held by them in 1953 (91):

Size class of ownership	Number of private forest owners	Commercial forest acreage	Percentage of total commercial forest land
Less than 100 acres	1,098,398	34,923,000	40.7
100 - 500	90,143	17,201,000	20.0
500 - 5,000	3,285	3,542,000	4.1
5,000 or more	161	6,313,000	7.4
	1,191,987	61,979,000	72.2

About 1.1 million private ownerships, each with less than 100 acres of commercial forest land, contain 41 percent of all commercial forest land in the region. Another 20 percent is found on properties containing between 100 and 500 acres of commercial forest land. It is evident from these figures that, except in some areas of predominantly public forest ownership, the supply side of the stumpage market is definitely atomistic.

Whereas private forest owners control 72 percent of the region's commercial forest land, 81 percent of all sawtimber volume is found on privately owned lands. The national forests contain slightly less than 7 percent, and other public agencies account for about 12 percent of all sawtimber volume.

During the period 1953 to 1963, the acreage of commercial forest land owned by farmers decreased from 36.1 million acres to 33.9 million acres. All other ownership classes, except federal agencies other than the Forest Service, experienced an increase in their share of total commercial forest land. The following tabulation indicates the percentage of commercial forest land held by each ownership class in 1953 and 1963 (91, 93):

Ownership class	1963	1953
	(percent)	
Farmers	40.8	42.1
Forest industries	4.1	4.1
Other private	27.0	26.0
National forests	9.2	8.9
Other federal	1.8	2.2
State	9.7	9.5
County and municipal	7.4	7.2
All ownerships	100.0	100.0

Since most farm-forest ownerships are smaller than 500 acres, we can assume that there has been some decrease in the total acreage held and the relative importance of small forest ownerships. If we assume that the number of ownerships with less than 100 acres of commercial forest land decreased in proportion to the decrease in farm-forest acreage, then we would estimate that the number of these small ownerships decreased by some 69,000 from 1953 to 1963. This would still leave, however, some one million of these small ownerships containing about 39 percent of all commercial forest land in the region. Regardless of the implications that might be drawn from the above trends, it is evident that the present structure of forest ownership is still dominated by the multitude of small, private holdings.

Another indication of recent trends in the structure of forest ownerships is the change in sawtimber volumes held by each type of ownership. The most significant change from 1953 to 1963 was an increase of 3.8 billion board feet of sawtimber on public lands other than the national forests. This represents an increase of 35 percent for the ten year period. During the same period, sawtimber volumes on national forests increased by 230 million board feet, or 3 percent; sawtimber volume on all lands in private ownership increased by 6.8 billion board feet, or about 1 percent. Although the volume of sawtimber in private ownerships increased from 1953 to 1963, the proportion of total sawtimber volume in private holdings decreased from 82.9 percent to 81.1 percent. The share held in public ownership other than on national forests increased from 10.0 percent to 12.3 percent. Without regional data on stand structure and site productivity by ownership classes, it is not possible to accurately judge the significance of these trends and what their implications are for the future. Although the trends in the ownership of sawtimber and commercial forest land indicate a slight increase in the concentration of the timber resource on large holdings and public ownerships, the most significant deduction to be drawn from these trends is that the extremely atomistic structure of forest ownership has not changed much in the past 10 years.

The predominant forest type in the North Central Region, in terms of commercial forest acreage, is the oak-hickory type. This type includes about one-third of all commercial forest acreage. The aspen-birch type ranks second with about one-fifth of total commercial forest acreage.

Considerable differences in the species composition of the forest cover are evident in comparing the three Lake States with the six other states. This comparison is made in Table 4. In the Lake States, the largest forest type is the aspen-birch type which includes about one third of all commercial forest acreage. The maple-beech-birch type and the spruce-fir type are the second and third largest, respectively. In the six other states, the oak-hickory type includes about two-thirds, and the elm-ash-cottonwood type accounts for about one-fourth of all commercial forest land.

Just as hardwood types cover most of the forested area, hardwoods outrank softwoods five to one in terms of sawtimber volume. In 1963 there were 99.8 billion board feet of hardwood sawtimber and 19.6 billion board feet of softwood sawtimber in the nine states. About 40 percent of the hardwood volume and 93 percent of the softwood volume occurred in the three Lake States.

The red oak group is the dominant species group and accounts for about 16 percent of all volume. The white oak group ranks second with 14 percent of total volume. Other important species and species groups in descending order of importance are: hard maple; cottonwood and aspen; spruce, hemlock, and balsam fir; red and white pine; and soft maple.

During the ten year period 1953-1963, some changes have occurred in the species makeup of the sawtimber resource. Total sawtimber volume on commercial forest land increased from 108.5 billion board feet in 1953 to 119.3 billion board feet in 1963. Hardwood volume increased by 6.9 billion board feet and softwood volume increased by 3.9 billion board feet (Table 5). However, as a proportion of total sawtimber volume, hardwood volume decreased from 86

Table 4. Distribution of commercial forest land by forest type and sub-region, 1963

Forest Type	Three Lake States	Six Central States	All nine states
		(P e r c e n t)	
Oak-hickory	12	65	32
Aspen-birch	34	a	22
Elm-ash-cottonwood	9	24	15
Maple-beech-birch	19	4	13
Oak-pine	--	3	1
Oak-gum-cypress	--	2	1
Spruce-fir	17	--	10
White-red-jack pine	9	a	5
Loblolly-shortleaf pine	--	2	1
	100	100	100

[a]Less than 0.5 percent.

Source: U. S. Forest Service. 1965. Timber trends in the United States. Wash., D. C.

Table 5. Comparison of the distribution of sawtimber volume by species, 1953 and 1963

Species	1963	1953	Change 1953-63
	(Percent)		(Million bd.ft.)
Oaks	30.1	33.8	- 743
Sugar maple and yellow birch	9.6	9.4	+ 1,182
Soft maple and beech	6.8	6.6	+ 973
Cottonwood and aspen	6.0	5.8	+ 928
Yellow poplar	1.7	1.5	+ 115
Other hardwoods	29.4	28.5	+ 4,429
Total hardwoods	83.6	85.6	+ 6,884
White and red pine	5.5	4.6	+ 1,605
Jack pine	1.9	1.9	+ 215
Spruce, hemlock and balsam fir	5.9	5.1	+ 1,417
Other softwoods	3.1	2.8	+ 704
Total softwoods	16.4	14.4	+3,941
All species	100.0	100.0	+10,825

Source: Year 1963: U. S. Forest Service. 1965. Timber trends in the United States. Year 1953: U. S. Forest Service. 1958. Timber resources for America's future.

percent to 84 percent and softwood volume increased from 14 percent to 16 percent.

The volume of most species and species groups increased over the ten year period (Table 5). The volume of oak, however, decreased by about 700 million board feet, and as a percentage of total sawtimber volume, it decreased from 34 percent to 30 percent. Data were not available for all major species, but of those species represented in Table 5, it appears that the more valuable species, such as sugar maple, yellow birch, soft maple, yellowpoplar, and red and white pine, have at least held their own in terms of their share of total sawtimber volume. It is apparent from Table 5 that sawmill firms, in the region as a whole, have faced an increasing sawtimber volume of most species during the past ten years.

It is questionable, based upon growth and cut data for 1962, whether the recent trends in the species composition of the sawtimber resource will continue into the future. The following tabulation[1] presents net annual growth and cut of sawtimber in 1962 for selected species (93):

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[1]The data represent the nine states under study plus Kentucky, Nebraska, and North and South Dakota. Since the four states outside the study region account for only a small share of the growth and cut volumes reported here, there is reason to believe that comparisons among species, based on these data, would be valid for the region under study.

Species	Net annual growth	Cut	Net annual growth minus cut
	(Million bd. ft., International 1/4")		
Select white and red oaks	1,051	635	416
Other white and red oaks	785	274	511
Sugar maple	214	207	7
Yellow birch	24	48	-24
Yellowpoplar	208	89	19
Hickory	309	55	254
White and red pine	266	78	188
Spruce and balsam fir	223	122	101

The above data indicate that net annual growth of oak sawtimber exceeded cut two to one. The net growth of lower-value oaks was about three times greater than the cut of these species in 1962. If the growth-cut relationships for 1962 continue, then one would expect a reversal in the recent downward trend in the volume of oak sawtimber and an increase in the proportion of total sawtimber volume accounted for by the oak group. It also appears likely that over half of the expected increase in oak volume will come from less-valuable oak species. The volume of hickory, another low-value species, will probably also increase significantly. Sawtimber growth approximately equalled sawtimber cut for sugar maple in 1962, and the volume of yellow birch cut exceeded growth two to one. These growth-cut relationships for 1962 cast serious doubt on whether some of the more valuable species will continue to increase in volume or maintain their share of total sawtimber volume.

Three additional characteristics of the timber resource which are of major significance are the density of the sawtimber cover, the size of sawtimber trees, and sawtimber quality. These three characteristics are discussed in the remainder of this section.

The forests of the North Central Region generally support a low sawtimber density. Almost 80 percent of the commercial forest land supports less than 1,500 board feet of sawtimber per acre. As a result of the increase in total sawtimber volume and the reduction in commercial forest acreage over the past 10 years, sawtimber volume per acre has apparently increased. This is evident from the fact that average sawtimber volume per acre of stocked commercial forest land increased from 1,493 board feet in 1953 to 1,657 board feet in 1963. Another indication of the trend in stocking over the past 10 years is given by the following tabulation (91, 93):

Stand-size class	Percentage distribution of commercial forest land		Change 1953-1963
	1963	1953	(1,000 acres)
Sawtimber[1]	23.8	19.4	+3,185
Poletimber	35.3	33.1	+1,080
Seedling and sapling	27.3	32.1	-4,928
Nonstocked areas	13.6	15.4	-1,890
	100.0	100.0	-2,553

These data indicate that the area supporting sawtimber stands increased from 20 percent to 24 percent of total commercial forest land during the period 1953-1963. This resulted from an increase of 3,185,000 acreas of sawtimber stands.

Whereas the timber resource has improved in many respects in recent years, the average size and quality of sawtimber trees have

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[1]Sawtimber stands are defined as stands that are at least 10 percent stocked, with half or more of the stocking as sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking. Other definitions are also given by the U. S. Forest Service (93).

declined. The decline in sawtimber size is shown in the following tabulation based on data reported for two areas defined by the U. S. Forest Service as the Lake States and the Central States (91, 93).[1]

Region and year	Percentage of sawtimber volume in trees 15" DBH or larger		
	Hardwoods	Softwoods	Total
Lake States			
1953	43.9	31.8	40.4
1963	40.9	31.7	38.1
Central States			
1953	62.6	32.2	61.4
1963	60.2	25.3	58.6
Both regions			
1953	56.8	31.8	53.5
1963	54.0	30.5	50.5

Although the regions are not defined the same in 1953 as in 1963 and do not correspond exactly to the region being studied, the trends indicated are probably representative of the North Central Region. The above figures indicate that the proportion of sawtimber volume, for both hardwoods and softwoods, in trees 15 inches DBH and larger has declined since 1953. Since large trees yield lumber of higher average quality than small trees, we would expect that the decline in sawtimber size has been accompanied by a decline in sawtimber quality.

The trend in sawtimber quality for hardwoods as a group is indicated in the following data reported by the U. S. Forest Service

[1]For the year 1953, Lake States include Michigan, Wisconsin, and Minnesota; Central States include Illinois, Indiana, Iowa, Kentucky, Missouri, and Ohio. For the year 1963, Lake States include Michigan, Wisconsin, Minnesota, and North and South Dakota; Central States include the same states as in 1953 plus Kansas and Nebraska.

(91, 93) for the same two regions mentioned above:

Quality class and year	Percentage of hardwood sawtimber volume		
	Lake States	Central States	Both regions combined
Grade No. 1			
1953	13	7	9
1963	12	6	8
Grade No. 2			
1953	27	11	17
1963	23	10	14
Grade No. 3			
1953	60	82	74
1963	65	84	78

The tabulated data indicate that the proportion of hardwood sawtimber volume in Grade No. 1 and Grade No. 2 logs decreased from about 26 percent in 1953 to some 22 percent in 1963. Grade No. 1 logs yield about 65 to 80 percent No. 1 Common and Better grades of lumber and Grade No. 2 logs yield about 40 to 64 percent No. 1 Common and Better. The volume of the lowest log grade, Grade No. 3, increased from about 74 percent to about 78 percent of total volume. Grade No. 3 logs yield only about 13 to 36 percent No. 1 Common and Better lumber and include logs which are not suitable for standard lumber but which can be used for ties and timbers.

Using these percentage relationships and the reported volumes of hardwood sawtimber in the North Central Region, it is estimated that the volume of hardwood sawtimber in Grade No. 1 and Grade No. 2 logs decreased by about 5 percent and 25 percent, respectively, while the volume in Grade No. 3 logs increased about 11 percent from 1953 to 1963. Clearly, the timber resource base for firms demanding high-quality hardwood sawlogs has worsened in the past 10 years.

Similar data on quality of softwood sawtimber are not reported by the Forest Service. However, since the average size of softwood sawtimber has decreased in the past 10 years, it is reasonable to assume that quality has also declined.[1]

In summary, the forest-ownership structure in the North Central Region is highly atomistic, there being some one million owners with less than 500 acres apiece controlling over half of the commercial forest acreage and sawtimber volume. Hardwoods predominate in terms of acreage and volume. Although sawtimber volumes of most of the more-valuable species have increased in both absolute and relative terms since 1953, present growth-drain relationships suggest that some of these species may not hold their own in the near future. While sawtimber volume per acre has increased, average size and quality of sawtimber trees have decreased since 1953.

Trends in Lumber Markets and Lumber Consumption

Most of the lumber produced in the North Central Region is consumed within the region. Since the early part of this century the North Central Region has imported a major portion of its lumber requirements, especially its requirements for softwood lumber. The majority of the imported lumber comes from the West; a considerable amount is imported from the South; and the remainder comes from Canada, the Northeast and an insignificant volume from other countries.

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[1]Caution should be used in interpreting trends in sawtimber quality which are based primarily on changes in sawtimber sizes. It is possible for over-all quality to decrease as a result of a decrease in average tree size, and, at the same time, average quality for each tree size class to increase.

While 90 percent or more of the region's softwood lumber requirements are imported, it is estimated that production and consumption of hardwood lumber within the region are approximately equal. There may even be an export surplus of hardwood lumber, but the data to support this supposition are poor.

Lumber consumption in the North Central Region has declined significantly since 1928 while national consumption has remained about the same (81, 88). Regional consumption and regional consumption as a percentage of national consumption in 1940 and 1928 are given in the following tabulation (88, 89). Regional consumption data for 1940 are the latest available.

	1940	1928
Hardwoods:		
Lumber consumption, million bd.ft.	1,264	2,883
Percentage of U.S. consumption	31	44
Softwoods:		
Lumber consumption, million bd.ft.	5,736	7,579
Percentage of U.S. consumption	23	26
All species:		
Lumber consumption, million bd. ft.	7,000	10,462
Percentage of U.S. consumption	24	30

It is evident from the above data that regional consumption of both hardwood and softwood lumber declined substantially from 1928 to 1940. Although national consumption declined during the same period, regional consumption declined relatively more so that the region's share of national consumption of both species groups also decreased.

Lumber used in manufacture within the region decreased by about 1.5 billion board feet during the 1928-1940 period. A major share of the decrease, some 800 million board feet, occurred in the manufacture of motor vehicles and railroad cars (87, 90). A decrease in lumber used in residential and nonresidential construction, amounting to about 2 billion board feet, was, however, the major factor contributing to the decline in regional lumber consumption.

Unfortunately there are few data available for estimating regional consumption after 1940. It is possible, however, to obtain an approximate estimate of apparent consumption. Apparent consumption, from here on referred to simply as consumption, is defined as: regional production, plus imports, minus exports and changes in the level of lumber inventories.

Table 6 presents average annual shipments of lumber, by rail, between the North Central Region and three other regions of the United States for two time periods: 1948-49 and 1960-61. The estimates are based upon originations and terminations of railroad waybills and may overestimate both imports and exports by rail. The estimates for the period 1948-49 represent nearly all of the lumber shipped between the North Central Region and the three other U.S. regions. Also, imports by rail from the West represent nearly all lumber imported from that region during both time periods, because the distances involved are too great for truck hauling, and because waterborne shipments from the West Coast to the North Central Region were insignificant during both time periods (84, 85). Long-distance trucking from the South was uncommon during 1948-49. However, Row (61) reports that in later years about 80 percent of southern lumber production was shipped by truck for distances up to 400 miles or more. This and other indications of changes in long-haul trucking suggest that imports from the South by truck exceeded

Table 6. Imports and exports of lumber[a] by rail between the North Central Region and other regions of the United States, 1948-49 and 1960-61

Region of origin or destination	Average annual shipments to the North Central Region		Average annual shipments from the North Central Region	
	1960-61	1948-49	1960-61	1948-49
	(Million bd. ft.)			
West[b]	3,497	3,594	40	41
South[c]	563	2,146	132	103
Northeast[d]	48	90	120	31
All regions	4,108	5,830	292	175

[a]Includes lath and shingles, which represent a small portion of the total.

[b]Includes all states west of Texas, Oklahoma, and the North Central Region.

[c]Includes all states south of Pennsylvania, Maryland, and the North Central Region.

[d]Includes all remaining states in the Northeast.

Source: U. S. Interstate Commerce Commission. Carload waybill statistics. Annual reports. Wash., D. C.

rail shipments during 1960-61.

It is evident from Table 6 that lumber imports far exceeded exports from the North Central Region during both 1948-49 and 1960-61. Imports from the West decreased slightly during the 11 year period. Yearly lumber imports by rail from the South decreased sharply by some 1,583 million board feet. There is reason to believe that the decline in rail shipments from the South was approximately offset by truck shipments. If we assume that the same proportion of southern production was shipped to the study region in 1960-61 as in 1948-49, then we would estimate annual imports from the South during 1960-61 at 1,930 million board feet. Annual imports from the South are therefore estimated to have been about 10 percent less in 1960-61 as in 1948-49.

Let us now consider lumber imports and exports between the study region and foreign countries. Most of the lumber imported by the United States comes from Canada, and much is transported by rail. Data are not available for regional imports and exports by rail, but the volume of waterborne trade can be estimated from reports by the Corps of Engineers (84, 85). Based on these reports, it is estimated that waterborne trade in lumber between the study region and foreign countries, including Canada, is very small. This point is illustrated by the following tabulation which presents estimates of the volume of waterborne trade in lumber between the North Central Region and foreign countries:

	1962	1948
	(M bd.ft.)	
Imports	1,150	60
Exports	945	15
Net imports	205	45

Net imports of lumber by rail and truck into the study region from Canada can be estimated approximately by allocating national net imports by rail and truck from Canada on the basis of the study region's share of national consumption in 1940.[1] These net imports are estimated as averaging 304 and 692 million board feet in 1948-49 and 1960-61, respectively.

The above estimates of net imports and regional production data for the two time periods 1948-49 and 1960-61 are presented in Table 7. Estimates of average annual lumber consumption are also shown. Consumption is defined here as a residual equal to production plus net imports (imports minus exports). Lumber inventories at the beginning and end of each two-year period are assumed to be equal.

Although the estimates of net imports and exports, especially imports from the South and Canada, are of questionable accuracy, the trends shown in Table 7 are reasonable judging from past trends in regional and national lumber consumption. National lumber consumption

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[1]The estimates were derived as follows: Net annual lumber imports by the United States from Canada averaged 1,466 and 3,626 million board feet during 1948-49 and 1960-61, respectively (21). By subtracting waterborne imports from British Columbia (53), amounting to an average of 200 and 744 million board feet during 1948-49 and 1960-61, respectively, average annual lumber imports by rail and truck from Canada were estimated as 1,266 and 2,882 million board feet for 1948-49 and 1960-61, respectively. Imports were then allocated to the study region according to the region's share (24 percent) of national lumber consumption in 1940. The region's share of national population was not thought to be a good basis for allocation because data for 1928 and 1940 indicated a poor correlation between the region's share of population and its share of lumber consumption.

Table 7. Estimated average annual production, net imports, and consumption of lumber in the North Central Region, 1948-49 and 1960-61

	1960-1961	1948-1949
	(Million bd. ft.)	
Production	1,508	1.433[a]
Net imports from:		
West	3,457	3,553
South	1,798	2,043
Northeast	-72	59
Total U. S.	5,183	5,655
Foreign (waterborne)	b	b
Canada (rail and truck)	692	304
Total net imports	5,875	5,959
Consumption	7,383	7,392

[a]Based upon 1949 data only; 1948 data are unavailable.

[b]Less than 500 thousand board feet.

Source: For sources of data, method of derivation and definitions used, see Table 6 and pp. 54-57.

increased only slightly from an average of 35.4 billion board feet in 1948-49 to 35.8 billion board feet in 1960-61 (21). The slight decrease estimated for regional consumption and in the region's share of national consumption during this period is quite reasonable. For instance, the region's share of national lumber consumption declined from 30 percent in 1928 to 24 percent in 1940 (88, 89). From Table 7 it is estimated that its share declined further to 20.9 percent in 1948-49 and to 20.6 percent in 1960-61.

The decrease in net imports of lumber from the West and South and the increase in net imports from Canada also seem reasonable. National imports from Canada increased from an average of 1,716 million board feet in 1948-49 to an average of 4,094 in 1960-61. This amounts to an increase of 238 percent as compared to the estimated increase of 228 percent for the study region. The increased competition from Canada probably affected imports from the West and the South. Growing markets for lumber in both the West and the South also probably tended to reduce shipments from these two regions to the North Central Region.

The above trends in aggregate lumber consumption must be examined in greater detail in order to appreciate their significance to the sawmilling industry in the North Central Region. Since hardwoods represent more than 80 percent of all lumber produced in the study region, but less than 20 percent of regional lumber consumption, it is difficult to determine how changes in aggregate regional lumber consumption affect the industry. Of the sawmill firms sampled in this study, about 85 percent produced predominantly hardwood lumber and products made thereof. The major products and the percentage of total production represented by each in 1960 was:

	Percent
Pallets, crates, boxes, and dunnage	38
Hardwood grade	17
Hardwood construction lumber	12
Railroad ties	12
Hardwood flooring stock	6
Softwood lumber	8
Other lumber	7
	100

The tabulation reveals that more than half of the lumber produced by sampled sawmills was sold for use in the manufacture of wood products, as opposed to non-manufacturing uses. Because of the dearth of data, it will be possible to examine consumption relationships for only a few of the major products produced in the study region.

Table 8 presents the volume of lumber used in manufacture within the study region during the period 1928-1948. The products listed represent the major uses of lumber produced in the study region, and all except millwork use predominantly hardwood lumber.

From Table 8 we see that the manufacture of containers dominated the manufacturing uses of lumber over the 20-year period. Millwork production maintained its position as the second largest use of lumber among the manufacturing uses. The amount of lumber used in the manufacture of furniture decreased by 15 percent from 1928 to 1948, but the relative standing of this use remained at about 12 percent of the total lumber used in manufacture within the region. The use of lumber in the construction of railroad cars and motor vehicles decreased by 65 percent and 85 percent, respectively.

Table 8. Lumber used in manufacture in the North Central Region, selected years 1928-1948

Product	1948	1940	1928
	(Million bd. ft.)		
Containers (except cooperage)	1,176	1,166	1,057
Furniture (excluding fixtures)	440	359	520
Flooring	156	168	a
Railroad cars	164	210	466
Motor vehicles	76	60	607
Pallets	77	a	a
Millwork	690	550	869
Other products	756	500	958
Total	3,535	3,013	4,477

[a]Not available separately; included with "Other products."

Source: U. S. Forest Service. Lumber used in manufacture. For years 1928, 1940, and 1948. Wash., D. C.

The use of wood pallets for the mechanized handling of commodities came into prominence during the early 1940's. By 1948 the manufacture of pallets was the sixth largest manufacturing use of lumber in the study region.

In the absence of regional consumption data after 1948, Table 9 indicates regional trends since 1947 in the number of firms and volume of shipments of three important lumber-using industries. The table indicates that the number of firms and the deflated value of wood furniture shipments remained about the same from 1947 to 1958. This suggests that perhaps little change occurred in aggregate consumption of lumber used in the manufacture of wood furniture within the region. Regarding millwork, both the number of manufacturing establishments and the deflated value of shipments increased during the period 1947-1958. It appears that the consumption of lumber in the manufacture of millwork has increased slightly or has at least remained at about the 1947 level. On the other hand, the indicated decline by 50 percent in the value of shipments of wooden boxes and shook suggests that regional lumber consumption in the manufacture of boxes and box shook has declined since 1947.

Data reported for 1960 on national lumber consumption show a decline of over 50 percent since 1948 in lumber used in the manufacture of motor vehicles (92). A similar decline undoubtedly occurred within the study region. National lumber consumption in the manufacture of flooring increased by only 4 percent from 1948 to 1960. Little change is likely to have occurred in the amount of lumber used in flooring manufacture within the study region. Nationally, the greatest change in the volume of lumber used in

Table 9. Number of establishments and value of shipments for three important lumber-using industries, 1947-1958

Industry	1958	1954	1947
Wood furniture[a]			
Number of establishments	1,005	1,007	954
Deflated value of shipments ($1,000)[b]	422,361	421,470	451,910
Millwork			
Number of establishments	761	877	574
Deflated value of shipments ($1,000)[c]	259,719	242,325	179,886
Wooden boxes and shook[d]			
Number of establishments	230	246	306
Value of shipments ($1,000)	42,255	77,751	89,159

[a]Includes wood household furniture, upholstered and not upholstered, and wood office furniture, old SIC 2511, 2512; 2521.

[b]Deflated by wholesale price index of household furniture.

[c]Deflated by wholesale price index of kitchen cabinets.

[d]Includes nailed and lock-corner wooden boxes and shook, old SIC 2444 and new SIC 2441.

Source: Years 1947 and 1954: U. S. Bureau of Census. 1957. U. S. Census of Manufactures: 1954, Vol. II, Part I. Year 1958: U. S. Bureau of Census. 1961. U. S. Census of Manufactures: 1958. Vol. II, Part I.

manufacturing occurred in the manufacture of pallets. The increase amounted to about 1.3 billion board feet. About 20 percent of the lumber produced by sampled sawmill firms in 1960 was either sold as pallet material or used by the firms themselves in the manufacture of pallets. Assuming that the region accounted for the same proportion of national consumption in 1960 as in 1948, it is estimated that regional lumber consumption in the manufacture of pallets increased from 77 million board feet in 1948 to about 540 million board feet in 1960.

To summarize, about 80 percent of the lumber consumed within the North Central Region is imported from other regions of the United States and from Canada. Some 90 percent of the study region's consumption of softwood lumber is imported. In contrast, half or more of its hardwood consumption is produced within the region. Only a small proportion of regional lumber production is shipped outside the region.

Total lumber consumption within the study region declined from 10.5 billion board feet in 1928 to 7.0 billion board feet in 1940. It is estimated that regional lumber consumption since 1940 has remained at about the 1940 level. Somewhat more than half of the lumber produced in the region is used in the manufacture of wood products; most of the remainder is used in the construction industry. The manufacture of pallets, wooden containers, and furniture are the major manufacturing uses of lumber produced in the study region. The amount of lumber consumed in the manufacture of pallets within the region has increased tremendously since 1948, while the amount consumed by the other two major uses has declined or remained about the same. There are insufficient data available to analyze the supply-demand relationships underlying the observed consumption trends.

CHAPTER 4

THE STRUCTURE OF THE SAWLOG AND SAWMILL-PRODUCTS MARKETS

The competitive behavior of sawlog producers and sawmill firms and the results of their activities are determined to a large extent by the economic environment, or market structure, within which they operate. This chapter describes the technological and organizational characteristics of the markets for sawlog material and sawmill products that strategically influence the nature of competition within these markets.

Number and Size of Sawmills

Sawmill firms in the North Central Region are, with few exceptions, small, localized enterprises, are usually owned by individual proprietors, and usually consist of only one sawmill per firm. On the basis of data published by the Bureau of the Census (79, 80), it is estimated that there were 9,035 active sawmills in the region in 1958. Of the total, 127 mills, less than 2 percent, employed 20 or more workers, and only 7 mills hired 100 or more employees apiece.

The characteristically small size of sawmills in the region is further illustrated by the average output and employment of the sampled sawmills. The mean 1960 output for the 424 sampled sawmills was 857 thousand board feet per mill. Due to the disproportionately small sample of small-scale mills (those that produced less than 500 thousand board feet in 1960), the true mean annual output per mill, for the entire population of mills in the region, was probably considerably less than 857 thousand board feet. The size distribution of the 100 percent sample of large-scale sawmills (those that produced 500 thousand board feet or more in 1960) is as follows:

Total production, 1960 (Thousand bd.ft.)	Sampled sawmills Number	Percent
500 - 999	87	39.1
1,000 - 1,499	62	27.9
1,500 - 1,999	32	14.4
2,000 - 2,999	27	12.2
3,000 - 3,999	11	5.0
4,000 - 9,999	--	--
10,000 or more	3	1.4
Total	222	100.0

All but three large-scale sawmills produced less than 4 million board feet in 1960. All three of the largest mills were located in Wisconsin and each produced more than 10 million board feet; the largest mill sawed 14.4 million board feet in 1960. The range in individual sawmill output is similar to that for cooperage mills in the region. However, the average pulpmill in the region consumes about 40 times as much wood volume annually as the average sawmill. Sawmills in the region are also much smaller than those on the West Coast. For instance, only three sampled mills produced more than 10 million board feet annually as compared with California where about 55 percent of all sawmills produce more than 10 million board feet annually and account for over 90 percent of total production in that state (104).

The number of employees hired per mill is another measure of the relative size and size distribution of the sawmills in the region. Most large-scale mills employ from 1 to 19 full-time employees, whereas nearly all small-scale mills employ fewer than 10 full-time workers. Of the sawmills sampled, 83 percent of the large-scale mills employed fewer than 20 full-time employees,[1] and 97 percent of the small-scale sawmills hired fewer than 10 full-time employees (Table 10). Many small-scale mills hire no full-time employees, and either the proprietor does all the work himself or he hires workers on a part-time basis. About half of the sampled sawmills hired some part-time workers in 1960 (Table 10). Most part-time workers are hired during the summer for unskilled tasks such as the sorting and stacking of lumber.

The number of workers employed by a sawmill depends not only upon the volume of lumber produced, but also upon the kinds of products produced and the extent to which they are manufactured beyond the initial, rough-lumber stage. Sawmills which produce either a highly manufactured product or a product which requires a great number of cuts and sorts in order to obtain high quality, generally employ more workers per mill than other sawmills of similar size. Table 11 presents employment figures for the product groups to which the sample mills belong. Sawmills that produced predominantly hardwood grade, or pallets, boxes, and crates, or "other" manufactured

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[1] Includes persons directly employed by sawmills, whether working at the mill or in the woods. A full-time employee is defined as one who normally works a full shift each day throughout the entire period of operation, which is the full year for mills operating year-round and part of a year for part-time mills.

Table 10. Percentage distribution of sampled sawmills, classified by number of full-time and part-time workers employed by each mill, 1960

Number of employees	Small-scale mills (100-500 M bd.ft.)		Large-scale mills (500 M bd.ft. or more)	
	Full-time employees	Part-time employees	Full-time employees	Part-time employees
0	21.1	42.0	3.8	56.6
1 - 4	60.5	47.6	17.9	23.1
5 - 9	15.6	7.8	33.5	9.9
10 - 19	0.6	2.1	27.8	6.6
20 - 49	1.1	0.5	12.3	2.4
50 - 99	1.1	--	2.4	1.4
100 - 249	--	--	1.4	--
250 - 300	--	--	0.9	--
Total	100.0	100.0	100.0	100.0

Table II. Mean number of full-time and part-time employees of sampled sawmills by product group, 1960

Product group[a]	Full-time employees	Part-time employees
Manufactured products except pallets, boxes, and crates	33.4	3.8
Pallets, boxes, and crates	17.7	3.8
Hardwood grade	12.9	3.6
Softwood lumber	5.2	2.6
Railroad ties	5.0	0.9
Flooring stock	3.9	1.0
Low-grade hardwood lumber	3.8	1.3
Pallet material and crating	3.6	1.7
Unclassified	21.8	4.3
Total	9.4	2.5

[a]See Appendix C, Table I for description of product groups.

products, hired from two to five times more employees per mill than sawmills which produced products that required less care and handling or less manufacturing.

The above production and employment figures illustrate the generally small size of most sawmill establishments. Since some firms own more than one sawmill, the degree of industry concentration is slightly greater than indicated by the above information. However, only 15 percent of the sampled sawmill firms own more than one mill and less than 5 percent own more than two mills. A slightly higher proportion, 21 percent, of the large-scale sawmill firms own more than one mill. In addition, a few large firms contract one or more sawmills to produce lumber at a specified price per thousand board feet. Nevertheless, the industry, for the most part, consists of a large number of small sawmill firms that generally own only one mill apiece.

In addition to the large number and small size of mills, another indication of the low degree of industry concentration is the proportion of total sawmill output accounted for by the largest firms. Of the estimated total sawmill output in 1960 in the study areas, the geographical areas actually covered by the sawmill survey, the four largest firms produced about 7 percent, the eight largest firms produced approximately 10 percent, and the 20 largest accounted for about 16 percent of total production. Since nearly all of the largest firms in the region are located in the areas covered by the survey, it is safe to say that the concentration ratios for the region as a whole are considerably less than the estimates for the surveyed areas. By way of comparison, in the three Pacific Coast states, the four, eight, and twenty largest firms accounted for 15.2 percent, 20.4 percent, and 29.0 percent, respectively, of the total lumber production in 1960 (43). The degree of concentration of the sawmilling industry in the study areas is approximately the same as that in the lumber industry in the nation as a whole. The latter is reported by Zaremba (102) as being the least concentrated of all but 12 U.S. industries. It is amply clear that the manufacturing sector of the lumber industry in the North Central Region has an atomistic structure, with the largest firms accounting for only a small proportion of total regional production.

Number and Size of Producer Operations

The typical producer operation is owned and managed by one person; it usually consists of only one truck, a tractor for skidding and loading, one or two chain saws, and usually not more than one employee. Most sawlog producers handle other types of wood products and a majority of them engage in other occupations, typically farming.

There are no published statistics on the number and size distribution of sawlog producers. However, some rough estimates can be made from the sample data. These data show that sampled producers sell to an average of two sawmills apiece and that the small-scale and large-scale mills buy sawlogs from an average of 5 and 19 producers apiece, respectively. The ratio of the average number of producers selling to each sawmill divided by the average number of sawmills sold to by producers is an estimate of the relationship between the total number of sawlog producers and sawmills. Since about 95 percent of all sawmills are small-scale mills, it seems reasonable that the total number of sawlog producers in the region is from two to three times greater than the total number of sawmills, that is, between 20,000 and 30,000 producers. It should be noted that this estimate of the total number of sawlog producers includes all producers who handle any amount of sawlogs, regardless of whether or not sawlogs make up a major portion of their producer operations.

The range in annual sawlog production for the random sample of sawlog producers is as follows:

Total sawlog production, 1960 (Thousand bd.ft. Int. 1/4")	Sampled producers	
	Number	Percent
1 - 49	141	41.3
50 - 149	104	30.5
150 - 499	76	22.3
500 or more	20	5.9
Total	341	100.0

A number of producers handled only one or two loads whereas the largest producer sold 1,220 thousand board feet in 1960. Only 6 percent of the sampled producers handled more than 500 thousand board feet of sawlogs, an amount which might be considered the minimum for a profitable, full-time operation. Of those who produced less than 500 thousand board feet of sawlogs in 1960, 70 percent produced other forest products. Many of the remaining 30 percent, like the majority of sawlog producers, had other sources of income. On the average, sampled sawlog producers sold 131 thousand board feet of sawlogs in 1960, 86 thousand board feet of pulpwood, 20 thousand board feet of veneer logs, an equivalent of 10 thousand board feet of fuel wood, cooperage bolts, and other products, and 36 posts, poles, or piles.

The small scale of most producer operations is further illustrated by the fact that nearly two-thirds of the sampled producers hire no full-time employees and only about one-fifth of them hire more than one full-time worker. (The mean number and range in number of employees are given in Table 12.) Sawlog producers generally hire more part-time employees than full-time employees. However, about half of the sampled producers hire no part-time personnel and less than one-fourth hire more than one part-time employee. About 60 percent of the full-time employees and about 25 percent of the part-time employees are members of the producers' families.

Number and Types of Buyers of Sawmill Products

There are thousands of buyers of sawmill products located in the study region. Figure 3 shows the number of outlets for sawmill products represented by retailers, wholesalers, commission agents, and manufacturers of various lumber-based products. These types of buyers total about 12,300, and since some buyers represent more than one type of outlet, a total of 13,770 outlets are represented in Figure 3. Retail outlets, numbering some 8,220, account for nearly 60 percent of the total. Other large groups include: lumber wholesalers, manufacturers of kitchen and other cabinets, millwork producers, and manufacturers of furniture and furniture parts. In addition to the outlets presented in Figure 3, there are hundreds of industrial users, firms that use lumber for shipping and packing but do not manufacture lumber-based products, hundreds of home builders,

Table 12. Mean number and range in number of full-time and part-time employees of sampled producers, by size class of producer, 1960

Size class	Full-time employees		Part-time employees	
	Mean	Range	Mean	Range
(M bd.ft.)				
1 - 49	0.4	0-4	0.7	0-4
50 - 149	0.7	0-6	1.3	0-10
150 - 499	0.9	0-5	1.8	0-40
500 or more	1.4	0-4	2.5	0-30
All producers	0.7	0-6	1.2	0-40

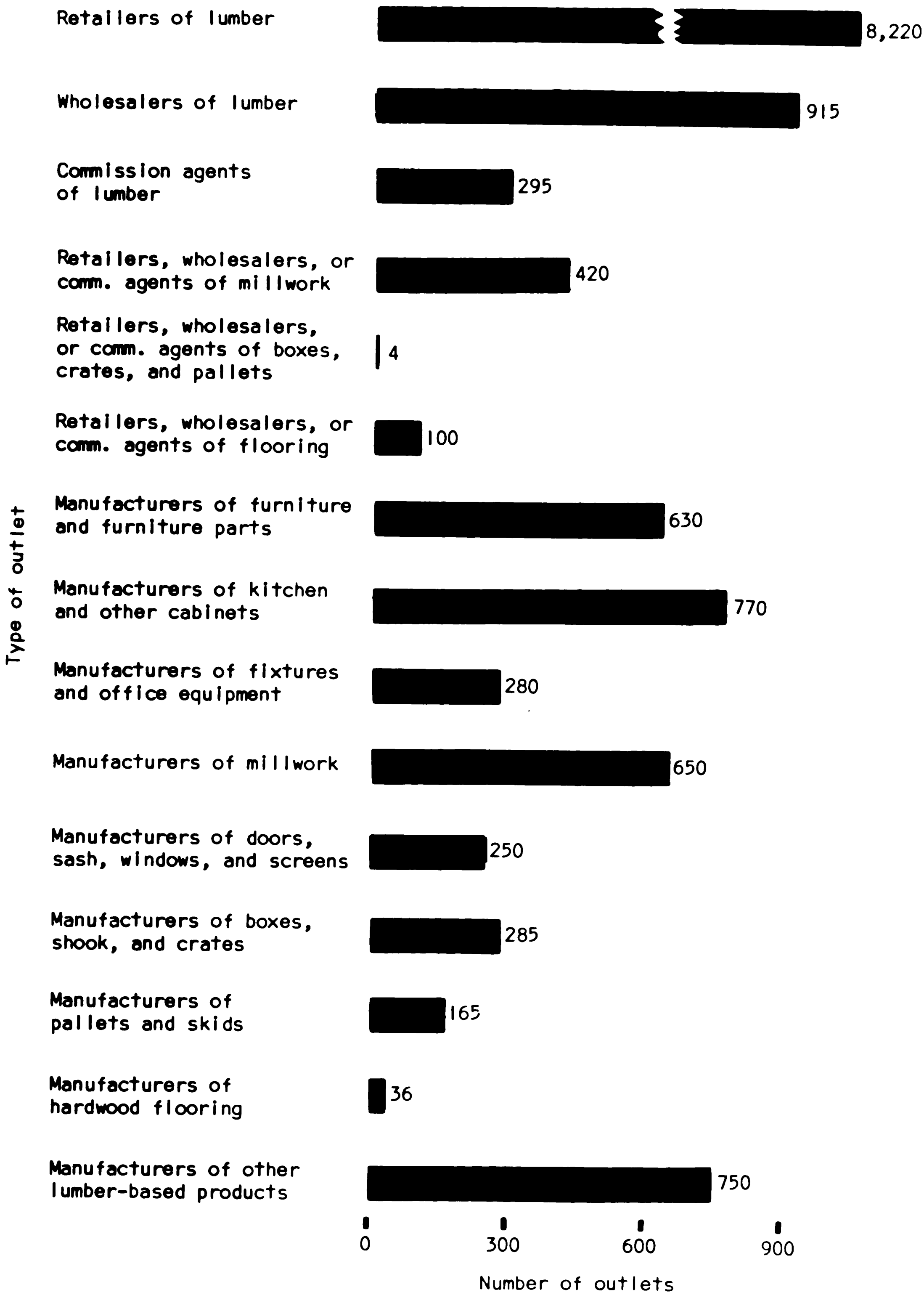

Figure 3. Number of commercial sales outlets for sawmill products in the North Central Region, by type of outlet, 1964. (Source: Lumbermen's Credit Association, Inc. 1964. The lumbermen's national red book service reference book, May, 1964. Chicago.)

and thousands of noncommercial final consumers.

Most types of outlets are located in each of the nine states of the region. However, there are a greater number of outlets in Illinois, Michigan, Ohio and Indiana, whereas Kansas and Iowa have the least number. Illinois, in particular the Chicago area, has the highest concentration of buyers of sawmill products of any area in the Midwest. About one-third of the manufacturing and wholesale outlets, and nearly one-fifth of the retail outlets in the study region are located in Illinois. There are, of course, a number of buyers located outside the study region that make up part of the markets for the region's output of sawmill products. The inclusion of buyers located outside the region would not substantially alter the structure of the regional markets because not more than 20 percent of the region's production is sold outside the region (see Tables 6 and 7) and because the highly atomistic structure of the demand side of the national wholesale lumber market (43) makes it improbable that any outside buyer controls a significant share of the regional markets.

The mere existence of a large number of buyers, however, does not necessarily mean that sawmill firms face a highly atomistic demand structure. For instance, many of the lumber wholesalers and commission agents deal exclusively with western mills and buy no lumber produced in the study region because it is not comparable to western lumber with regard to species characteristics, quality, and availability in large-volume orders. Many retailers depend entirely upon wholesalers and commission agents for their supplies and do not buy directly from sawmills. In general, manufacturers of millwork, doors, sash, windows, and screens prefer western pines over local species. On the other hand, manufacturers of furniture and fixtures; cabinets; boxes, shook, and crates; pallets and skids; and hardwood flooring buy a larger share of their lumber requirements from sawmills in the region. In spite of the large number of commercial buyers in the study region, most small-scale and large-scale sawmill firms in the sample sold to less than five commercial buyers apiece in 1960. The limited number of commercial sales accounts held by most sawmill firms is due largely to the typically small volume of sawmill output and partly to inadequate information about market outlets.

It has been established that there is a large number of buyers of sawmill products in the study region. All available information indicates that the structure of demand for sawmill products produced in the region is characterized by a large number of different types of firms and a low degree of concentration. However, sawmill firms generally do business with no more than two or three commercial buyers, although the number of commercial buyers the average firm has to choose from may be actually or potentially much larger.

Number, Size, and Types of Forest Landownerships

The timber resource in the North Central Region is owned by some 1.2 million forest landowners. A detailed description of the number and size distribution of these landownerships is given in Chapter 3. This section summarizes the important characteristics of the forest landownership pattern and investigates the relationships between forest ownership characteristics and sawtimber marketing.

All but a few thousand owners have less than 500 acres of commercial forest land apiece. These small private ownerships account for about 61 percent of all commercial forest acreage, and all private ownerships contain 72 percent of the total acreage and 81 percent of all sawtimber volume. Farmers own about 41 percent of all commercial forest land whereas sawmill firms own only 1 percent. National forests, which account for 9 percent of all commercial forest land, are located in each of the nine states except Kansas. Again, all states except Kansas have state forests, which, as a group, account for 10 percent of total commercial forest land. About 7 percent of all commercial forest acreage is owned by county and municipal governments, and about 2 percent is under the control of federal agencies other than the Forest Service.

Private forest ownerships, which contain 81 percent of the total sawtimber growing stock, are the major sources of the sawlog material purchased by sawlog producers and sawmill operators. The survey of sawlog producers revealed that 83 percent of their sawlog supply in 1960 came from private lands. Since about three-fourths of all private forest land in the region occurs in ownerships of less than 500 acres, it is reasonable to estimate that these small private ownerships supplied about half of the sawmilling industry's sawlog requirements. The amount of sawtimber acquired by sampled producers from other types of ownership was approximately proportional to volume owned by each. For example, 9 percent came from national forests, and 8 percent from state forests and other public lands.

Several landownership characteristics, especially the large number and small size of private holdings, have an important influence on sawlog marketing. The large number of individual sawtimber suppliers makes it necessary for sawmills and producers to spend more time searching for landowners with stumpage for sale than would be the case if the forest resource was owned by only a few individuals. Because the holdings are small, stumpage buyers must obtain their sawlog requirements from a large number of different landowners, and thus relatively more time is required for the inspection and evaluation of tracts, and for the negotiation of sales. Logging costs on small tracts are also higher than for similar, large tracts because the fixed costs of moving to a small timber tract and preparing logging roads are spread over a smaller volume, and also because more economical logging methods are suitable for larger tracts.

In addition to the higher costs of search, sales negotiation, and logging associated with small-scale chances, the atomistic forest landownership pattern also affects sawlog marketing through its influence on the forest management motivations of forest owners and the degree of knowledge and skill they have in the transaction of timber sales. Most small private forest owners have so little forest acreage and growing stock that they are unable to make more than one or two sawtimber sales in a lifetime. Studies by Farrell (13), Schallau (64), Yoho _et al_. (101), Turner and Mitchell (77), and Sutherland and Tubbs (72) all indicate that most private forest owners in the region make timber sales so infrequently that they have little or no knowledge of current stumpage prices and marketing practices. This ignorance on the part of private forest owners doubtlessly enhances the bargaining position of stumpage buyers. This advantage which timber buyers enjoy is offset in part or wholly by the unfavorable results of management practices on small ownerships. In contrast to the objective of high-level production on a sustained yield basis, which is followed in the management of most public and industrial forest land in the region, the five studies cited above found that the vast majority of small private forest owners made little or no effort to improve timber yields. The reasons for the lack of any constructive forest management practices on most small ownerships include: ignorance of how to properly manage forest holdings and of the possible rates of return from forest management, preoccupation with other means of income, high rates of time preference which discourage long-term forestry investments, and the inability of small owners to accumulate the capital needed for forestry investments. As a result, the vast majority of the owners of less than 500 acres of forest land make little or no effort to see that their timber is harvested properly, neither do they attempt to increase the yield of their woodlots through forest management practices. The poor management characteristic of small private holdings results in poorly stocked stands which are more costly to harvest and which yield a low proportion of high-quality timber. Short planning horizons, diverse management objectives, and the absence of any effort to coordinate independent cutting plans so as to provide a sustained, annual timber supply increase the variability of the timber supply as well as the uncertainty faced by producers and sawmill operators regarding future supplies.

The Raw Material: An Important Element of Market Structure

As in many other industries, such as the oil, coal, steel, and meat packing industries, the structure of the sawmilling industry has been influenced to a large degree by the physical characteristics of its raw material base. One need only to compare the relatively concentrated redwood lumber industry of California with the highly unconcentrated industry of the North Central Region to realize what a tremendous effect the physical character of the timber resource has upon the organization of the market and the nature of competition. In the Redwood Region, a single tree often contains as much volume as that handled in a whole year by many of the small producer and sawmill operations in the study region. In addition to the large and fairly uniform size of the individual redwood trees, the large, relatively pure stands found in the Redwood Region have favored large, capital-intensive logging and milling operations. In contrast, the timber resource of the North Central Region is characterized by a large number of small, noncontiguous stands, which are generally poorly stocked and contain several species and a wide spectrum of quality classes. These characteristics greatly influence the kind and quality of products produced, operating costs, the optimum size of producer and sawmill operations, and the degree of diversification of these operations.

The most obvious way in which the timber resource affects the behavior of producers and sawmill firms, and the results of their activities is through its influence on the nature of the products produced. There are 20 to 30 species or species groups of commercial importance in the study region. The physical characteristics of the lumber sawn from these species, such as color, grain, texture, number and size of knots, strength, dimensional stability, hardness, and nail-holding capacity, play a major role in determining the use of lumber and in differentiating the products made from it. In the case of some products, the differentiation is based primarily on the appearance of the product, whereas strength and other properties are important characteristics for other products. For example, two tables of identical size and shape, one made of hard maple and the other of white oak, will have a considerably different appeal to various buyers and will command different prices. White pine, which is softer, of smoother texture and with better nail-holding capacity than jack pine, is generally preferred over the latter for construction lumber. The degree of differentiation resulting from differences among species varies from product to product. For instance, whereas discerning housewives may regard oak tables and maple tables as relatively poor substitutes, there is less difference in buyer preferences and prices paid for warehouse pallets made from these two species.

The quality of the raw material, aside from the physical characteristics peculiar to the different species, not only determines the quality of the end product, but also influences the number and kind of products produced from each species. All of the commercially important tree species in the study region are used in the manufacture of several different products. As in the case of hard maple, where the best grades are sold mainly for furniture stock, the medium grades as flooring stock, and the lowest grades for pallet material or other low-priced products, sawlog quality has an important influence in determining the product mix. Despite the multiple uses of each species and, to a lesser degree, of each grade class, the quality and species composition of the timber resource sets definite limitations upon the composition of the firm's product mix and the number and nature of the marketing opportunities open to it. Although this point may seem obvious, its significance must be fully comprehended in order to understand the product policies and competitive behavior prevailing within the industry.

Perhaps the most important influence which the timber resource has upon the structural character of the sawlog and sawmill-products markets is its influence on firm size and ease of entry into these markets. The small sawtimber typical of the study region can be handled by light tractors and trucks; thus, capital requirements for a producer operation are relatively small. Neither is very heavy equipment needed for the sawing, edging, trimming, and planing operations. Some sawmill firms have no equipment other than a headsaw, which also doubles as an edger, and a gasoline or electric motor for power.

Another factor which favors small-scale operations is the marked discontinuity of the forest cover. Apart from the segmented landownership pattern, which also encourages the proliferation of producer and sawmill firms, the numerous, noncontiguous woodlots typical of much of the region preclude most economies of large-scale logging operations and favor numerous, small logging firms. Logging chances of less than 5,000 board feet are typical in the agricultural areas. For the sample of sawlog producers, logging chances averaged only 18,000 board feet of sawlog-size material in 1960. Many of the stumpage purchases, however, contained other material, although sawlog material predominated in most cases. Beside the fact that logging chances are usually small and scattered, the relatively sparse stocking of most woodlots also favors small, flexible logging operations.

As indicated in Chapter 3, most stands in the study region contain a wide spectrum of species, tree sizes, and quality classes. This diversity in the raw material base favors a high degree of diversification in producer and sawmill activities. Although some producers and sawmills handle only a few species and quality classes, the majority handle most of the species and grades found in their procurement areas, including products other than sawlogs. Nearly 70 percent of the producers and 28 percent of the sawmills in the sample handled such other products as pulpwood, cooperage logs, veneer bolts, fuelwood, and post, poles or piles. The heterogeneity typical of most stumpage purchases complicates logging operations, milling and shipping operations, and the regulation of sawlog and lumber inventories. Producers and sawmill operators often have to stockpile certain species and grades in order to accumulate sufficient volumes to attract buyers who pay higher prices. Furthermore, the small size of the timber, relatively low densities, and the small volume typical of most logging chances also contribute to higher operating costs. Higher costs of logging and milling result because a greater number of small logs must be handled per thousand board feet of output than of larger logs; skidding costs are greater in poorly stocked stands; more time is required for travel between widely scattered tracts; and the conversion return of lumber per 1,000 board feet of logs is less for smaller than for larger logs.

In addition to the higher operating costs associated with greater diversification, the heterogeneity of the raw material base also leads to higher costs for the dissemination of market information. The costs of keeping informed about market conditions are naturally higher for firms handling several species and products, because grading rules and market outlets vary considerably among species and also because some species and grades are handled so infrequently that it is difficult for producers and sawmills to maintain market outlets. The diversity of the timber resource base has yet another direct effect upon market performance. Most logging chances contain only a few thousand board feet of highly valued species and grades. Consequently, both producers and sawmill operators often lack the experience and special skills needed to process this material. They are also frequently ignorant of the potential value and of the market outlets for these species and grades. Moreover, the quantities are often too small to justify separate processing and marketing, and occasionally the equipment needed to convert this material into more valuable products is not available. Consequently, the scarcity and lack of concentration of highly valued species and quality classes, which is typical of the mixed forests in the region, often results in the use of this sawlog material at lower than its maximum potential value.

The Nature of the Production Process

Sawlogs and nearly all sawmill products are characteristically bulky commodities with a high weight to value ratio. The costs involved in handling these products and moving them from the stump to their final place of consumption represent a major portion of the total cost of transforming the raw material into usable products. Trucking costs alone may represent from 15 to 50 percent of the price of sawlogs delivered at the sawmill, depending upon the species, quality, and other conditions existing within the timbershed.

The process of converting sawlog material into lumber and other sawmill products involves a considerable reduction in the weight of the material. The reduction in weight results from lowering the moisture content of the wood and from discarding the unused portions of the log, such as the bark, edgings, and cull material.[1] Significant cost advantages are therefore realized by locating sawmills close to the timber resource.

Aside from the question of transportation costs, other locational requirements, such as an adequate source of power and a suitable labor force, are fairly easily met. A study of locational requirements for sawmills in the Northern Appalachians, where industry structure is similar to that in the region under study, indicated that the cost of sawlog material was two and a half times more important than transportation costs and six times more important

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[1]For instance, a cubic foot of air-dried sugar maple or red oak lumber weighs about 30 percent less than an equal volume of green sawlogs (86). The total weight reduction is greater than this because a given volume of sawlogs will yield a lesser volume of lumber.

than labor costs in evaluating plant location. Other factors were of even lesser importance in comparison to raw material costs (19). Since locational requirements are not very specific, and since the timber resource is fairly ubiquitous, we would expect, as is in fact the case, sawmill plants to be widely dispersed throughout the forested areas of the region. The typically small size of the mills is also related to the cost advantages of locating close to the source of timber. It was shown in Chapter 3 that the sawtimber resource consists mainly of small trees and fairly poorly stocked stands. The small size of the timber limits the cost economies to be gained from increasing the scale of milling operations. Furthermore, the low density of the sawtimber resource also discourages large-scale milling operations because the costs of assembling the raw material increase rapidly as mill scale is increased, so that the processing economies associated with increased milling capacity are soon offset by higher assembling costs. These conditions encourage an industry structure consisting of a large number of small and widely dispersed sawmills.

The structure of the industry and the nature of market behavior are influenced by another characteristic of the manufacturing process. Lumber manufacturing is essentially a modification process whereby the raw material is modified in size, shape, and content, but the basic anatomical character of the raw material is nearly identical to that of the end product. For example, mill-run oak lumber differs from oak logs only in respect to its shape, size, the absence of bark and some of the cull and knotty material, and in its moisture content and weight. In many other industries, the raw material undergoes more drastic changes, often involving a complete change in its anatomical make-up so that the end product looks nothing like the original raw material. In the pulp and paper industry, where the individual wood fibers can be sorted out and refined to meet the structural requirements of the products produced, the physical characteristics of the end products are not so dependent upon those of the raw material. In contrast, the physical characteristics and uses of lumber and lumber-based products are pretty much predetermined by the character of the timber resource. This is especially true with regard to certain qualities such as strength, dimensional stability, hardness, workability, and knottiness; whereas the appearance of the product, such as its color, grain, and texture, can often be changed, accentuated, or disguised.

Locational Flexibility

Sawmill and producer firms must locate close to their raw material supply but, in general, they are not firmly tied to any particular plant site or base of operations. As mentioned previously, site requirements are easily fulfilled. Unskilled laborers with a few days of training can perform all the functions required in a producer operation. The same is true for most sawmill firms, with the exception that the head sawyer must, in all cases, have several months of experience. Sawlog producers, by the very nature of their operations, require equipment which is easy to transport. Most of the sawlog producers in the study region need only a place to live as their base of operation. Site requirements are somewhat greater for sawmill firms since, as a minimum, a fairly flat and dry location is needed to set up milling equipment and for holding inventories of sawlogs and finished or semifinished products. The milling machinery typical of most sawmill operations in the study region is fairly lightweight and is powered by gasoline or electric motors of moderate size. Other factors of production represent a minor share of total operating costs and do not restrict the choice of plant location.

The degree of locational flexibility possessed by sawmill firms in the study region is exemplified by the mills canvassed. Slightly over one-fourth of the small-scale mills and about 14 percent of the large-scale mills are portable mills in the sense that the head rig and other equipment are designed so that they can be easily transported. The proportion of portable mills of the entire regional population is probably close to 25 percent. Some of the portable mills have all major pieces of equipment mounted on wheels; in the case of other mills, it is necessary to load the milling equipment on trucks when making a move. In the Michigan sample, one of the firms has a modern portable mill consisting of a self-propelled unit upon which is mounted a head rig, edger, and trimmer. While many portable mills move from one tract to the next upon the completion of each stumpage sale, many others stay in one location until all the available timber within an economical hauling distance has been cut.

The sample data indicate that portable mills are more prevalent among small-scale mills than among large-scale mills. This is understandable in view of the fact that it would normally cost more to move a larger mill. Similarly, there are relatively few portable mills among sampled firms which produce predominantly pallets, crates, or boxes, and "other" manufactured products. These types of firms require relatively more milling machinery and, therefore, are more costly to relocate than firms which concentrate on the production of products which involve little manufacturing beyond the rough-lumber stage.

The importance of locational flexibility as an element of market structure is fairly obvious. In the first place, it facilitates entry by producers and sawmills into stumpage and sawlog markets. Most producers and many portable and semiportable sawmill firms are able to travel considerable distances in moving from depleted areas into areas of more abundant timber supply. The ability to move from one market area to another not only presents a constant threat of greater competition to stumpage and sawlog buyers operating within the various local market areas, but it may also help to alleviate destructive competition in areas of contracting timber supply. It is also possible, however, to theorize that a high degree of industry mobility favors destructive cutting practices and reduces the appeal of sound forest management programs. If a producer or sawmill operator moves from one locality to another as supply conditions tighten up, he may be inclined to disregard good harvesting practices and to violate other terms of stumpage contracts under the philosophy that he will make only one purchase in a lifetime from each landowner and will be out of the territory before the news of his deceitful behavior is spread around. In a similar way, it would be difficult for sawlog producers and sawmill firms to appreciate the long-run advantages of sound forest management programs if they are convinced that future timber supplies can be obtained more economically simply by moving from depleted areas to areas of greater timber abundance. With due regard for objectivity, a policy of periodic relocation is apparently more profitable than other methods of operation for some firms, for they would abandon this policy if other alternatives were more lucrative. We cannot, however, concern ourselves only with the welfare of the mobile producer and sawmill firm but must evaluate the significance of locational flexibility as it affects the well-being of all market participants. This and other considerations of market performance are reserved for Chapter 8.

Conditions of Entry

The degree of industry concentration reflects the number and size distribution of the existing market rivals of a firm, while conditions of entry are concerned with potential rivals. Conditions of entry are said to be easy or free when potential entrants are able to buy or sell in a new market without incurring substantially higher per-unit costs or lower profits than firms already in the market. The importance of entry conditions is illustrated by the contrast between the degree of market power held by firms in a highly competitive industry, with comparatively unimportant barriers to entry, and that held by oligopolists or monopolists. The latter have a high degree of latitude in setting prices and establishing marketing policies so as to achieve so-called excess profits. When entry barriers are low, potential rivals present a constant threat to enter the market at the slightest increase in industry profits. The conditions of entry, therefore, play a major role in insuring competitive behavior and acceptable market performance.

Conditions of Entry for Sawmill Firms

One of the commonly used measures of the magnitude of barriers to entry is the distribution pattern of firm numbers over time. If the number of firms active in a market changes considerably over short periods of time--often, but not always in response to changes in demand and market price--then entry conditions are assumed to be comparatively easy. A pattern of wide fluctuations in the number of active sawmills is typical of the study region. As shown in Figure 4, the number of active sawmills increased from 1,960 mills in 1939 to 8,860 mills in 1942, which represents a fantastic average rate of net increase of 2,300 mills per year. Undoubtedly, many of the firms which entered the market during that period did so by reactivating idle sawmills. Unlike less durable or more complicated manufacturing plants, small sawmills can be reactivated at relatively little expense. The more than three fold increase in the number of sawmills active in the study region was accompanied by an increase of 18 percent in annual lumber production and increases ranging from 10 to 20 percent in lumber prices for several important species in the region (82, 83). After the initial surge, the number of active mills increased by an additional 42 percent during 1942-1947 to a peak of 12,540 mills, decreased slightly during the next seven years, and decreased even more from 1954 to 1958 to a total of 9,035 mills (Figure 4). During those latter periods, production fluctuated somewhat and the lumber prices for most of the important species showed some tendancy to increase. The rates of

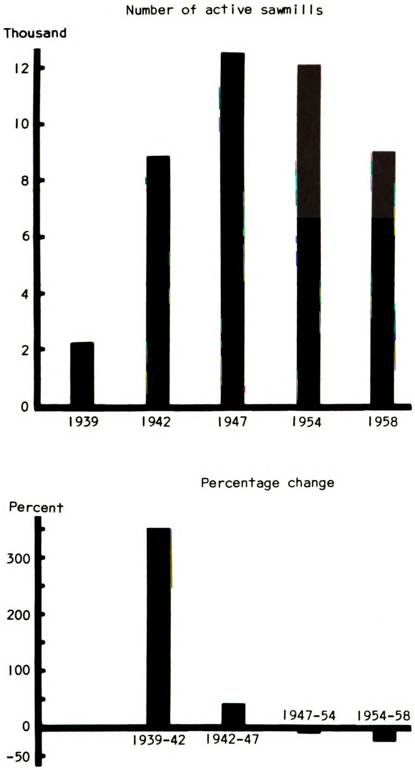

Figure 4. Number of active sawmills in the North Central Region, and percentage change in sawmill numbers, selected years 1939-1958. (Source: U. S. Bur. of Census. U. S. Census of Manufactures. For years 1939, 1942, 1947, 1954, and 1958. Wash., D. C.)

entry and exit illustrated above certainly suggest that barriers to entry or exit for sawmills are low.

One of the reasons why entry into the sawmilling industry is easy is that initial investment requirements are small. Beside the fact that many firms reenter the industry by reactivating previously idle sawmills, capital requirements are only moderate even for firms that are entirely new to the industry. One apparent reason for this is an abundant supply of secondhand milling equipment, especially during periods of constant or decreasing demand for sawmill products. A recent study of four sawmills in Missouri revealed initial investment requirements, figured at the replacement cost of new equipment and buildings, of $7,863 for the smallest mill and $21,107 for the largest mill (46). Each of the mills produced rough lumber and a few other rough products, and their output in 1960 ranged from 135 to 868 thousand board feet, although none of the four operated at full, eight-hour-shift capacity throughout the year. Certain types of sawmill operations, such as those producing pallets, field boxes, and other highly manufactured products, would require more equipment and a larger initial investment. However, it seems apparent that most of the active sawmills in the study region could be replaced new at a cost of less than $20,000 apiece.

Initial investment requirements are low primarily because increasing the scale of sawmill plants does not substantially reduce average production costs, with the possible exception of those mills producing a highly manufactured product. Marginal raw material costs increase rapidly as scale increases; thus, total marginal costs tend to rise rather steeply as mill capacity increases. Since economics of scale are not substantial, an entering firm need not capture a large share of the market in order to achieve an efficient size. Consequently, a single new firm has no appreciable effect upon the total supply of sawmill products or market price, and thus existing firms do not oppose new entries on this account.

The situation is different, however, in the case of competition for timber supplies. Many large-scale sawmills (those with an annual production of 500,000 board feet or more) buy a substantial share of the total sustained-yield sawtimber supply within their procurement territories. Additional sawtimber purchases within these territories by new firms would likely represent a significant increase in the demand for sawtimber and result in higher raw material costs. Established firms may raise their offering prices for sawlog material in order to discourage prospective entrants or to destroy new firms, which are often financially weak and unable to survive short-run losses. The scale of operations also has some effect upon a firm's ability to attract buyers and sell the various species and grades to buyers who pay the highest price for each type. For example, sampled large-scale mills sold on the average to 27 commercial buyers (wholesalers, retailers, manufacturers, and industrial users) whereas small-scale mills averaged only 5 commercial buyers in 1960. Large-scale mills also did a larger volume of business, on the average, with each commercial buyer than did small-scale mills--46 thousand board feet versus 30 thousand board feet per buyer. Large mills often receive higher prices than small mills for the same material because buyers often pass on to sellers a share of the savings realized in handling large-volume orders, and also because buyers wish to maintain strong contacts with large firms, which generally are a more certain source of supply than the smaller mills. In addition, small sawmills often handle such small amounts of certain high-value species and grades that it is uneconomical to sort out this material, and thus it is sold along with lower-priced material. Nevertheless, available evidence of the rate of sawmill entry does not suggest that economies of scale are so important as to represent significant barriers to entry.

Another major reason why entry conditions are easy for sawmill firms is the almost total lack of name branding or promotional advertising. Properly graded products offered by new firms are viewed by buyers as being identical to the same products offered by long-established firms. Consequently, new firms can expect to receive equal, or nearly equal, prices as established firms. Sawmill firms may achieve a limited amount of product differentiation through the services offered to buyers, but well-managed new firms can easily duplicate such services. In the regional market for softwood lumber, a certain amount of product differentiation may occur as a result of the importation of name-branded western and southern lumber. The actual amount of differentiation achieved by name branding, whether by producers located within or outside the study region, is questionable in view of the small amount of advertising of these name brands. All in all, product differentiation, found to be one of the most important barriers to entry in oligopolistic markets (1), has apparently little effect upon the conditions of entry in the regional markets for sawmill products.

Other factors which contribute to the relatively free entry into the regional markets for sawmill products include: (1) the technology involved in most types of sawmill operations is fairly simple and easily acquired; (2) there are no severe shortages of any critical factors of production; (3) many sawmill firms are highly mobile; (4) there are no known cases of captured resources or exclusive market outlets. The first three factors have already been discussed. Turning briefly to the question of captured resources, forest resources in particular, we find that sawmill firms own only 1.3 percent of all commercial forest land in the study region (93). Sampled sawmills obtained 14 percent of their sawlog supply in 1960 from their own lands. Most of this volume was accounted for by mills operating on Indian reservations. Excluding these mills, the percentage obtained from land owned by sawmills amounted to 6 percent. Most sampled mills, 83 percent of both small-scale and large-scale mills, bought all of their sawlog requirements on the open market in 1960. Less than 3 percent acquired all of their sawlog material from their own land, which does not necessarily mean that these mills were self-sufficient. In addition to backward integration through the ownership of forest resources, sawmill firms may use long-term purchase contracts with forest owners and sawlog producers as a means of insuring an adequate, sustained supply of sawlog material. Such contracts are rarely if ever used by sawmill firms in the study region. Few firms have contracts or commitments for more than a month's supply of sawlogs at any one time. Stumpage is usually purchased by individual negotiation for each tract, and contracts with producers usually cover the estimated volume in a particular tract, or the producer's estimated production for one to five days. Only 11 percent of the sampled mills consider sawlog purchase agreements with producers to be binding upon the producer, or in any way enforceable. Moreover, about 40 percent of the total volume purchased from producers by sampled sawmills is bought upon delivery to the mills without prior agreement with the producers.

Open market activities also characterize the marketing of sawmill products. Many sawmill firms in the region are characterized by various degrees of forward integration, but none control a large share of the market for any particular product line. Except for the producers of pallets, boxes and crates, most sawmills sell out of inventory instead of regulating their output to fill previously obtained orders. For the latter mills, individual sale contracts normally cover less than 25 thousand board feet, whereas the producers of pallets and related products often have sales contracts which cover from one to three months production of a particular item. Some pallet producers have sales contracts which guarantee them the privilege of supplying all of a buyer's needs of a particular product for periods up to a year. Nevertheless, the marketing of pallets, boxes, and crates consists mainly of competitive bidding for short-term contracts, and the marketing of other sawmill products consists predominantly of individual sale negotiations for small-volume lots. In both cases, entering firms are on nearly equal footing with established firms in regard to the number and types of market outlets. The above analysis leaves little doubt that there are no important barriers to entry for most types of sawmill firms, either in the markets for sawmill products or the markets for sawlogs and stumpage.

Conditions of Entry for Sawlog Producers

Barring significant changes in the competitive relationship among sawlog producers and sawmill firms, we would expect them to exhibit similar patterns of entry and exit over time. The demand for sawmill products and the cost of manufacturing these products affect the derived demand for sawlog material. An increase in the demand for sawmill products or a decrease in manufacturing costs will, if other conditions remain the same, cause an increase in the derived demand for sawlogs. Converse results will occur for changes in the opposite direction. Therefore, the profitability of producing sawlogs, although lagging somewhat behind, tends to increase and decrease as the profitability of producing sawmill products increases and decreases. Conditions that are favorable for sawmill entry generally lead to favorable conditions for the entry of sawlog producers.

Time series data on the number of sawlog producers active in the region are not available, but it is possible to get some idea of the rates of entry and exit of sawlog producers by comparing the age distribution of these firms with that of sawmill firms. Of the firms surveyed in 1961, 36 percent of the producers had entered the industry within the previous five years as compared to 22 percent of the sawmills. Sawmill firms exhibited better survival rates. For example, 56 percent of the sawmills, compared to 42 percent of the producers, had been operating for 11 years or more. These data indicate a higher rate of turnover for sawlog producers than for sawmills. It seems reasonable, therefore, that the conditions of entry and exit are as easy or easier for sawlog producers as for sawmill firms.

The factors which determine the conditions of entry for sawlog producers are similar to those which affect entry conditions for sawmill firms. Initial investment requirements for a producer operation are even smaller than those for a typical sawmill. The basic equipment--a chainsaw, tractor, and truck--can be acquired for as little as $5,500. About one-third of the sampled producers are part-time farmers; they use their farm tractors and trucks in producing sawlogs and needed only to buy a chainsaw to get started as a producer. Some producers do not own a truck and either sell their output at roadside or have the hauling done under contract.

Although we might expect some increase in efficiency as the scale of a producer operation is increased, cost estimates supplied by sampled producers do not bear this out. The average total cost per thousand board feet for logging and per mile of haul are given for four size classes of producers in the following tabulation. These costs are based upon estimates of what it cost the producers to perform these operations; they exclude contract prices for logging and hauling.

	Production size class of producer, 1960			
	1-49 M bd.ft.	50-149 M bd.ft.	150-499 M bd.ft.	500 M bd.ft. or more
	(Dollars per M bd.ft. Doyle)			
Average logging cost	13.02	12.46	13.39	11.44
Average hauling cost per mile	0.48	0.46	0.53	0.48

Despite the weakness of the above data, it does not appear that substantial economies result from increasing the scale of a producer operation. The entry of a new producer into the market for sawlog material and stumpage would have no appreciable effect upon the market prices of these commodities. Besides, tactics of established firms to prevent new entries, such as selling sawlogs below their cost of production, are out of the question. In the first place, none of the firms could withstand the financial burden of pricing below costs. Secondly, few, if any, of the producers are capable of supplying the total demand within a local market area. Consequently, the unsupplied demand for sawlogs would eventually result in sawlog prices being bid up.

Product differentiation, as a barrier to entry generated by name branding and advertising, plays no part in the markets for stumpage and sawlogs. True, sawmill operators do not regard the services provided by all producers as being equally good, but such established preferences would not severely hamper market penetration by a well-managed producer firm. As in the case of sawmill firms, other potential barriers to entry, such as the difficulty of acquiring needed skills and technology and the existance of captured resources or exclusive market outlets, have little effect upon the ease of entry by sawlog producers into the markets for sawlogs and stumpage.

Market Information

Market information, as an element of structure, refers to the availability, the distribution, and the adequacy of information about prices and market outlets. Producers and sawmills must have adequate information about current prices and market outlets for each species and grade handled if they are to maximize their incomes and make intelligent decisions about the allocation of resources.

Several basic factors underlie the problem of communicating information among the participants in the markets for sawmill products and sawlog material. In the first place, it is difficult to identify quality variations in lumber, in sawlogs, and in standing trees. Cull material and some knots are usually hidden beneath the bark of standing trees, and only an experienced woodsman can make reasonably accurate estimates of stumpage quality and value. The problems of identifying defects and differences in grade are reduced, but by no means eliminated, as processing continues toward the end product.

A second factor which adds to the problem of communicating market information is the fact that lumber and sawlog material are difficult to describe both quantitatively and qualitatively. It is impossible to measure the volumes of the various grades contained in a standing tree or cut sawlog before they have been sawn into lumber. Rules for classifying stumpage and sawlogs according to grades provide only an approximate indication of quality and value. The problem of measuring sawlog material is further complicated by the fact that at least eleven different log rules or methods of measurement are commonly used in the study region. The methods of measurement and the grading rules for lumber provide more accurate measures of quality and value than those employed in the measurement of sawlog material. Lumber grading rules are quite complicated, however, and many sawmill operators do not know how to grade their own lumber.

A third factor which inhibits the flow and accumulation of price and product information is the infrequency of the sales made by producers and sawmill firms. In contrast to the lumber industry on the West Coast, where the typical sawmill has a sales manager who is in constant contact with buyers by telephone or teletype and receives from 20 to 100 market quotations per day, the typical sawmill in the study region probably makes no more than one transaction a day with a commercial buyer. Full-time sawlog producers may receive market information every day from contacts with sawmills and other producers, but such contacts are limited primarily to the producer's wood procurement area. Moreover, nearly 30 percent of sampled sawmills and 59 percent of sampled producers operate only part of the year and would therefore have little or no contact with the markets for their products during nonoperating periods. Forest landowners have even fewer contacts with buyers than do producers and sawmill operators; they commonly make a stumpage sale only once every 10 to 20 years.

Finally, the diversity of the timber resource base with respect to the species, quality, and size of timber and the dispersed location of timber stands also contribute to the problem of communicating market information.

In addition to information which is communicated through market transactions and by other contacts between market participants, there are several published sources of market information. The more prominent of these are: Minnesota Forest Products Marketing and Pricing Review (45); Wisconsin Forest Products Price Review (94); Timber Prices (28), published by the state of Illinois; Price Report on Indiana Timber Products (56); Missouri Forestry and Forest Industries (47); National Hardwood Magazine (44); and monthly reports by the Bureau of Labor Statistics on wholesale prices and price indexes for lumber (83). The first five publications are similar in content and contain some general marketing information in addition to price quotations. Prices are quoted either semi-annually or annually. The Minnesota and Wisconsin reports publish price data for stumpage, and for lumber and sawlogs priced f.o.b. mill; the other three report only stumpage and sawlog prices. Due to the infrequency of these five reports and the lag in time between data collection and its publication (typically four months for two of the reports), it would appear that they provide little information about current market conditions. The last two publications listed report monthly on lumber price averages for most of the important species found in the study region, but the National Hardwood Magazine reports only hardwood prices. This magazine is the best published source of information on hardwood lumber prices, on a regional basis, because it reports prices for each grade and thickness.

According to Wynd (100) public agencies in the states of Michigan, Wisconsin, Minnesota, Indiana, and Missouri periodically publish lists of stumpage, sawlogs, sawmill products, and logging and milling equipment which individual firms desire to sell or buy.

The mere existence of the above published sources of market information is not evidence, however, that sawmill operators and sawlog producers are either familiar with them or make use of them. In view of the frequent inquiries about market outlets and conditions made by sawmill firms and producers during the course of the interviews, it would appear that many, or perhaps most, sawlog producers and sawmill operators are unfamiliar with the published sources of market information available to them.

Factors Affecting Continuity of Operations

The pattern of production for both sawmill and producer firms is, with few exceptions, characterized by a high degree of discontinuity and seasonal variation. Changes in the level of production are effected through changes in the rate of production by individual firms and by the discontinuation of production from time to time. Seasonal variations in weather conditions are a major cause of the seasonal patterns of sawlog and sawmill-products production. Since the weather cannot be manipulated or altered by the participants in the markets for sawlogs and sawmill products, it is perhaps better to regard it as an external factor rather than an element of market structure. Several other factors, all of which can be regarded as elements of structure, also affect the continuity of sawlog and sawmill-products production as well as the elasticity of the supply of these products.

The production of sawlogs and sawmill products consists of a series of separate (though interdependent) processes. Each successive step in production does not, however, depend upon the concurrent functioning of a preceding or succeeding process, as long as a backlog of material is available. For example, the production process of a producer operation normally consists of the following steps: (1) felling, which may be preceded by the preparation of logging roads, (2) limbing and bucking, (3) skidding the logs to a loading point, and (4) loading and hauling the logs to a mill. In most producer operations the same personnel perform all of the first three tasks, and often the hauling as well. Consequently, the process may proceed by continually shifting from one task to the next, or efforts may be concentrated on felling, limbing, and bucking for the first few days,skidding for the next few days, and finally hauling the logs to the mill. The generally high durability of both lumber and sawlogs enables producers and sawmill operators to discontinue operations at various stages in the production process without suffering significant losses due to the deterioration of their stocks of raw material and semiprocessed or finished products. The divisibility of the process by which sawlogs and sawmill products are produced and the great durability of these products are major contributing factors to the variability and discontinuity of production by sawlog producers and sawmill firms.

In conjunction with the above two factors, the relatively low fixed costs characteristic of both producer and sawmill operations also encourage discontinuous operations. Firms will continue in production as long as income is high enough to cover variable costs and at least part of the fixed costs which continue whether or not production is discontinued. Other things being equal, firms with a high ratio of fixed costs to total costs are able to cover all variable costs and part of their fixed costs at lower price levels than other firms in the same industry which have a lower ratio of fixed to total costs. Since such variable costs as sawlog material and labor make up the major share of the total costs incurred by producers and sawmill operators, decreasing profits readily induce them to cease their logging and lumbering operations in favor of alternative employment opportunities.

Seasonal fluctuations in the demand for sawmill products, and the resulting fluctuations in sawlog demand, also affect the stability and continuity of logging and milling operations. Seasonal fluctuations are especially important in the markets for pallets, skids, and related products, as well as boxes, crates, and other wooden containers. Other factors, such as poor financial strength and the general lack of backward integration by way of forest landownership, often prevent producers and sawmill firms from lasting through periods of inadequate profits or high stumpage costs.

CHAPTER 5

MARKET CONDUCT IN THE PRODUCTION AND MARKETING OF SAWMILL PRODUCTS

There are several possible reasons for studying the behavior of firms in a particular industry or market. Knowledge of how a market operates may reveal some of the problems and inefficiencies that exist. Such conclusions, however, must necessarily be based upon evidence that a causal relationship exists between market performance and the modes of behavior that are suspected as being undesirable. Another reason often given for studying market conduct is that a better understanding of how a market functions is useful to the participants in the market and to prospective entrants as well. Presumably, the more knowledge that a particular firm or group of firms has relative to its rivals the better off it is. According to this line of reasoning, a thorough description of how sawlog producers and sawmill firms conduct their business would be particularly useful to forest landowners and the buyers of sawmill products. However, it would not necessarily lead to better market performance.

In this study, the purpose of analyzing and describing market behavior is twofold: to increase our understanding of this phenomenon and thus provide a frame of reference for subsequent research, and to discover and describe the relationship between the structure and the performance of the markets for sawlog material and sawmill products. An analysis of market conduct, in addition to explaining how a certain kind of performance evolves from a given market structure, often provides a good indication of the quality of performance produced by a market. In oligopolistic markets, for instance, proof that firms conspire to set prices not only gives validity to the theoretical implications that an oligopolistic market structure often leads to price-fixing conduct, but also strongly suggests that prices are higher than what they would be under more competitive conditions. Furthermore, by identifying the process by which market performance evolves from market structure, market conduct, as well as market structure, is exposed as a point of focus for remedial policy.

Diverse Nature of Output

The uses of lumber and other sawn material largely depend upon the species and grade of the sawn wood material. A firm which produces white oak lumber, for instance, is likely to sell its No. 1 Common and Better lumber as furniture stock, the No. 2 and No. 3A Common for flooring stock, and the poorer grades for pallet material, crating, or rough construction lumber. The number and types of products produced by sawmill firms in the study region depend primarily on the characteristics of the sawlog material used in manufacture, and secondarily upon market outlets. Due to the heterogeneity in species, size, and quality of the forest cover, as well as to quality variations within individual sawlogs, nearly all sawmill firms produce several different sawmill products.

The ten most important products produced by sampled sawmills are listed in Table 13. They accounted for 98 percent of the total 1960 production of the sawmills sampled. Hardwood grade, that is, the upper grades of hardwood lumber, represented the largest volume of any product produced by sampled mills. Of slightly lesser importance in terms of volume of production were crating and blocking, hardwood construction lumber, railroad and mine ties, and pallets. Altogether, the above five products accounted for 66 percent of total production. Nearly half of the sampled mills produced hardwood grade, and 25 percent or more produced one or more of the other four products, excepting pallets (Table 13). Other products, each representing 5 percent or more of total production, included softwood construction lumber, pallet material, crates and boxes, hardwood flooring stock, and ungraded poor-quality hardwood lumber, which is sold for a variety of uses. The remaining 2 percent of the total output by sampled firms was made up of such products as gunstock blanks, railroad car decking, softwood paving blocks, hardwood veneer flitches, sawed guard-rail posts, shoe heel stock, manufactured cabin siding, sawed cabin siding stock, and manufactured hardwood flooring.

As noted in Chapter 4, structural characteristics of the industry vary somewhat among the eight product groups recognized in this study.[1] A closer look at these product groups is worthwhile at this time. The largest product group, which includes 25 percent of the

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[1]A firm was placed in a product group on the basis of the product or group of similar products which accounted for the largest share of the firm's total value of production. See Appendix C, Table I for a description of each product group.

Table 13. Ten most important products produced by sampled sawmills, 1960

Product	Volume produced as a percentage of total production[a]	Percentage of mills that produced the product
Hardwood grade (mainly No. 2 Common and Better)	16.8	45.6
Crating and blocking	13.6	25.1
Hardwood construction lumber	12.0	31.6
Railroad ties (including mine ties)	12.0	25.1
Pallets	11.3	12.9
Softwood construction lumber	8.2	23.7
Pallet material	7.1	17.8
Crates and boxes (including some pallets)	6.0	6.7
Hardwood flooring stock	6.0	12.9
Ungraded poor-quality hardwood for various uses	4.8	19.3
	97.8	

[a]Production data for each type of product were available for most sampled sawmills in all states except Wisconsin.

sampled mills, consists of sawmill firms which concentrate on the production of hardwood grade. This product group contains the largest or second largest number of sampled mills in all states except Missouri. Firms that produce predominantly low-grade hardwood lumber, most of which is used for construction purposes, account for 17 percent of the sample. Each of four other groups includes between 10 and 13 percent of the sample and is made up of firms that concentrate on one of the following products or group of products: softwood lumber; pallet material and crating; pallets, boxes, and crates; and railroad ties. The two smallest product groups include firms which produce predominantly flooring stock, or manufactured products other than pallets, boxes, and crates.[1] The distribution of the sawmill sample among the eight product groups is believed to be representative of the areas actually surveyed, when taken as a whole, but somewhat less indicative of the entire study region because of variations among the different forested areas of the region.

Most firms, nearly three-fourths of those sampled, produce two or three different types of products. Only 10 percent of the sampled mills produce only one product or combination of similar products, and very few manufacture more than six different products. The majority of sawmill firms direct their attention to the production of one or two products, but since the raw material is not homogeneous, products of secondary interest are also produced. (See Table 14.)

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[1]Twenty-one mills, 5 percent of the sample, could not be classified by product group because of insufficient information about the products they produced.

Table 14. Percentage of sampled sawmills of each product group that produced the secondary products indicated, 1960

Product group[a]	Product of secondary importance[b]						
	Hardwood grade	Hardwood construction lumber	Pallet material	Ungraded poor-quality hardwood	Railroad ties	Hardwood flooring stock	Pallets, boxes, and crates
	(Percent of sampled mills of each product group)						
Hardwood grade	c	22	31	28	9	3	7
Pallets, boxes, and crates	26	11	2	4	6	2	c
Pallet material and crating	35	19	c	6	14	11	2
Manufactured products except pallets, boxes, and crates	21	--	7	36	14	28	25
Low-grade hardwood lumber	36	c	10	17	24	6	6
Softwood lumber	15	15	8	14	20	3	2
Railroad ties	33	4	9	30	c	43	--
Flooring stock	--	31	6	25	81	c	6

[a]See Appendix C, Table I for complete description of product groups.

[b]A product other than the primary product. Includes only those which were produced by 25 percent or more of the mills sampled in any product group.

[c]Product represents the primary product or part of the group of primary products produced by the indicated product group.

For instance, a large share of the firms that manufacture predominantly hardwood grade also produce other products such as pallet material, hardwood construction lumber, and other ungraded poor-quality hardwood lumber. With the exception of firms that concentrate on the production of pallets, boxes, and crates, firms in other product groups generally offer a diversified product mix (Table 14). On the other hand, a high degree of specialization is typical of the pallets-boxes-and-crates group. Of the firms in this group, 28 percent produce only the primary product, as compared to only 10 percent of all sampled mills. Unlike the majority of firms of other product groups, producers of pallets, boxes, and crates generally have relatively large investments in plant and equipment, much of which is highly specialized in its use. Furthermore, the manufacturing facilities typical of this product group are more highly automated than the average sawmill, and the flow of materials through these plants is continuous and follows a fixed pattern. The costs of switching production from one product to another are therefore relatively high for this product group.

Aside from the advantages of product specialization realized in the manufacture of pallets, boxes, and crates, the product policies of most sawmill firms consist of producing a combination of products which will yield the highest return from a given supply of sawlog material. Most firms adjust their product mix to suit current sawlog supplies, whereas few firms limit sawlog procurement to only certain species and grades of sawlogs which are suitable for producing a particular line of products. Since the value of a product depends largely upon the quality of the wood from which it is produced, many firms strive to obtain the highest feasible grade recovery from the logs they saw. Where quality is not an important consideration, as in the production of ties, pallet material, and crating, emphasis is placed upon maximizing the volume of output relative to both time and the quantity of sawlog material consumed. Even in the latter case, however, most of these firms market several different products on the basis of grade and species differences. For instance, of the sampled firms which concentrate on the production of railroad ties, some 80 percent also produce flooring stock, and both softwood lumber and low-grade hardwood lumber are sold by about 20 percent of these firms. Although product diversification is typical of the sawmilling industry in the region, it represents for the most part an attempt to achieve the highest value of output from the available raw material, rather than a means of reducing the risks associated with fluctuations in the demand for various sawmill products. It is essentially a passive policy, a reaction to the variability in the species and quality composition of sawlog supply. Few, if any, of the sawmill firms in the region have policies or programs aimed at creating new product varieties.

Other Business Activities

In addition to producing and marketing a variety of sawmill products, many sawmill firms engage in other enterprises. Some 30 percent of the sampled sawmill operators work part time as farmers, common laborers, producers of sawlogs and other raw wood products, contract loggers, and as wholesalers of sawmill products produced by other firms. Farming is the most common alternative occupation of the sawmill operators in the sample. A much greater proportion of small-scale sawmill firms (44 percent of those sampled) than large-scale firms (only 16 percent) engage part time in alternative business enterprises. In general, few firms engage in other business activities among those sawmill firms that produce a highly manufactured product or a product which requires precision equipment and a high degree of sawmilling skill. The advantages of full-time operation to these firms include: (1) the maintenance of market outlets, (2) the production of sufficient volumes making it possible to sell products in graded lots and to buyers who pay premium prices for graded material, (3) a sufficient sales volume in order to avoid the discriminating prices paid for small-volume lots, (4) continuous operation needed to train and retain competent employees, and (5) sufficient output for efficient use of relatively expensive equipment. On the other hand, producers of relatively low-value sawmill products and products requiring little processing after initial breakdown by the head saw, such as pallet material, crating, blocking, hardwood construction lumber, rough softwood lumber, and railroad ties, can easily alternate between sawmilling and other activities. The buyers of many of these products do not require a continuous supply, and market outlets are generally easy to find or reestablish because most are located within a few miles radius of the mills. Furthermore, skilled laborers, with the exception of the head sawyer, are not required by producers of these products, and fixed equipment costs and the costs of restarting processing operations are relatively unimportant. Other factors which influence the suitability of operating on a full-time or part-time basis include: operating conditions, especially the effect of weather on harvesting and milling costs; seasonal fluctuations in the supply of woods and mill workers and in the demand for sawmill products; alternative employment and investment opportunities open to the sawmill operator; and the overall profitability of sawmilling.

It should be pointed out that the primary incentive for diversifying into other business activities is to increase total net income, whereas the reduction of variations in income is normally of secondary importance. A good example is the part-time farmer who operates a sawmill during times when little work is required on the farm. Sawmilling augments his income but it is not so profitable that he can give up farming to run his mill full time. Furthermore, sawmilling and farming, as well as some other activities, are complementary in their use of labor and equipment so that a combination of sawmilling and another enterprise will often yield a higher net return than either enterprise separately. This is especially true when the periods of favorable and adverse operating conditions for sawmilling tend to alternate with and offset those of the alternative enterprise.

The alternative business activities mentioned above are often carried out independently of the sawmilling enterprise and usually when the mill is shut down. Many sawmill operators, however, act as dealers in raw wood products concurrently with the operation of their sawmills. That is, they resell a portion of the raw wood material received at their mills rather than convert it into lumber and other sawmill products. Of the sawmills sampled, 28 percent resold some of the logs and other raw wood material acquired by them in 1960. The volume of raw wood material resold amounted to about 4 percent of the total volume received. Veneer logs, a product which usually commands a higher price than sawlogs, accounted for over half of the material resold.

In most cases, the sawmill operator's role as dealer in raw wood products represents a subordinate part of his total operation. Most sawmill firms handle raw wood products other than sawlog material only when they occur in the tracts of timber purchased by them or their producers. Large, high-quality material is often resold as veneer logs or cooperage bolts, whereas small, poor-quality material may be sold for pulpwood or posts. The volume handled of such material is usually too small to sustain efficient converting operations by the individual sawmill firms. It is often too small to even justify the additional handling costs involved in reselling such material. Nevertheless, it is evident that many sawmill firms make an important contribution to marketing efficiency through the resale of raw wood material which has a higher value in the production of goods other than sawmill products.

Another activity which is often an integrated part of a sawmill operation is custom sawing. About half of the sawmills in the regional sample did some custom sawing in 1960; the proportion of mills that did custom sawing was somewhat higher for small-scale mills than for large-scale mills. Custom sawing accounted for less than 10 percent of total production for a majority of these mills. In all, it represented only 4 percent of total sawmill production in 1960.

Custom sawing is usually performed during slack periods caused by adverse logging conditions or by poor market conditions for sawmill products. Often, however, sawmill operators will work on a custom job along with their regular sawing. Sawmill firms usually charge a specified amount per thousand board feet of lumber sawn (normally 15 dollars per thousand), or occasionally they charge by the hour. Many small-scale sawmill firms obtain a large share of their total income from custom sawing, but most large-scale firms do custom sawing mainly as a favor for friends and sawlog producers.

A number of firms saw exclusively on a custom basis and neither buy sawlogs nor sell any of the products they produce. Available evidence suggests that many sawmills which produce less than 100,000 board feet per year specialize in custom sawing for local farmers and other noncommercial buyers. Also, there are a few mills in the region that specialize exclusively in custom sawing for entrepreneurs who buy timber and sell sawmill products but do not operate sawmills themselves. In general, however, custom sawing is normally a subordinate function, which is designed primarily to augment the sawmiller's income in the case of small-scale mills and to maintain good relations with forest owners and sawlog producers in the case of large-scale mills.

Seasonal Patterns of Production, Sawlog Receipts, and Inventories

One of the most striking characteristics of the lumber industry in the North Central Region is the seasonal nature of its operations. Seasonal variations in the rate of production of sawmill products, in the quantity of sawlog material harvested, and in the inventory levels of sawlogs and sawn products represent a dominant and pervasive behavioral characteristic of the industry. The causal factors which underlie these four highly interdependent operational patterns are rooted in the structural elements which affect the continuity of sawmill and producer operations. The more important of these elements include: the high degree of divisibility of the production process, the relatively high durability of the product, the low level of fixed costs and the low ratio of fixed to variable costs, the high seasonal demand for certain products, the weak financial strength of most sawmill and producer firms, and the small amount of productive forest land owned by sawmill and producer firms.

The seasonal patterns of operation are quite similar in seven of the states in the study region, whereas the combined data for Wisconsin and Minnesota indicate seasonal patterns which are substantially different from those of the seven other states. These patterns are shown in Figures 5 and 6, respectively. The patterns illustrated are based upon the number of sawmill firms which reported high, average, or low levels of production, receipts, and

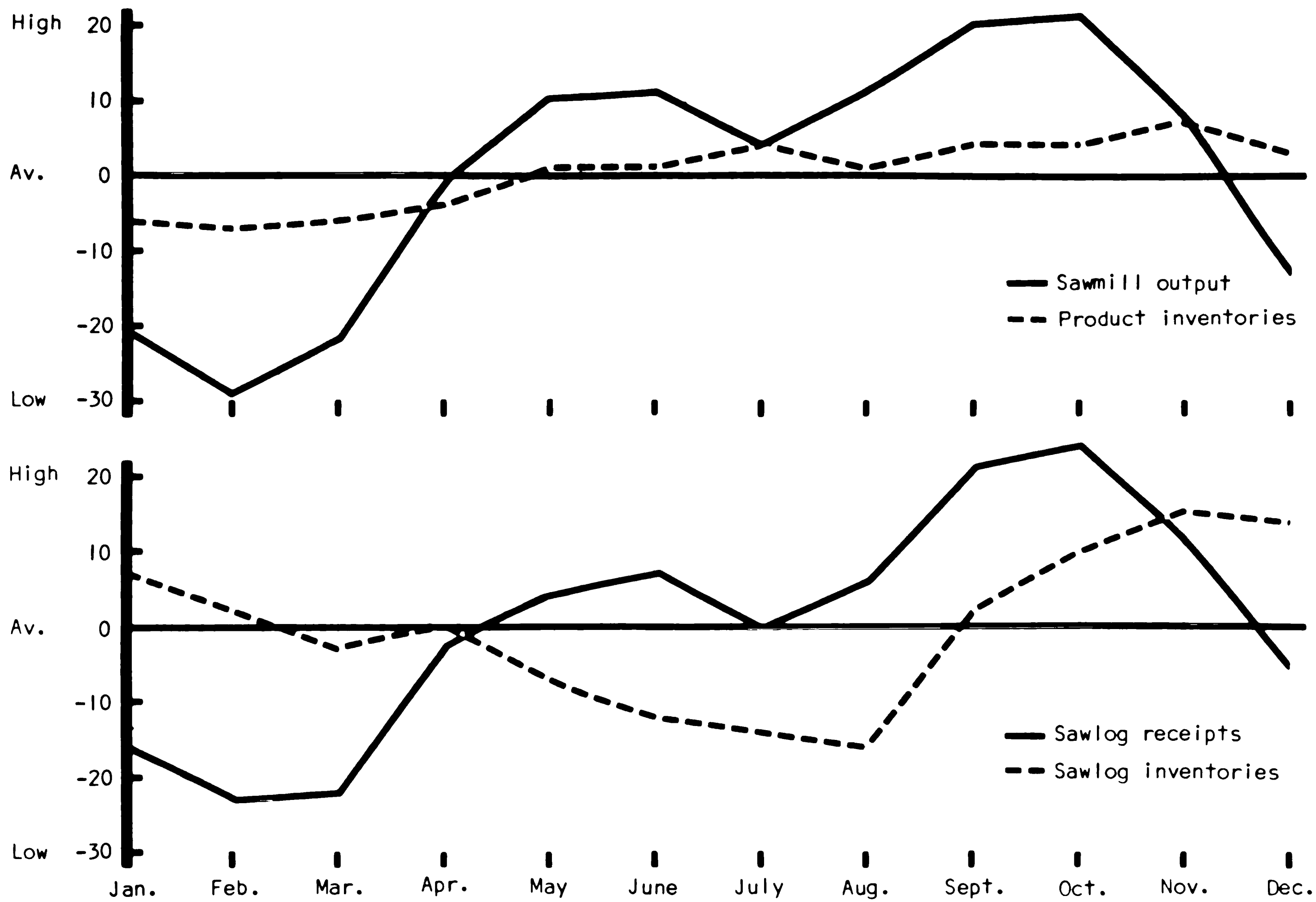

Figure 5. Seasonal patterns of sawmill output, product inventories, sawlog receipts, and sawlog inventories for sawmills sampled in all North Central States except Wisconsin and Minnesota, 1960.

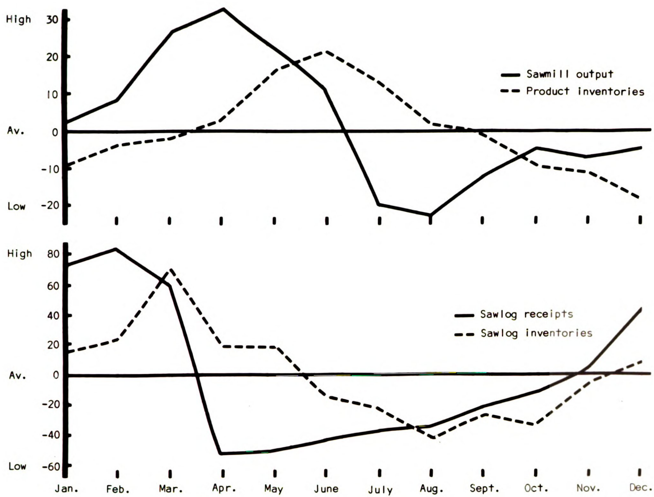

Figure 6. Seasonal patterns of sawmill output, product inventories, sawlog receipts, and sawlog inventories for sawmills sampled in Wisconsin and Minnesota, 1960.

inventories.[1]

The seasonal pattern of sawmill production for the seven states represented in Figure 5 shows the level of production falling below average in December, reaching its lowest level from January through March, increasing to above-average levels during May and June, declining slightly in July, and reaching its highest level from September to November. A high degree of interdependence exists between the seasonal pattern of sawmill output and the seasonal pattern of sawlog receipts; both are influenced to a large extent by weather conditions. Seasonal variations in the level of sawlog receipts for the seven states represented in Figure 5 nearly coincide with seasonal fluctuations in sawmill output. Cold weather and snow hamper both logging and milling operations during the winter. Logging and hauling operations are also difficult during the spring when the ground is soft and more restrictive highway load limitations are in effect. Both sawlog receipts and sawmill production decline slightly during July. Many of the producers and sawmill operators and their employees are part-time farmers and they must devote more

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[1]An index of activity for each of the four operational phenomenon was constructed for each state in the following manner: (1) The number of firms reporting low activity was subtracted from the number reporting high activity for each month. Firms reporting average or normal activity were counted as zero in value. (2) In order to standardize the indexes so that the mean value of each index equaled zero, the preponderence found in step 1 for each index was divided by 12 and subtracted or added to each month's observation. (3) This adjusted observation for each month was then expressed as a percentage of the total number of firms reporting and the pattern was plotted for each state. States with similar patterns were then combined into two groups by summing the adjusted observations for each month (step 3) and then expressing each month's sum as a percentage of all the reporting firms in each of the two groups and plotting. Note that a higher amplitude in seasonal fluctuation may

of their time to farm work during the summer. Sawlogs and lumber also deteriorate more rapidly during this period so that sawmill firms are reluctant to add to their inventories. Sawmill output and the rate of sawlog receipts are both at their highest levels during the late summer and fall. Weather conditions during these months are ideal for logging, sawlog storage, and lumber seasoning. In addition, many sawmill firms build up their sawlog inventories during this period (Figure 5) in order to sustain sawing operations throughout the winter and early spring. The level of product inventories follows a seasonal pattern similar to the pattern of sawmill output but the fluctuations are more subdued.

Seasonal fluctuations in sawmill output in Wisconsin and Minnesota (Figure 6) show an approximately inverse relationship to those of the seven other states. Sawmill production in these two Lake States is at a high level from February to June and at a low level from July to December. In these two states the seasonal pattern of sawmill output appears to depend to a greater extent upon the seasonal pattern of sawlog receipts than in the seven other states. The rate of sawlog receipts reaches a high level in December, and remains at a high level through March. During the winter the frozen ground facilitates logging operations on the low swampy areas so prevalent in these two states. As a result of the increased logging activity, sawlog inventories begin to accumulate in November and attain their highest level from January to May.

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indicate a high degree of agreement among firms as to months of high and low activity, but it does not necessarily indicate a greater amount of fluctuation in the volume of activity.

Sawmill output is stepped up from February to June in order to reduce sawlog inventories to low levels for the ensuing summer months when logs deteriorate very rapidly. Lumber inventories which build up from May to July are also quickly reduced in order to minimize losses due to stain, checking, and other defects. Both sawmill output and sawlog receipts remain at below-average levels throughout the summer and fall, largely as a result of the loss of workers to farming and other seasonal employment opportunities.

Throughout the study region, seasonal changes in the rate of production of sawlogs and sawmill products are effected largely through changes from inactive to active status, and vice versa, by producers and sawmill operators. The length of the work week and the number of hours worked each day are also varied in order to achieve the desired rate of production. Very few firms, however, ever operate more than one shift per day; most operate less than 40 hours a week except during the months of peak production. Frequent changes in the rate of production, especially when operations are completely shut down, obviously impose hardships upon laborers who cannot readily find other employment. Seasonal fluctuations in production also add to the instability of the market for sawtimber. However, the ability of sawlog producers and sawmill firms to quickly activate operations when conditions are favorable may be considered a desirable characteristic from the standpoint of the employment provided to persons without alternative employment opportunities. Also, many timber owners are able to increase their marketing opportunities because of the relative ease with which they can initiate or reactivate their own logging or milling operations. There are, therefore, both desirable and undesirable aspects of the pronounced seasonal variations in the rates of production of sawlogs and sawmill products. An analysis of the net effect upon welfare of the observed seasonal instability is, however, beyond the scope of this study.

Inventory Management

The great variability of the rates of sawmill output and sawlog deliveries intensifies the problems of inventory management. In most cases adverse logging conditions during the winter or spring preclude the continuous delivery of sawlogs to the mills. Most full-time sawmill firms build up sawlog inventories in the late summer and fall in order to maintain sawmill production throughout the winter and spring (Figures 5 and 6). Many firms, however, discontinue sawmill operations during some or all of the winter and spring. The build up in sawlog inventories usually lasts throughout the winter in Wisconsin and Minnesota. Sawlog inventories accumulated during the fall and winter months must be largely eliminated by summer to prevent large losses due to staining and insect damage. This is especially true of the higher quality softwood and hardwood logs. As sawmill production is stepped up in order to reduce sawlog inventories, inventories of finished products also begin to accumulate (Figures 5 and 6) and these must also be reduced in order to diminish losses due to staining and checking during the hot summer months.

Most large-scale sawmill firms (those that produced at least 500 thousand board feet in 1960) follow inventory policies consistent with the patterns described above. That is, inventories of both sawlogs and sawn products are allowed to fluctuate, with the exception that sawlog inventories are built up prior to periods of adverse logging and hauling conditions, and inventories of both sawlogs and finished products are kept at low levels during periods of poor storage conditions. Many small-scale sawmill firms follow the same policies, except that they do not usually saw during the winter and spring and thus do not build up sawlog inventories in the fall. In general, sawmill firms try to maintain a more uniform level of product inventory than sawlog inventory. Of the sawmill firms that responded to questions about their inventory policies, about half indicated that they try to completely eliminate inventories of sawmill products at all times. Only 16 percent of the responding firms followed this same policy in managing sawlog inventories. No more than one firm in ten indicated that its policy was to maintain a fixed level of either sawlog or product inventories, or a fixed ratio of sawlog or product inventories to sawlog receipts or product sales. A large number of sawmill firms have no consistent policies regarding the management of sawlog and finished-product inventories. This is understandable since the supply of sawlogs and, to a lesser extent, the demand for sawmill products are generally highly variable and unpredictable.

Sawlog inventories averaged 27 thousand board feet for sampled small-scale mills and 195 thousand board feet for sampled large-scale mills in 1960. Expressed as a percentage of average sawmill output in 1960, average sawlog inventories amounted to about 14 percent of sawmill production for both small-scale and large-scale mills. Inventories of sawn products averaged 32 thousand board feet for small-scale mills and 326 thousand board feet for large-scale mills in 1960. As a percentage of sawmill output, average product inventories amounted to 16 percent and 22 percent for small-scale mills and large-scale mills, respectively. However, if the largest sawmill is excluded from the sample, average product inventories for the remaining large-scale mills would amount to 194 thousand board feet and 14 percent of average production by these mills.

Sawmill firms were asked whether biological factors or economic and technical factors imposed limitations on the volume of sawlogs and finished products they were able to hold in inventory. About 45 percent of the sampled sawmills indicated that economic and technical factors affected their inventory policies by imposing limitations on the volume of sawlog inventories they could maintain. The cost of the sawlog material itself as well as the opportunity costs of carrying inventories were mentioned by 20 percent of the sampled sawmills. Financial limitations were mentioned with about the same degree of frequency by all size classes of mills. Another 23 percent indicated that the size of their storage yards prevented them at times from holding as much volume as they would like. These two limitations are especially critical during the high sawlog inventory period in the fall and winter. Other factors such as the limitations of log-handling equipment were mentioned by a few firms. Biological factors such as stain, checking, and insects, also limit the volume of sawlog inventories stored by sawmills in the region. About 54 percent of the sawmills in the sample reported that one or more of these factors prevented them at times from storing as much volume as they would like. About 35 percent of the sampled sawmills reported that stain limited the volume of sawlogs they could store. Boring insects were mentioned as a limiting factor by 20 percent of the sampled sawmills and checking by 6 percent. Hardwood-grade mills and mills that produce mainly manufactured products other than pallets and containers are more frequently limited by biological factors than other mills. About half of the sawmills that experienced either economic and technical limitations or biological limitations to their sawlog inventories were limited to 100 thousand board feet or less.

Nearly half of the sampled sawmills indicated that the volume of sawmill products they could store was limited at times by economic and technical factors. Economic and technical considerations were mentioned as imposing limitations on product inventories about as often as they were for sawlog inventories. Biological factors were mentioned less frequently in the case of product inventories than in the case of sawlog inventories. Limitations to the volume of sawmill products that can be stored occur with about the same degree of frequency for all sawmill size classes. The causes of these limitations are also about the same for each size class.

The financial cost of holding product inventories limits the volume of sawmill products that can be stored for 21 percent of the sawmills sampled, and storage space imposes limitations for 13 percent of the sawmills in the sample. Biological factors such as stain, insect damage, checking, and warping limit the volume of finished products which can be stored for 19 percent of the sampled firms. A considerable number of pallet mills also reported that inventories of pallet lumber must be kept relatively small to prevent excessive drying which causes difficult nailing.

Market Outlets

Five types of market outlets were recognized in this study: manufacturers, industrial users, wholesalers, retailers, and noncommercial final consumers. Manufacturers are firms which remanufacture sawmill products into other products such as furniture and furniture parts, flooring, millwork, pallets, and containers. Industrial users are firms which use sawmill products without substantially changing their form; included are building contractors and the many users of pallets, crating, and containers. Wholesalers buy from sawmill firms and resell to other commercial users of sawmill products--manufacturers, industrial users, retailers, and other wholesalers. A few brokers, intermediate marketing agents who handle sales on a commission basis but do not take title to the material, are included in the wholesaler category. Retailers operate lumber yards and sell largely to noncommercial final consumers. Wholesalers and retailers often carry out such finishing operations as seasoning, surfacing, and grading, but they usually do not process sawmill products beyond these stages. Noncommercial buyers include farmers and the do-it-yourself trade.

The vast majority of the volume produced by sampled sawmill firms is sold within the study region to manufacturers, industrial users, and wholesalers. Manufacturers bought 41 percent of the total volume of sawmill products sold by sampled mills in 1960

(Table 15). Industrial users and wholesalers accounted for 19 percent and 20 percent, respectively. The remaining 20 percent of sawmill output was sold to noncommercial final consumers and retailers. It is evident from Table 15 that large firms sell a larger share of their output to manufacturers, industrial users, and wholesalers than do small firms. Small firms tend to sell a larger share of their output to local buyers.

It is not surprising that the market shares held by the various types of buyers vary among product groups. Table 16 indicates that hardwood-grade mills sell close to two-thirds of their lumber directly to manufacturers and about one-fifth to wholesalers. Direct sales to industrial users account for over half of the volume sold by the producers of pallets, boxes, and crates, and nearly one-fourth of their output is sold to wholesalers. Firms producing predominantly pallet material and crating sell about half of this material to the manufacturers of pallets, boxes, and crates; wholesalers and industrial users also account for a large share of this market. Mills that produce predominantly flooring stock sell about two-thirds of their output directly to manufacturers. Softwood-lumber producers sell nearly two-thirds of their output to retailers and noncommercial final consumers. The remaining product groups listed in Table 16 exhibit a more uniform distribution of sales among the different types of buyers. The market shares listed in Table 16 are based upon all the products produced by each product group. A separate analysis of each product would probably reveal a narrower range of buyer types for each individual product.

Table 15. Distribution of sales by type of buyer for each size class of sawmill sampled, 1960

Type of buyer	Sawmill size class				
	1-99 M bd.ft.	100-499 M bd.ft.	500-999 M bd.ft.	1000 M bd.ft. or more	Total[a]
	(Percent of sales)				
Manufacturer	23	38	44	42	41
Industrial user	11	17	14	20	19
Wholesaler[b]	15	15	21	21	20
Retailer	--	2	6	7	6
Noncommercial final consumer[c]	51	28	15	10	14
	100	100	100	100	100

[a]Includes the 7 mills which could not be classified by size.

[b]Includes brokers.

[c]May include some building contractors, most of whom were classified as industrial users.

Table 16. Distribution of sales by type of buyer for each product group, 1960

Product group[a]	Type of buyer					
	Manufacturer	Industrial user	Wholesaler[b]	Retailer	Noncommercial final consumer[c]	Total
	(Percent of sales volume)					
Hardwood grade	65	9	21	1	4	100
Pallets, boxes, and crates	8	58	23	d	11	100
Pallet material and crating	54	17	19	1	9	100
Manufactured products except pallets, boxes, and crates	17	33	1	24	25	100
Low-grade hardwood lumber	16	19	24	9	32	100
Softwood lumber	17	3	17	35	28	100
Railroad ties	27	25	29	d	19	100
Flooring stock	65	3	6	1	25	100
Unclassified	65	11	3	4	18	100

[a]See Appendix C, Table 1 for description of product groups.

[b]Includes brokers.

[c]May include some building contractors, most of whom were classified as industrial users.

[d]Less than 0.5 percent.

Additional information about the number and types of market outlets is presented in Table 17. It is evident that a very small percentage of the sampled firms fit the classic image of the "captured mill." Over 90 percent of both small-scale and large-scale mills had more than one market outlet in 1960. However, because of the small size of most sawmill operations and the inadequacy of market information, sales accounts with commercial buyers are generally limited to only two or three accounts. For example, 90 percent of the small-scale firms sampled and about two-thirds of the large-scale firms sold to less than five manufacturers apiece in 1960, and over 60 percent of both size classes sold to no more than one industrial user, wholesaler, or retailer.

The following tabulation shows the average number of buyers and the average volume sold to each buyer by sampled sawmills in 1960:

Mill size class	Average number of buyers		Average sales volume per buyer	
	All buyers	Commercial buyers	All buyers	Commercial buyers
(M bd.ft.)			(M bd.ft.)	
1 - 99	18	2	4	20
100 - 499	38	5	6	30
500 - 999	42	18	16	33
1000 or more	67	33	29	55

It is apparent that large sawmill firms have more and larger buyer accounts than small firms. Large-scale mills generally have from three to six times as many accounts with commercial buyers than do small-scale mills. The difference in the average size of commercial accounts is not substantial, however. Judging from the

Table 17. Percentage of sawmills that sold to each type of buyer, by number of buyers and size class of sawmill, 1960

Type of buyer	Number of buyers: 0	1	2-4	5-9	10-19	20-49	50-99	100-499	500 or more	Total
	Small-scale mills, 100-499 M bd. ft.									
Manufacturer	31	24	35	4	4	2	--	--	--	100
Industrial user	71	12	9	3	3	1	1	--	--	100
Wholesaler	68	17	14	1	--	--	--	--	--	100
Retailer	91	4	3	1	1	a	--	--	--	100
Noncommercial final consumer	43	8	6	3	2	8	9	21	--	100
All types	--	9	32	14	8	8	10	19	--	100
	Large-scale mills, 500 M bd. ft. or more									
Manufacturer	24	7	33	15	10	8	3	--	--	100
Industrial user	61	8	13	6	6	5	5	1	--	100
Wholesaler	44	18	25	6	4	2	1	--	--	100
Retailer	84	4	3	4	2	1	1	1	--	100
Noncommercial final consumer	63	6	5	2	2	6	4	11	1	100
All types	--	8	17	22	15	18	6	12	2	100

[a]Less than 0.5 percent.

average volume sold to each commercial buyer, it appears that most sawmill firms, especially those that produce less than 500 thousand board feet annually, make no more than two or three sales to each commercial buyer in the course of a year.

Sawmill firms in the study region generally sell most of their output in a fairly limited market area. Sales territories increase in size with increasing sawmill size. They also vary in size among the product groups. The maximum distance the sampled firms shipped their products in 1960 averaged 172 miles. In general, firms that sold predominantly high-value products reached out to more distant markets than other firms. Nearly two-thirds of the mills sampled did not sell outside their home states. Most of the remaining mills were limited to market outlets within the North Central Region, but as many as 4 percent of the sample sold to outlets in foreign countries.

Questions about the adequacy of markets for sawmill products produced in the study region cannot be answered completely without a more thorough understanding of the economic characteristics of each of the broad types of market outlets recognized in this study. Market characteristics such as variability of demand, market power relationships, and the geographical distribution of the buyers would have to be studied in depth. However, two things are evident from the above analysis. Firstly, nearly all sawmill firms have sufficient marketing opportunities so that they are able to choose among two or more buyers. Secondly, the majority of sawmill firms reach only the market outlets located within their respective home states, and very few reach markets outside the study region. The relatively small volume sold through wholesalers may offer a partial explanation. It is generally recognized that wholesalers provide sawmill firms with the opportunity of increasing the number and the variety of market outlets for their products. For instance, Ho (23) in Western Oregon and Teeguarden (74) in the Central Sierra Nevada Region of California concluded that small sawmill firms were at a disadvantage in comparison to large sawmills because the latter sold proportionally more of their output through wholesalers and thus realized the benefits of selling to a larger and less variable market. However, over half of the output of even the smallest sawmill size class recognized in those two studies was sold through wholesalers and brokers. In contrast, softwood-lumber producers in the study region sold only 17 percent of their output to wholesalers. Admittedly, market conditions are substantially different in the West, and sawmills in the study region may realize some advantages by selling directly to potential buyers. Nevertheless, increased contacts with wholesalers would seem to offer sawmill firms in the study region a greater choice of potential buyers and an efficient means of improving their knowledge of market conditions.

Selling Practices and Policies

Nearly all sales are made at the mill, and they are usually handled by the sawmill operator who acts as both production manager and sales manager. Very few sawmill firms operate a separate retail or wholesale yard or a sales office apart from the mill. Only the largest firms have continuous contact with the major wholesale markets for their products. Most firms make sales at frequent intervals to local farmers and the do-it-yourself trade, but such sales are largely limited to the medium and lower grades of construction lumber. In the course of a year, small firms may have only from one to four contacts with commercial buyers; large firms may be contacted on a monthly or weekly basis depending on the size of mill. In general, the buyer takes the initiative in contacting the sawmill firm, usually by telephone or by visiting the mill. Only the largest sawmill firms have an organized sales department. The use of price or stock lists and advertising in trade publications are uncommon among all but the largest sawmill firms.

Selling procedures differ considerably depending on whether the product is sold out of inventory or whether it is produced to fill a previously obtained order. Products such as hardwood grade, hardwood construction lumber, railroad and mine ties, softwood construction lumber, hardwood flooring stock, and ungraded poor-quality hardwood lumber are generally sold out of inventories. On the other hand, pallets, crates and boxes, pallet material, and crating and blocking are usually sold on a prior-order basis; that is, orders are received before the products are produced.

Two product groups--firms that concentrate on the production of pallets, boxes and crates or pallet material and crating--generally operate on a prior-order basis. Orders may specify a specific number of items to be purchased or they may be of the blanket order type. The latter is commonly used in the sale of pallets. A blank order for pallets states the total number that a producer may be expected to supply for the duration of the contract;

then releases for a specific number of pallets are made periodically. Sutherland (71), in his study of the use of pallets by the auto industry, reported that purchase orders for pallets usually consisted of blanket orders of three-months duration. For the sawmills sampled in the two product groups, purchase orders usually were of two to four weeks duration. Prices are set by negotiation with the buyer or by competitive bidding among suppliers. Pricing on the basis of bids is commonly used in selling pallets and, to a lesser extent, boxes and crates. Prices for pallet material and crating are usually either specified by the buyer or determined through negotiation. Most purchase orders stipulate that prices are to be fixed for the duration of the contract. Many of the sawmill firms in the sample, however, complained that although they were held to the agreed price, buyers often cancelled contracts or forced the mills to renegotiate a lower price.

Firms that sell on a prior-order basis tend to devote more time and effort to the pricing of their products than firms that sell from inventories. When selling on a prior-order basis, the decision of whether or not to produce the product and the pricing decision are coincidental and mutually dependent. The sawmill firm must take into consideration not only the market price and the price an individual buyer may be willing to pay, but it must also determine the price that will be required to cover production costs and an allowance for profit. A minimum acceptable price based upon the average cost per unit of output plus an allowance for profit is the most frequently used criterion in pricing sawmill products which are sold on a prior-order basis. This criterion is especially important in sales made by competitive bidding among supplies. Unlike the negotiated sale, where the buyer may often accept a price which is above the seller's minimum acceptable price, in a bid sale the seller is more likely to quote a price equal to his minimum acceptable price in order to increase his chances of underbidding rival suppliers.

Selling procedures and pricing policies are considerably different for products which are normally sold out of inventories. Orders for these products may specify a specific volume of material, or they may call for a "truck load" or whatever volume the mill has in inventory. Payment for high-value products is normally made on the basis of a grade tally, but low-grade products are commonly sold on a mill-run basis. In either case, most small and medium size sawmill firms do not scale their own material but rely completely on the buyer's tally of grade and volume. Many of these small and medium size firms have no personnel capable of grading lumber, and often the sales volume is too small to justify the hiring of an independent grader. For these reasons, the amount of confidence which the sawmill firm has in the fairness of the buyer's scale plays an important role in the marketing decision.

The pricing decision for products sold from inventories is usually made on the basis of the seller's understanding of market price. The purchase of sawlog material and the costs of processing typically occur a few weeks to several months before the products are sold. At the time of sale, all costs incurred in production are sunk costs and they are not affected by the pricing decision. Therefore, firms that sell from inventories, unlike those that sell on a prior-order basis, pay little attention to their operating costs but base their pricing decisions almost entirely on their estimates of current market prices. The only indication which many sawmill firms have of market price is based upon their last sales transaction. Market information from published sources and other mass communication media is limited and often dated. Since most small-scale mills and many large-scale mills make sales or receive price quotations only at infrequent intervals, their knowledge of current market conditions is usually poor.

An indication of the relative amounts of market power held by sawmill firms and the buyers of sawmill products is shown in Table 18. The majority of sampled firms in five product groups indicated that their principal products were usually sold at the buyer's offered price. In only one product group--the producers of manufactured products other than pallets, boxes, and crates--does it appear that sawmill firms have the advantage over buyers in setting prices. The firms in this product group deal with a large number of retailers to whom they can apparently dictate prices. It appears that many sawmill firms, especially those that produce pallet material and crating, railroad ties, and flooring stock, are faced with the decision to either accept or reject the prices offered by buyers. The fact that such a high proportion of sales are made on the basis of the buyer's offered price is to a large extent a reflection of the inadequate knowledge which most sawmill firms have of market conditions. With very little knowledge of the prices other buyers are offering or of his costs of production, the sawmill operator has few arguments to support his case in negotiating with a buyer. Thus

Table 18. Average number of commercial buyers and most common method of price determination, by product group, 1960

Product group	Average number of commercial buyers[a]	Method of price determination			
		Buyer's price	Sawmill's price	Negotiation	Bid
		(Percent of sampled mills)			
Flooring stock	0.8	94	--	6	--
Railroad ties	1.2	87	4	9	--
Pallet material and crating	1.4	71	8	19	2
Hardwood grade	3.9	61	3	36	--
Softwood lumber	1.4	55	33	12	--
Low-grade hardwood lumber	1.6	43	25	30	2
Pallets, boxes and crates	5.6	32	20	25	23
Manufactured products except pallets, boxes, and crates	55.9	30	50	20	--
Unclassified	3.9	23	23	50	4
All mills	3.8	57	15	25	3

[a]Manufacturers, industrial users, wholesalers, and retailers.

he can only reject the price if he thinks it is too low, or he can accept it if he thinks it approximates the current market price or if the added costs of obtaining other price quotations would exceed the probable gain in price. Pertinent to this point is the high negative correlation between the proportion of mills that sold at the buyer's price and the average number of commercial buyers sold to (Table 18). Aside from other aspects of market power relationships, the data presented in Table 18 give some support to the notion that the greater the number of buyers a sawmill firm deals with, the more knowledge it will have of market conditions, and the better will be its bargaining position.

CHAPTER 6

MARKET CONDUCT IN THE PROCUREMENT OF SAWLOG MATERIAL

This chapter is concerned with how the sawmilling industry obtains its supply of raw wood material. There are three general ways in which sawmill firms acquire sawlog material: they may harvest timber from their own land, buy stumpage from other forest owners, or buy sawlogs from sawlog producers. The analyses in this chapter are focused on the marketing relationships among sawmill firms and forest owners, sawlog producers and forest owners, and sawmill firms and sawlog producers.

Timber Handled

The sawlog material procured by sampled sawmill firms in 1960 consisted of 84 percent hardwood logs and 16 percent softwood logs. These proportions are almost exactly equal to the proportional distribution of the sawtimber resource among hardwoods and softwoods in the North Central Region. The six most important species or species groups and their respective shares of the total volume of sawlog material received by sampled mills was as follows: oaks, 41 percent; poplar, 16 percent; hard maple, 12 percent; soft maple, 6 percent; elm, 6 percent; and red and white pine, 4 percent. Other species which represented one percent or more of total receipts included: walnut, beech, basswood, yellow birch, hemlock, white birch, cherry, and white cedar.

Sawmill firms and producers generally handle all marketable species in their wood procurement areas, yet they tend to concentrate on certain species depending upon the market outlets they have developed. The species preferred by sawmill firms naturally differ among the eight product groups recognized in this study. For instance, manufacturers of pallets, boxes, and crates prefer run-of-the-woods oak, poplar, and elm, whereas producers of hardwood grade lumber prefer high-quality maple, basswood, cherry, walnut, and others. Most firms do not have highly restrictive quality specifications; they generally accept all quality classes above a certain minimum. Sawlog quality specifications also vary according to the kinds of sawmill products produced. Some firms, such as mills that produce hardwood grade, pay premium prices for the higher grades of logs, but firms that produce products which do not require high quality material pay no differential based on log grade. Sawlog sizes are usually specified by a minimum length of 8 feet. Most firms do not handle logs over 16 feet in length. Many pallet and container producers buy bolts from 3 to 8 feet in length and down to 4 inches in diameter.

Both sawmill firms and sawlog producers handle other timber products in addition to sawlogs. Sampled sawmill firms resold from their receipts of raw wood material 15,223 thousand board feet of other timber products. This volume amounted to about 4 percent of total receipts. The material was resold as veneer logs, which accounted for over half of the volume, pulpwood, cooperage logs, posts, poles, piles, and other miscellaneous products.

Timber products other than sawlogs represented a large share of the total volume of raw wood material handled by sawlog producers. The following tabulation presents the volume of each timber product sold by sawlog producers in 1960 and the proportion which each product represented of the total volume of products sold:

	Volume in M bd.ft.	Percent of total volume
Sawlogs	45,495	53.1
Pulpwood	29,703	34.7
Veneer logs	6,980	8.1
Cooperage bolts, fuelwood, etc.	3,445	4.0
Posts, poles, or piles (Total number 12,710)	63 (Estimated)	0.1
All material	85,686	100.0

Localized Nature of Wood Procurement Areas

Sawmill firms acquire their sawlog material from smaller, more localized market areas than the market areas for the products they produce. The typical sawmill firm is in competition with no more than two or three other sawmills for sawlog material. Sawmills within a particular timbershed are not immune, however, to competition from outside by pulp mills, especially for aspen, pine, spruce and fir, and from cooperage mills, veneer mills and other sawmills for the higher grades of oak, maple, walnut and other species.

The wood procurement activities of most sawmill firms are confined to a 30-mile radius of the mill. About half of the sampled sawmills obtained all of their sawlog requirements in 1960 within a 25-mile radius of their respective mills, and less than 8 percent received sawlogs from beyond 75 miles. A few sawmills received sawlogs from distances of over 150 miles.

A producer's wood procurement area may lie wholly within or roughly coincide with a sawmill firm's timbershed, but more often it overlaps the timbersheds of several sawmills. Procurement areas of sawlog producers are similar in size to those of sawmill firms. Slightly over half of the sampled producers had procurement areas of no more than 20 miles in radius in 1960 and less than 10 percent operated in an area greater than 50 miles in radius. Truck hauling distances for sampled producers averaged 22 miles.

The wood procurement areas of sawmill firms are typically small because of the advantages of locating processing facilities close to the timber resource. Variations in the size of wood procurement areas can be explained largely by differences in the density of the timber resource, in the size of mills, in the degree of competition for sawlog material, and in the delivered prices of sawlogs. Under similar conditions, large mills require larger timbersheds than smaller mills. An increase in size of timbershed, as measured by both the average and maximum truck hauling distances, with increasing size of sampled sawmill is shown in Table 19. The correlation between volume of production and size of procurement area was not quite as high for sawlog producers. The major difference in size of wood procurement area was between sampled producers who sold more than 150 thousand board feet of sawlogs in 1960 and those who sold less than 150 thousand board feet. The latter group contained many part-time producers and many who harvested and sold sawlogs only from their own lands. The maximum hauling distance averaged 31 miles for the first group of producers and 18 miles for the second group.

Table 19. Truck hauling distances to sampled sawmills, by size class, 1960

Sawmill size class	Mean average hauling distance[a]	Mean maximum hauling distance[b]
(M bd.ft.)	(Miles)	
1 - 99	8.7	16.4
100 - 499	12.4	26.3
500 - 999	16.2	38.1
1,000 or more	22.0	53.5
All mills	15.8	36.6

[a]Mean of the average hauling distances reported.

[b]Mean of the maximum hauling distances reported.

Considerable variation is found among the product groups in regard to the size of wood procurement areas. (See Table 20.) Firms that produced primarily hardwood grade, pallets and containers, or other manufactured products in 1960 generally reported larger wood procurement areas than other firms whose principal products were generally of lower value. The larger procurement areas reported by firms that produced high-value products may be explained in part by the generally larger size of these firms. However, part of the explanation may be due to the higher ratio of sawlog prices to hauling costs per unit-mile for these firms in comparison to firms in other products groups. For example, the average price paid for delivered sawlogs in 1960 was lowest for flooring stock mills, the group with the smallest wood procurement areas on the average, and highest for hardwood-grade mills, the group with the largest wood procurement areas on the average.

The use of trucks is the most common means of transporting sawlogs in the study region. Some 89 percent of the sampled sawmills received all of their sawlog material by trucks in 1960. Truck transportation accounted for 91 percent of the sawlog volume delivered to sampled mills. A few sawmills received sawlogs that had been transported all or part of the way by rail. Railroads accounted for 5 percent of the sawlog volume delivered to sampled sawmills. Other means of transportation, such as skidding or hauling by tractors, accounted for only 4 percent of the volume received by sampled mills. Portable sawmills that had set up operations within timber stands accounted for a large share of the mills that received sawlogs by skidding and hauling with tractors.

Table 20. Truck hauling distances to sampled sawmills, by product group, 1960

Product group	Mean average hauling distance[a]	Mean maximum hauling distance[b]
	(Miles)	
Hardwood grade	23.0	53.5
Manufactured products except pallets, boxes, and crates	19.8	45.8
Pallets, boxes, and crates	15.3	39.0
Softwood lumber	14.7	35.2
Pallet material and crating	13.2	27.4
Low-grade hardwood lumber	12.2	27.3
Railroad ties	9.4	17.6
Flooring stock	9.0	9.4

[a]Mean of the average hauling distances reported.

[b]Mean of the maximum hauling distances reported.

Sources of Sawlog Material

Sampled sawmills in 1960 acquired 37 percent of their total sawlog material requirements from stumpage purchases, 14 percent from their own land, and 49 percent by sawlog purchases from other market agents.

Landownership Source

The landownership source of the sawlog material used by sawmill firms in the study region depends primarily upon the pattern of landownership within the sawmill firms' wood procurement areas and the volume of sawtimber held by each type of landowner. Farm ownerships account for 41 percent of the total commercial forest land in the region and supply nearly half of the sawlog material used by sawmills. The following tabulation shows the percentage of total volume received from each landownership source and the percentage of sampled mills that received sawlog material from each source in 1960:

	Percent of volume	Percent of mills
Sawmiller's own land	14	20
Farmers	46	79
Other private	21	39
National forests	10	20
State and other public	9	17
	100	

Sawlog material purchased from private landowners accounted for about two-thirds of the total volume acquired by sampled mills in 1960. About 62 percent of the sawmill firms acquired all of their sawlog material from private lands, including their own land.

Sampled sawmills acquired 14 percent of their sawlog requirements from their own land, but the sample data probably overestimate the importance of this source. Four firms in Wisconsin, each ranking among the largest firms in the regional sample, accounted for 63 percent of the volume obtained from land owned by sawmill firms. Excluding these four firms, sawlog material from sawmill-owned land represented 6 percent of total sawlog requirements for the remaining mills in the sample. This latter figure is probably more representative of the study region as a whole.

Landownership sources of sawlog material handled by producers are similar to those of sawmill firms. However, sawlog producers generally acquire a greater proportion of their requirements from farmers and they also tend to limit their purchases to a fewer number of landownership types. The proportion of the total volume received from each landownership source in 1960 and the proportion of sampled producers who obtained sawlog material from each source is given in the following tabulation:

	Percent of volume	Percent of producers
Producer's own land	6	24
Farmers	57	60
Other private	20	28
National forests	9	8
State and other public	8	13
	100	

Sawlog producers, like sawmill firms, acquired slightly more than 80 percent of their sawlog requirements from privately owned land. About 80 percent of the sampled producers acquired all of their sawlog material from privately owned land, including land owned by producers themselves.

The importance of various landownership sources differs somewhat among mills requiring different species and qualities of sawlog material because the species and quality composition of the timber resource varies among different types of landowners. The relative importance of different landownership sources varies little among sawmill and producer firms of different sizes with the exception of the share of the total volume obtained from land owned by sawmill firms or producers. Except for a few large-scale mills, sawmill firms that produce less than 100 thousand board feet annually normally obtain a larger share of their sawlog requirements from their own land than do larger mills. Similarly, the proportion of total requirements obtained by sampled producers from their own land decreased from 26 percent for firms that produced less than 50 thousand board feet of sawlogs in 1960 to 2 percent for firms that produced more than 500 thousand board feet. Sawmilling is a sideline to most sawmill firms that produce less than 100 thousand board feet per year. Often it is used primarily as a means of increasing the return from growing sawtimber. Many of these firms do not purchase sawlog material from other sources. The opportunity to realize a larger gross return from their sawtimber also motivates many forest owners to assume the producer function and sell their sawtimber as cut logs delivered to the mill rather than as stumpage. Many of these individuals limit their producer activities to their own stumpage.

Agent Source

Sawmill firms and sawlog producers carry out nearly 90 percent of the sawlog procurement activity within the study region. The following tabulation lists the proportion of the total volume of sawlog material that was obtained from each agent source and the proportion of sampled mills that received sawlogs from each source in 1960:

	Percent of volume	Percent of mills
Sawlog producers (using own employees)	48.1	69.8
Sawmill firms (using own employees)	42.2	64.8
Loggers contracted by sawmills or producers	9.4	13.6
Dealers	0.3	1.5
	100.0	

Sawlog producers--including landowners who harvested and/or delivered their own sawlogs--supplied nearly half of the sawlog volume received by sampled mills in 1960. Seventy percent of the sawmill firms purchased some sawlogs from producers. Most of the volume (86 percent) acquired from sawlog producers was bought on a f.o.b. mill basis; of the remainder, the majority was purchased at a roadside and the rest f.o.b. railroad. Sawmill firms that carried out their own logging and hauling supplied about 42 percent of the total sawlog volume. About one-fifth of the sawlog producers and a similar proportion of sawmill firms subcontracted part or all of their logging and hauling operations. Contract loggers accounted for 9 percent of all sawlog material acquired by sampled mills in 1960. Less than 2 percent of the sampled mills purchased sawlog material from dealers, who supplied less than 0.3 percent of total sawlog receipts.

Sawmills that produce predominantly pallets, boxes, and crates or flooring stock log and haul very little of their sawlog requirements. The mills in these two product groups logged and hauled only 9 percent and 22 percent, respectively, of their sawlog receipts in 1960, as compared to 43 to 53 percent for other product groups. Many sawmill firms, especially those that produce hardwood grade, conduct their own logging operations because they have more skill and experience than the average producer in locating, buying, and logging the highly valued species and grades of sawtimber that are preferred. Pallet and container mills use low-quality hardwoods of any species except the very hardest such as hickory. Little skill and experience is needed to buy and log this kind of material, and most sawmill firms are able to acquire a sufficient supply from producers. The fact that flooring stock mills use oak almost exclusively and do not demand high quality may partly explain why these sawmills do such a small share of their own logging and hauling. Other factors, such as the sawmiller's knowledge of logging operations, his ability to finance logging equipment, his ability to manage both the milling and logging operations, and the supply of sawlogs offered by producers, also determine the amount of logging and hauling performed by sawmill firms.

The share of the total logging and hauling performed by sawmill operators decreases as size of sawmill increases. Most small sawmills do their own logging and hauling in order to utilize their employees more efficiently and because the alternative employment opportunities for the operators of these mills are usually poor. Many small sawmills produce an insufficient volume to operate year-round. In order to retain competent employees, these mills offer a longer period of employment to their employees by using the same personnel for milling and wood procurement operations. Larger sawmills which produce a sufficient volume to keep their mill workers employed all or most of the year have less incentive to do their own logging. Producers are also more willing to sell to large sawmills because these mills offer a more stable demand for sawlogs, and also because individual producers can sell larger volumes to these mills.

Stumpage Procurement by Sawmill Firms

Sawmill firms obtain a large share of their sawlog requirements by the direct purchase of stumpage from forest owners. Nearly three-fourths of the sawmills sampled in 1960 purchased stumpage for at least part of their wood requirements. Most purchases were made from farmers and other private owners of small forest holdings. The average size of stumpage purchase and the average number of landowners that sampled firms bought from in 1960 are listed below:

Sawmill size class	Average volume per purchase	Average number of stumpage sellers
(M bd.ft.)	(M bd.ft.)	
100 - 499	29.6	4.6
500 or more	27.9	17.9

The small size of the average stumpage purchase made by both small-scale and large-scale sawmill firms is evident. The above averages include the relatively large tracts, which often contain from one to five million board feet, purchased from public lands. Stumpage purchases from private landowners make up the vast majority of acquisitions and these purchases may be somewhat smaller than the above averages. Large-scale firms apparently do not acquire larger timber tracts on the average than small-scale mills but make a greater number of purchases in order to fulfill their needs.

Methods of Stumpage Acquisition

The supply side of the stumpage market consists of over one million small farm woodlots and other private ownerships plus a limited number of national forests, state forests, and other public holdings. To a large degree, each tract of sawtimber represents a distinct commodity in a localized market determined by the sphere of influence of a limited number of sawtimber buyers. Each tract has its peculiar characteristics with regard to the species, size, and quality composition of the timber, the ease with which the tract can be logged, and the distance to the nearest sawmill. There is no organized sawtimber market for the entire study region. Stumpage prices are determined through negotiations between a buyer and seller for each individual sale rather than by a market price resulting from the unrestricted interaction of all buyers and sellers in the region. With the exception of the Au Sable Forest Products Association at East Tawas, Michigan, the only sales cooperative for forest products known to exist in the region, market transactions take place at widely dispersed locations. Because of the wide spatial separation of market participants, adequate communication of market news is of vital importance. However, unlike most farm crops, weekly or even monthly reports of market conditions for sawtimber stumpage are not generally available from popular mass-communication media. The exchange of knowledge among market participants is almost entirely by word of mouth. Market characteristics which impede the flow of market information, such as the difficulty of identifying and measuring quality differences in sawtimber, the great diversity of the timber resource, the infrequency of market transactions by sawmill firms, producers, and landowners in particular, and the dispersed location of stumpage sellers, were examined in an earlier section.

Sawmill firms that rely on sawtimber purchases for most of their sawlog requirements are almost constantly looking for available sawtimber. During much of their spare time, sawmill operators travel throughout their wood procurement areas looking for suitable tracts of timber. They are usually familiar with the majority of the woodlots and forest owners within their timbersheds. Private forest owners also seek out buyers but their efforts are normally only periodic since most private landowners make timber sales only once every 5 to 20 years. However, because of the greater number of forest owners, the proportion of stumpage sales which are initiated by forest owners is about equal to the proportion initiated by sawmill firms.

The methods that sawmill firms use in gathering information about the availability of sawtimber stumpage are not very sophisticated. Most sawmill operators, regardless of size of mill or principal product produced, initiate stumpage purchases by personally contacting landowners. Personal contacts include face-to-face encounters as well as telephone conversations. As shown in the tabulation below, 62 percent of the sampled sawmill firms that bought stumpage in 1960 indicated that they used personal contacts only. About one-fifth indicated that they rarely took the initiative and followed no regular policy. Less than 15 percent contacted sellers through the mail or by advertising. Only five firms employed buyers or regularly paid commissions to persons who informed them of potential stumpage purchases.

Method of contact	Percent of sawmills
Personal contact only	62.3
Personal contact and by mail	9.9
Personal contact and advertising	2.2
Mail and advertising	0.9
Mail, advertising, and free information from informers	1.2
Mail, advertising, and pays informers a commission	0.6
Mail, advertising, and employs a buyer	0.9
Rarely takes initiative	22.0
	100.0

The procedure followed in acquiring sawtimber from public lands is somewhat different than that used with private landowners. Stumpage sales from public forests are generally of two types. Sales which contain stumpage in excess of a designated minimum value (commonly 300 to 2,000 dollars, depending on the agency) are advertised locally and open to competitive bidding. Smaller sales are made by direct negotiation between the buyer and public agency (40). The latter type of sale, which is more prevalent than the advertised sale, is often initiated by the stumpage buyer.

Sawmill firms have very flexible policies regarding the timing of stumpage purchases and the proportion of total sawlog requirements acquired by purchases of standing sawtimber. Large sawmill firms that obtain most of their sawlog material by purchasing stumpage often line up potential stumpage purchases as much as a year in advance of harvesting. These firms generally attempt to secure pledges and make purchases which will provide a year's supply of sawlog material. Many firms, especially among those which rely heavily on stumpage purchases, depend upon sawlog deliveries by producers to offset variations in the supply of sawlog material acquired by direct purchase from forest owners. Small-scale sawmills, part-time operators in particular, and firms that rely largely on sawlogs supplied by producers are less concerned about keeping a backlog of available stumpage. To many of these firms the acquisition of stumpage is primarily a matter of capitalizing on fortuitous opportunities. When sawtimber stumpage is available, they may cut back on sawlog purchases from producers; when it is in short supply, they may cut down on sawmill production or increase purchases from producers.

Sawmill operators must personally inspect sawtimber tracts before they can make an intelligent offer for the timber. After making initial contact with a landowner and finding out he is willing to make a sale, the sawmill operator first inspects the timber tract before making a firm offer. If the landowner has indicated a willingness to accept a lump sum for the entire parcel, the buyer may make a superficial survey of the tract and offer a sum which is low enough to cover any unfavorable errors he may make in estimating timber quality or volume. If the initial quotation is unacceptable and if the buyer demands a much higher amount, a more detailed survey will often be made before the buyer makes another quotation. If the tract is small, a one-hundred percent tally will often be made of each species, size, and quality class--with the sawmiller using his own classification system. If payment is to be made on the basis of a sawlog tally, the buyer will normally walk throughout most of the tract in order to get a good idea of the species and quality composition before quoting any prices. In order to determine the reasonableness of offered prices, forest owners must obtain several bids, or compare the offered prices with prices received for similar sawtimber tracts in the local area, or obtain the advice of a reliable consultant who is familiar with market conditions and capable of evaluating the worth of standing timber.

There is little question that sawmill firms generally occupy a superior bargaining position when negotiating stumpage purchases from private forest owners. Sawmill operators have far more experience in evaluating the inherent worth of various sawtimber stands and they are more familiar with market conditions. Data presented earlier in this report indicated that sawmill firms that buy stumpage normally make from 5 to 20 stumpage purchases per year as well as numerous purchases from sawlog producers. On the other hand, several studies of landownership in the study region have indicated that private forest owners generally do not take an active interest in growing forest products for sale and that they make sales of sawtimber only at infrequent intervals (13, 63, 64, 72, 77, 101). Schallau's study of private forest owners in southern

Michigan, an area typical of much of the nine-state study region, revealed that, of the landowners he interviewed, only 9 percent had received more than one bid for the timber they sold (63). Furthermore, 55 percent admitted that they had no basis for determining the reasonableness of the prices they had received for stumpage. Although private landowners in the more densely forested areas of the study region may be better prepared to make intelligent decisions about the sale of sawtimber stumpage (64), it appears that, in general, sawmill firms have an advantage over most private owners in negotiating sawtimber purchases. The sample data provide some evidence of this:

Most common method of stumpage price determination	Percent of sawmills
Sawmill's offered price	60
Landowner's price	9
Negotiation	27
Sawmill's offered price and negotiation	3
Sealed or auction bid	1
	100

Since most stumpage purchases were made from privately owned land, the above data indicate that sawmill firms are generally able to set the price when buying sawtimber from private forest owners. This was found to be true for both the small-scale and large-scale sawmill firms in the sample. The situation is reversed, however, when buying sawtimber from public lands. Either the price is determined by competitive bidding among buyers or, as is the case in the more numerous small sales, the public agency sets the price on the basis of current market values.

Stumpage Purchase Contracts

A stumpage purchase contract is an oral or written agreement which specifies the terms of sale agreed to by the seller and buyer. The terms of sale usually differ considerably depending upon whether the contract is made with a public agency or a private landowner. In general, the terms of sale for stumpage purchased from public lands are specified by the seller and, except for the price, are usually not subject to negotiation. Each public agency (state and federal agencies in particular) uses a formal written document which always includes the species, sizes and quantity of timber to be cut, the method and time of payment, the length of time in which logging must be completed, and applicable logging restrictions (40). Public stumpage contracts normally require that partial or full payment be made in advance of cutting. The United States Forest Service, for instance, requires that buyers maintain a credit--either by cash payments or by credits for road construction and other improvements--equal to the value of the timber expected to be removed over a specified time period. Most public contracts require that all merchantable material be removed, and most are written for periods of less than one year. Other provisions which are usually specified include: restrictions on the use of equipment or logging layout, utilization to stated minimum top diameters, maximum stump heights, and provisions for imposing penalties for unauthorized cutting (40). These latter provisions are not normally included in stumpage contracts negotiated with private landowners.

Contracts for the purchase of stumpage from private landowners vary considerably in content but usually include only a few brief oral or written statements. Only a few minutes are needed to negotiate a stumpage purchase contract after the sawmiller has looked over the tract. The contract may be a simple statement of the amount received by the landowner for all the marketable timber on a given tract. The price to be paid, the method of payment, and the time of payment are almost always specified. In a number of cases, the price to be paid is not definite but is contingent upon "the going price" for stumpage or what the sawmill operator can get for the lumber. Some 80 percent or more of the contracts include some reference to the period of harvest and the species and size of timber to be cut. Other provisions, especially those regarding the conduct of logging operations, are usually "understood." That is, either the landowner informs the sawmiller what practices will be acceptable to him, or the sawmill operator assumes the responsibility of doing a good job.

Written agreements are used in the purchase of all stumpage from state and federal lands and for most of the volume purchased from private landowners. Of the volume purchased from private forest owners by sampled mills in 1960, 75 percent was acquired under written agreements. Large-scale sawmill firms generally bought a higher proportion of private stumpage under written agreements than did small-scale firms. Sawmill firms tend to use written agreements more frequently when buying large tracts. Therefore, in terms of the number of contracts negotiated, written agreements probably acounted for considerably less than three-fourths of the total. Studies of private landowners in the region have reported that written agreements are used in only about one-third of the stumpage sales made by private forest owners (13, 63).

The fact that the majority of private stumpage is bought under written contracts is not particularly significant in itself. In the first place, what is considered to be a written contract is subject to various interpretations. For example, one sawmill operator considered the notes which he had made on the back of a check used to pay for the stumpage as constituting a written agreement. Secondly, the provisions of written contracts differ very little from those of oral contracts in the vast majority of cases. The main difference between oral and written agreements is in their use. Of the sawmill operators who had used both written and oral agreements in 1960, about half of them reported that there was no difference between their written and oral stumpage contracts. Some 30 percent reported that they used oral stumpage contracts only when buying small tracts and when they knew and trusted the landowner. About 20 percent indicated that they used written agreements when buying by "the lump sum" or "boundary" and in other cases when partial or full payment is made before the logs are delivered to the mill. It is not uncommon, however, for sawmill operators to use oral agreements for lump sum purchases--even when payment is made in advance of harvesting. On the other hand, written agreements are often used with the more suspicious landowners. Nearly all sawmill operators will agree to use a written contract when it is demanded, yet many sawmillers look upon a written contract as an affront to their honesty.

Many stumpage contracts with private landowners contain both written and oral provisions. The written conditions usually include an acknowledgment of the fee paid or price to be paid, a description of the timber tract, and the size and species to be cut. The oral provisions usually cover questions of access and precautions to be taken while logging.

A detailed summary of the provisions included in stumpage contracts negotiated between sampled sawmill firms and private forest owners is given in Appendix C, Table 2. Following is a brief discussion of the provisions.

Species of timber.--The tree species to be cut is specified in nearly all cases. About half of all contracts give the buyer the right to cut all marketable species, whereas permission to cut only certain species is specified in about one-fourth of all cases.

Size of timber.--The size of timber to be cut is specified in nearly 90 percent of all stumpage contracts negotiated by sawmill operators. About two-thirds of all contracts stipulate a minimum stump diameter limit. The minimum stump diameter specified is usually the same for all species on a tract. In a few cases a minimum DBH is stipulated instead of a minimum stump diameter. In only one contract out of 10, the height to which trees are to be utilized is indicated by specifying a minimum top diameter.

Quality of timber.--The quality of timber to be cut is mentioned in only 12 percent of all stumpage contracts with private landowners. A few sawmill operators buy stumpage on the basis of log or tree grades. The sawmill operator usually applies his own grading standards.

Quantity of timber.--The quantity of timber to be cut is mentioned in about 70 percent of all stumpage contracts with private landowners. The majority of contracts are negotiated with the stated or implied provision that all marketable timber will be cut. The sawmill operator is usually given considerable leeway in deciding what is marketable. Buyers favor maximum flexibility on this point because of possible changes in lumber demand from the time of contract negotiation to the time of harvest. Occasionally a specific volume of certain species or a specific number of trees is mentioned.

Method of payment.--The method of paying for the stumpage is mentioned in nearly all contracts. About one-third of all sampled sawmillers buy only by the lump sum. Payment by the thousand board feet is normally used in about one-fourth of all cases, and some 25 percent of all sawmillers purchase both by the lump sum and the thousand board feet. A few sawmillers buy stumpage by the cord and a few pay for stumpage according to a fixed percentage of the gross revenue received from the sale of the lumber.

Time of payment.--Over 95 percent of all stumpage contracts between sawmillers and private landowners specify when payment is to be made. In the case of lump-sum purchases, total payment in advance of cutting is specified about as often as partial payment in advance. When stumpage is purchased on a per unit basis, partial payment in advance is specified somewhat more often than total payment during or after harvesting.

Place of measurement.--Nearly all stumpage contracts that specify payment on a per unit basis also specify the place where the timber is to be measured. About two-thirds call for the timber to be scaled at the mill.

Period of harvest.--In about 80 percent of all stumpage contracts with private landowners, a limit is imposed upon the amount of time the sawmiller has to harvest the timber. A time limit of one to two years is stipulated in about one-third of all contracts and from six months to one year in about one-fourth of all contracts. Occasionally the limit is set at more than two years, but rarely is it less than six months.

Logging provisions.--About 55 percent of the sampled sawmill operators normally include some provisions regarding how the logging is to be carried out. (See Appendix C, Table 3.) About 36 percent of the sampled sawmill operators agree to repair any damage to fences and gates. Some 23 percent also agree to repair damages to roads, waterways, and other property. Approximately 17 percent agree to clear slash away from roads and waterways, and 16 percent agree to the location of logging roads, to restrictions of travel across fields, and other reasonable restrictions on the use of logging equipment. Of those sawmill firms that do not regularly include logging provisions in their stumpage purchase contracts with private landowners, 72 percent are willing to agree to certain logging precautions at the landowner's request. The provisions which these sawmillers will accept are about the same as those which other sawmill operators commonly include in their stumpage contracts.

A certain amount of caution should be used if one tries to draw conclusions about cutting practices on the basis of the above stumpage contract provisions. In the first place, it appeared that respondents tended to give the impression that private forest owners received more favorable contract provisions than may actually have been the case. On the other hand, the above information may underestimate the quality of cutting practices because it may fail to include many cases in which provisions favorable to the seller are not explicitly stated but they are either understood to exist or are voluntarily provided by the sawmill firm as a regular business practice. Nevertheless, at least one conclusion appears justified. Most sawmill firms are willing to agree to a number of provisions designed to preserve the value and productive capability of the forest property. This conclusion is generally supported by the responses of sawmill operators to most of the above provisions, but of special significance is the fact that 87 percent of sampled firms indicated that they either included provisions governing the conduct of logging operations or would do so at the landowner's request. It would appear that unethical or destructive cutting practices are in large measure due to the failure of private forest owners to demand adequate safeguards and to supervise harvesting activities.

Diversity of Producer Operations

Most tracts of timber contain trees which are suitable for a variety of uses. Therefore, sawlog producers generally do not specialize in producing sawlogs but handle other timber products as well. Each timber product represented in sufficient quantity is usually segregated and sold as a separate commodity. When the volume of a particular timber product is too small to justify separate handling, it is commonly sold along with the predominant product, and it may be separated out later by the buyer for resale. Sawlog material is usually sold directly to sawmill firms, but sawlog producers often sell other timber products to dealers.

Only one-third of the sawlog producers in the sample specialize in producing sawlogs. However, sawlogs account for the largest volume of production for two-thirds of the producers and they rank either first or second in importance for over 95 percent of the producers in the sample. Pulpwood is the second most important product handled. It accounted for 35 percent of the total volume handled by sampled sawlog producers in 1960, as compared with sawlogs which represented 53 percent of the total. Other timber products handled by sawlog producers include: veneer logs, cooperage bolts, fuelwood, posts, poles, piles, and a few other minor products. The share of total production and the proportion of sampled sawlog producers who handled each product in 1960 is presented in the following tabulation:

	Percent of total production	Percent of producers
Sawlogs	53.1	100.0
Pulpwood	34.7	38.9
Veneer logs	8.1	21.2
Cooperage bolts	(	16.7
Fuelwood; miscellaneous	4.0 (	8.0
Posts, poles, or piles	0.1	5.4
	100.0	

The number and types of timber products handled by sawlog producers depend largely upon the characteristics of the timber in the producers' procurement areas. Differences among geographical areas in the types of products handled by producers are indicated by the following sample data. Over half of the producers in the three Lake States and Ohio produced pulpwood, as compared to less than one-fourth in the other states. Cooperage was handled by 20 percent or more of the producers in all states except the Lake States, where no producers handled cooperage. Less than 15 percent of the producers in the Lake States, Ohio, and Missouri handled veneer logs, whereas over 35 percent did so in the other states.

The volume of sawlogs handled by producers is by no means wholly determined by the characteristics of the timber resource. Other influential factors include: the level of demand for sawlogs, the relative prices of sawlogs and other timber products, the relative profitability of alternative employment opportunities, the supply of sawtimber, and logging and hauling costs. Sampled sawlog producers indicated that the following factors affected the volume of sawlogs handled:

	Percent of producers
Demand for sawlogs	56
Demand for other timber products	8
Alternative employment opportunities	16
Availability of stumpage	8
Effects of weather on logging conditions	13
Availability of woods workers	1
Volume of sawlog material in tracts purchased	8

The overwhelming importance of demand factors is evident. As was pointed out earlier, one of the reasons why sawmill firms acquire sawlogs from producers is to mitigate the undesirable effects resulting from variations in the derived demand for sawlog material and in the amount of sawtimber stumpage acquired by sawmills.

Part-time producers allocate their time between producing sawlogs and other means of employment depending upon the relative profitability of the competing activities. Producers often shift their efforts from one timber product to another if significant changes occur in the relative prices of the products. Many producers who concentrate on producing pulpwood switch to sawlogs when they have fulfilled their pulpwood quotas or are temporarily cut off by the pulp mills. As relative prices for timber products change, producers not only shift their emphasis from one type of stumpage to another, but substitutions of one timber product for another are also made in the utilization of the stumpage. For instance, if the price of sawlogs increases relative to the price of pulpwood, producers will sort out a greater proportion of the larger logs to be sold to sawmill firms. An opposite shift in prices will result in a higher proportion of logs of sawlog quality being sold as pulpwood.

Like sawmill firms, many sawlog producers are part-time operators. One-third of the sampled producers indicated that they typically operate only part of the year. Many part-time producers, as well as those that produce sawlogs year-round, have alternative sources of income. Of all the producers sampled, 59 percent work at other occupations or operate other business enterprises. The proportion of producers who have alternative sources of income decreases somewhat as the size of producer operation increases; yet 40 percent of the producers who sell more than 500 thousand board feet of sawlogs annually have alternative means of income. Unlike sawmill firms, the alternative source of income normally represents the largest share of the gross revenue received by part-time producers. About 40 percent of all sampled producers receive more than half of their gross revenue from alternative sources.

Farming is the most common alternative enterprise of part-time producers. As in the case of the combination farm-sawmill enterprise, a producer operation and farming are two compatible and often complementary enterprises. Some 32 percent of sampled sawlog producers are part-time farmers. Other alternative occupations, in decreasing order of occurrence, include: common laborer, owner and operator of stores and other businesses, contract logger, sawmill operator, and dealer in timber products.

In order to reduce their supervising activities and have more time to devote to other aspects of their producer operations or to other more profitable employment opportunities, a considerable number of sawlog producers subcontract part or all of their logging and hauling operations to other loggers. Producers may use subcontract arrangements regularly or periodically as needed. Approximately 19 percent of the sawlog producers in the sample subcontracted some logging in 1960, and 17 percent subcontracted some of their hauling operations. The proportion of the total volume of logging and hauling that was subcontracted amounted to 20 percent and 11 percent, respectively. Large-scale producer firms tend to subcontract logging more often than small-scale firms, but the contrary is true with regard to hauling.

Although the reduction of supervisory responsibilities is an important consideration, the primary reason producers give for subcontracting logging operations is that subcontracting is cheaper than doing their own logging. Producers often find it cheaper to subcontract logging or hauling during periods of high demand rather than to increase the size of their own logging crews. The lack of necessary transportation equipment is the most common reason given for subcontracting hauling. Many small producers handle such a small volume that it is cheaper for them to subcontract their hauling requirements rather than operate their own trucks.

Stumpage Procurement by Sawlog Producers

Sawlog producers supply approximately half of the sawlog material used by sawmill firms in the North Central Region. Nearly all of the sawlog material handled by producers is acquired through stumpage purchases.

Methods of Stumpage Acquisition

Sawlog producers are generally of two types: part-time producers who obtain almost all of their sawtimber from their own land, usually operate on a small scale and normally receive a minor share of their income from producing timber products, and full-time or part-time producers who acquire most of their sawlog requirements through stumpage purchases. The former group consists mainly of landowners who sell sawtimber periodically and, instead of selling the timber on the stump, they perform the harvesting and often the hauling operations themselves. The primary incentives for doing their own logging and hauling are to increase the total net income (including payments for their own labor) received from the timber and occasionally to gain access to a more favorable market outlet. The second group of producers are more numerous and account for the vast majority of the sawlog volume handled by producers in the study region.

Sawlog producers depend somewhat more heavily than sawmill firms on farm woodlots and other private holdings for their saw-timber supply. As shown in the following tabulation stumpage parcels acquired by sampled producers in 1960 contained an average of 31 thousand board feet of all timber products combined. Unlike sawmill firms, however, large-scale producer firms bought larger stumpage parcels on the average than did producers operating on a smaller scale. Another interesting contrast between sawmill firms and producers is that large-scale mills make from three to four times as many stumpage purchases as small-scale mills, whereas the largest producer firms on the average make fewer purchases than most smaller producer firms. The most likely explanation for this is the fact that large-scale mills depend on producers for about half of their sawlog requirements. The stumpage procurement activities of these mills are often directed to finding the more valuable species and quality classes which, as a general rule, occur in small groups. On the other hand, dealing in a few, relatively large timber tracts is apparently one of the factors which make it possible for producer firms to operate on a large scale.

Producer size class	Average volume per stumpage purchase: Sawlogs	Average volume per stumpage purchase: All timber products	Average number of stumpage purchases
(M bd.ft.)	(M. bd.ft.)		
1 - 49	4.7	22.0	5.8
50 - 149	9.3	19.5	9.1
150 - 499	23.9	37.1	11.0
500 or more	107.1	112.8	6.4
Total	18.4	31.3	8.3

Wood procurement methods used by sawlog producers follow the same pattern as those used by sawmill firms in acquiring stumpage. Purchases of private stumpage are almost always negotiated by a face-to-face encounter with the landowner at the location of the timber tract. Sawtimber from public lands is acquired either by bidding in competition with other buyers or by bilateral negotiation with the public agency. Like sawmill firms, sawlog producers rely almost entirely on personal contacts in locating potential stumpage sellers. Nearly three-fourths of the sampled producers reported that they contacted forest owners only by personal visits or by telephone. Nearly 20 percent indicated that they infrequently took the initiative in contacting stumpage sellers and had no policy in this regard. Slightly over 10 percent made contacts through the mail and not over 3 percent advertised for stumpage in newspapers or by radio. None of the sampled producers paid commissions to persons who informed them of potential stumpage purchases and none hired stumpage buyers. Producers took the initiative in contacting stumpage sellers in slightly over half of the contracts negotiated.

Since producers are almost wholly dependent upon sawmill firms for the resale of the sawlog material they buy, it would be reasonable to expect producers to make resale arrangements with sawmills prior to making stumpage purchases. Nevertheless, approximately 80 percent of the sampled producers reported that they normally had no resale agreements with sawmill firms prior to executing stumpage acquisitions. This discovery is not surprising, however, under conditions of a generous supply of individuals willing to produce sawlogs. Unless the sawmill's requirements with regard to species and grade are not very restrictive, the sawmill operator would generally have to inspect each timber tract before agreeing to buy the logs from the producer. This would, of course, add to the sawmill firm's procurement costs. Resale agreements would also tend to decrease the sawmill operator's flexibility with regard to taking advantage of stumpage offerings himself and the offerings of other sawlog producers. As long as there is an abundant supply of sawlogs offered by producers, there is little incentive for sawmill operators to make resale arrangements with producers except when they are especially interested in retaining the services of a particular producer or obtaining the timber from a certain tract. Another reason why resale agreements for sawlogs are not very common is that sawlog material is only of secondary importance to about one-third of the sampled producers. Sawlog material represents only a minor share of the total volume contained in many of the tracts acquired by these firms. In these cases, producers are primarily concerned with securing market outlets for the most important timber products contained in the tract and may give little consideration to the possible markets for the sawlog material. Although most sawlog producers do not make resale agreements with sawmill firms before negotiating stumpage purchases, they commonly consult with sawmill operators before making stumpage purchases in order to find out the probable prices and the amounts that might be demanded of the kind of sawtimber they anticipate buying.

As a general rule, sawlog producers do not try to maintain a backlog of purchased stumpage. Whereas sampled sawmill firms used lump-sum arrangements for a majority of their stumpage purchases, sawlog producers made arrangements for payment on a per-unit basis for most of the tracts they bought. Sampled producers usually paid the landowners for the stumpage after the logs had been resold to a sawmill firm or other buyer. So as not to run out of stumpage, most producers negotiated purchase agreements from two to six weeks in advance of the time they planned to initiate logging operations. It appears likely that one of the reasons sawlog producers make relatively fewer stumpage purchases on a lump-sum basis than sawmill firms is that producers are generally weaker financially. Producers also face a more uncertain demand for their sawtimber stumpage than is the case with sawmill firms. For instance, during short-run periods of depressed prices for sawmill products, sawmill firms may discontinue buying sawlogs from producers and rely solely on stumpage purchased at a previous date because, in the short run at least, this stumpage represents a source of "free" raw material. Also during the periods of depressed product prices and reduced sawmill output, many sawmill firms, small-scale firms in particular, switch to doing more of their own logging and hauling to keep from laying off their own employees and possibly losing them to other employment opportunities.

Except for the differences noted above, the competitive relationships between sawlog producers and forest landowners are about the same as those between sawmill firms and forest landowners. Because most private forest owners have little understanding of market conditions for sawtimber stumpage, there is reason to believe that sawlog producers, like sawmill firms, generally have an advantage over private forest owners in negotiating sawtimber purchases.

Stumpage Purchase Contracts

Stumpage purchase contracts negotiated between sawlog producers and forest landowners are very similar in form and content to those used by sawmill firms. Contracts for the purchase of public stumpage are formal, written documents. They are more detailed than agreements with private landowners, and the provisions are usually specified unilaterally by the public agency concerned. Stumpage contracts negotiated with private landowners are usually brief, do not follow a standardized form, and normally contain only a few oral or written statements concerning the price or fee to be paid, the basis for payment, the time of payment, and the species, size, and quantity of timber to be cut.

Only about one-third of the volume purchased by sampled producers from private landowners in 1960 was bought under written agreements. In contrast, sampled sawmill firms bought about three-fourths of their private stumpage under written agreements. The main reason for the difference is the fact that sawmill firms buy a much higher proportion of private stumpage on a lump-sum basis than do sawlog producers. Since lump-sum payments are usually made in advance of harvesting, buyers normally require a written contract showing the amount received and describing the timber to be cut. As noted in the case of sawmill firms, the main difference between written and oral contracts is not in the provisions they contain but in the types of circumstances under which they are used. Producers use oral agreements as a rule, but written agreements are usually used when total or partial payment for the stumpage is made in advance of harvesting, when the landowner is not trusted, at the landowner's request, or in order to gain the confidence of a suspicious forest owner.

A brief description of the provisions included in stumpage purchase contracts negotiated by sawlog producers with private landowners is given below. A detailed outline of the provisions is given in Appendix C, Table 4.

Species of timber.--Nearly 90 percent of contracts make some mention of the species of trees to be cut. About half of the contracts call for the cutting of all marketable species and about one in four specifies the particular species to be cut.

Size of timber.--The size of timber to be cut is indicated in about 80 percent of all contracts. A minimum stump diameter, usually 11 inches or more, is by far the most common way of specifying the size of trees to be harvested. Slightly over 10 percent of the producers usually stipulate both a minimum stump diameter and a minimum top diameter. Producers that normally buy pulpwood usually agree to take all trees with at least two bolts which have a minimum top diameter of 4 to 5 inches.

Quality of timber.--As is the case with sawmill firms, nearly 90 percent of the stumpage contracts negotiated between sawlog producers and private landowners make no mention of timber quality. It is always explicitly or implicitly agreed that cull trees are not to be included in the timber to be purchased.

Quantity of timber.--This provision is usually included; the majority of contracts mention that all marketable volume is to be taken. For purchases made on a lump-sum basis, the quantity of timber to be cut is not usually mentioned explicitly, but it is ordinarily understood that all marketable trees will be taken. In most cases, the landowner has little influence in deciding what is marketable. Marketable trees are defined as those which the producer can resell to sawmills and other buyers. Thus, the marketability of the different species, sizes, and grades of sawtimber changes with fluctuations in the demand for sawlogs of various characteristics.

Method of payment.--Agreement on the method of payment is almost always decided before the landowner consents to a stumpage sale. About half of the sampled producers pay for stumpage only on the basis of the measured volume of timber in thousands of board feet. Fewer than 15 percent use lump-sum purchases exclusively. Most of the remainder use both methods and a few pay on the basis of the standard cord and other units of measure.

Time of payment.--When payment is made on the basis of the measured volume of timber cut, landowners are usually paid in installments as the producer receives payments from the sawmill operator, or a single payment for all the timber cut is made after the harvesting has been completed. In some cases, a down payment is made in advance of harvesting. When stumpage is bought on a lump-sum basis, it is almost always paid for in total before logging is begun.

Place of measurement.--The place at which the timber is to be measured is usually specified when payment is made on the basis of the measured volume of timber cut. It is not surprising that most contracts call for measurement to be made at the sawmill since landowners are often paid on the basis of the sawmiller's scale.

Period of harvest.--The period allowed for harvesting the timber is stipulated in only 60 percent of the contracts. Of the contracts that specify a time limit, most allow between six months and two years. When a time limit is not specified it is usually understood that logging will be completed within a reasonable length of time--normally less than a year.

Logging provisions.--About the same proportion of sampled producers (49 percent) as sampled sawmill firms normally include some provisions which govern the conduct of logging operations on timber tracts purchased from private owners. About one-third of the producers regularly agree to repair any damage done to fences, and about one-fifth also agree to repair damage to roads, waterways, and other property. Between 5 and 15 percent of the producers also agree to exercise care to preserve growing stock, to clear slash from roads, boundaries, and fields, and/or to abide by landowners' restrictions on the location of logging roads and the use of logging equipment. (See Appendix C, Table 5 for details of provisions.) About 65 percent of the producers that do not normally include provisions governing the conduct of logging operations indicated that they would accept certain provisions at the landowner's request. The provisions that would be acceptable are about the same as those which other producers commonly include in their stumpage contracts.

Minimum Logging Chance

It is generally accepted that one of the major factors which hinders the practice of profitable forest management on most private forest landownerships is the small size of these ownerships. Part of the reason why profitable forest management is not practiced is that logging costs are greater on these small woodlots because more-efficient large-scale logging methods are precluded and fixed costs are spread over a small volume of production. The small tracts are also unappealing to many buyers who are looking for large volumes of particular species and quality classes. To gain some idea of the effect which the amount of stumpage offered for sale has upon the number of buyers willing to bid for the sale, producers were asked if there was a minimum volume of timber which a tract must contain before they would be interested in buying it. In addition, to gain some understanding of the effect which low stand density has upon the marketing potential of sawtimber tracts, producers were also asked if a tract had to contain at least a certain minimum volume per acre. The proportion of sampled producers who reported that sawtimber tracts must contain some minimum total volume or minimum volume per acre is listed by size class of producer in the following tabulation:

Producer size class	Minimum volume per tract	Minimum volume per acre
(M bd.ft.)	(Percent of producers)	
1 - 49	45	35
50 - 149	53	40
150 - 499	51	36
500 or more	72	61
All producers	51	39

It is almost incredible that no more than about half of the sampled producers indicated that they would buy only tracts which contained at least a certain minimum volume and that only 39 percent limited purchases to tracts containing at least a certain minimum volume per acre. Based on the above tabulation, it might appear that large-scale producer firms tend to be somewhat more selective than producers operating on a smaller scale with regard to minimum volume requirements of stumpage parcels. However, the reported minimum volume requirements per tract or per acre did not vary significantly among the size classes of producer firms. In spite of the fact that no more than half of the sampled producers indicated that they limited stumpage purchases to tracts containing at least a certain minimum total volume or minimum volume per acre, it appears very likely that all producers have minimum volume requirements, but many of them regard their minimum requirements as being so low as to represent no minimum at all. At the very least, it seems unquestionable that a stumpage parcel would have to contain at least one truck load in order to attract any buyers.

Of those producers who reported minimum volume requirements, half indicated that tracts must contain a minimum total volume of from 1 to 8 thousand board feet. As shown in the tabulation below, minimum volume requirements per tract as high as 225 thousand board feet were also reported. Producers were in much closer agreement regarding the minimum volume required per acre. Half of the sampled producers reported minimum requirements per acre of from 200 to 1,500 board feet.

	Mean	Median	Range
		(M bd.ft.)	
Minimum volume per tract	21.0	8.0	1.0-225.0
Minimum volume per acre	1.8	1.5	0.2- 8.0

In view of the above information, it would appear that most producers would not refuse to bid on most sales offered by private forest owners because of insufficient total volume or insufficient volume per acre. This does not mean, of course, that the size of the sale or the density of the sawtimber on the tract would not affect the prices that producers would be willing to pay.

Marketing Relationships between Producers and Sawmill Firms

Under the existing conditions of easy entry into the market, virtually no product differentiation based on characteristics induced by buyers or sellers, and a large number of buyers and sellers, keen price competition is the dominant behavioral characteristic of the market. Arrangements between sawmill firms and sawlog producers to coordinate their activities or cooperate in achieving mutually rewarding goals are not uncommon but, at best, they are poorly developed. In general, transactions between producers and sawmill firms are carried out in an atmosphere of informality, characterized by face-to-face negotiations and with business being conducted mainly by means of oral agreements.

The large number of sellers in the market is illustrated by the tabulation presented below. Seventy percent of the sawmill firms sampled bought some of their sawlog requirements from producers. Of these firms, small-scale firms bought from an average of 9 producers each and large-scale firms from 22 producers each in 1960. The average amount purchased from each producer was rather small and represented only 8 percent and 3 percent, respectively, of the total volume acquired on the average by each small-scale and large-scale mill in 1960.

Sawmill size class	Number of producers per mill		Average volume per producer
	Mean	Median	
(M bd.ft.)			(M bd.ft.)
100 - 500	9	6	17.2
500 or more	22	15	43.3

Sawlog producers appear to be somewhat more restricted in their choice of market outlets for sawlogs than sawmill firms are in their choice of suppliers. Sampled producers, for instance, sold on the average to only 2 sawmills each. Nearly half of the sawlog producers sold to only one sawmill each and about 70 percent sold to no more than two each. In comparison, less than 15 percent of the small-scale mills and less than 10 percent of the large-scale mills bought from only one producer each. Large producer firms generally sold to a greater number of sawmills than smaller producer firms. For example, nearly two-thirds of the producers that sold less than 50 thousand board feet of sawlogs sold to only one sawmill each, whereas only about one-third of the producers that sold more than 500 thousand board feet sold to only one sawmill each. In addition to sales to sawmill firms, about 9 percent of the sampled producers sold sawlogs to other market outlets such as concentration yards, dealers, farmers and other noncommercial buyers. These outlets accounted for only 3 percent of the total sawlog volume sold by sampled producers in 1960. In addition to sawlogs, two-thirds of the producers handled other timber products, nearly the total volume of which was sold to buyers other than sawmill firms. These other buyers represent potential market outlets for sawlog material since a certain amount of substitution occurs between sawlogs and other timber products.

In general, marketing arrangements between sawmill and producer firms are concerned only with the short-run demand situation of the sawmill firm or the short-run supply situation of the producer. Very few marketing agreements involve any long-term commitments between producers and sawmill firms. Nearly all sale agreements are concerned only with the exchange of a particular lot of sawlogs. They are usually negotiated for an estimated volume which a producer has to sell, the volume in a particular tract of timber purchased by a producer, or a portion of a sawmill firm's sawlog requirements for a period of several days to two weeks. Many transactions involve only a single load of sawlogs.

The almost total lack of long-term marketing agreements between sawmill and producer firms is probably due largely to the highly elastic supply of sawlog material. Under conditions of elastic supply, sawmill firms can easily fulfill their requirements for sawlogs by small price increases or simply by increasing individual producer allotments. Avoiding long-term commitments to producers allows sawmill firms to cut off sawlog purchases from producers during periods of depressed product demand. That the supply of sawlog material is highly elastic is suggested by the structural characteristics of the supply side of the sawlog market, in particular, the ease with which prospective sawlog producers can enter the market. Some evidence that sawlog supply is elastic is provided by the responses of producers concerning the factors that affect the volume of sawlogs they produce. About 56 percent of the producers in the regional sample reported that production depended on the demand for sawlogs. The supply of available stumpage was mentioned only occasionally. In the survey of producers in Michigan, special attention was given to determine whether it was the quantity demanded or the level of sawlog prices that influenced the output of sawlogs by producers. Forty percent of the producers reported that the quantity of sawlogs demanded determined the volume they produced, whereas 21 percent mentioned both the level of sawlog prices and the quantity demanded. Nearly all of the producers in the first group indicated that they would have increased their volume of production had the quantity of sawlogs demanded increased without an increase in price. In view of the structural characteristics of the market and the responses of producers in the Michigan sample, it seems very likely that the supply of sawlog material by producers is very elastic.

Other factors which tend to disrupt the coordination of marketing activities and discourage long-term marketing agreements between producers and sawmill firms include: (1) variable weather conditions preclude continuous sawlog deliveries; (2) many firms discontinue or reduce their sawmilling or producer operations according to different schedules while pursuing alternative employment opportunities; (3) the highly variable demand for some sawmill products makes it difficult for some mills to predict their sawlog requirements; (4) the supply of sawtimber is not a continuous flow and producers may be without stumpage at various times; and (5) forest stands are not homogeneous, so that even if a producer has a marketing agreement with a sawmill firm, from time to time he very likely will buy some timber tracts from which most of the sawlog material is unsuitable for the sawmill's needs.

Sawlog Procurement Methods and Contracts

Full-time sawlog producers generally maintain contact on a day to day or weekly basis with several sawmill firms within their respective areas of operation. Except for mills that are intermittently out of touch with the sawlog market, sawmill operators do not normally have to seek out producers. However, of the sampled sawmillers who bought sawlogs, about 10 percent advertised in newspapers and occasionally contacted producers by mail. Only four sawmill operators, less than 2 percent of those that bought sawlogs, employed a full-time or part-time buyer.

Nearly 40 percent of the total volume of sawlogs purchased by sampled mills in 1960 was bought without making purchase agreements with producers prior to sawlog delivery. Most of this volume was probably made up of transactions between producers and sawmill operators who did business with each other on a regular basis but did not exchange commitments to buy or sell other than what was delivered to the mill each day. About half of the producers in the sample indicated that they normally had no sale agreements with sawmill firms before they made sawlog deliveries. On the other hand, about half of the producers reported that they usually had oral or written sale agreements with sawmill firms before sawlogs were delivered. Sampled sawmills purchased approximately half of their sawlog requirements under oral contracts and only 12 percent under written contracts. Five large firms accounted for most of the volume purchased under written agreements. Only 6 percent of the mills that bought sawlogs in 1960 used written sawlog contracts. Only 2 mills--both small-scale mills--acquired all of their sawlog supply under written contracts. Although sawlog contracts help to coordinate the activities of producers and sawmill firms to a certain extent, both parties often fail to abide by the provisions of the contracts. In nearly all cases, sawmill operators and producers do not consider either oral or written sawlog contracts to be legally binding.

The majority of sawlog contracts involve a few explicit conditions and several more understood or implicit conditions. Over 85 percent of sawlog purchase contracts mention the price to be paid, the species and sizes that will be purchased, the basis of measurement, and the time of payment. The price to be paid is quite often the only thing mentioned in purchase agreements with regular producers who are familiar with the sawlog requirements and procurement policies of the sawmill operator. Although price is always mentioned, the sawmill operator does not always agree to pay a specific price. Sometimes the price to be paid is contingent upon the grade recovery of the lumber which can be sawn from the logs and the market price for lumber at the time the lumber is sold.

A brief discussion of the provisions ordinarily included in sawlog purchase agreements between sawmill firms and sawlog producers is given below. The contract terms represent not only the provisions included in purchase agreements made between producers and sawmill firms but also the requirements imposed by sawmill firms that buy sawlogs without making any actual purchase agreements with sawlog producers. A detailed outline of the provisions is presented in Appendix C, Table 6. The table is incomplete to the extent that it does not include many standard or implicit conditions which were not always mentioned by the sawmill operators in the sample. The more important of these conditions are included in the following discussion.

<u>Species of sawlogs</u>.--The species of sawlogs that will be bought is mentioned in most contracts. The majority of agreements indicate that only certain species will be purchased. A few sawmills will buy all species except certain specified species.

<u>Size of sawlogs</u>.--Almost all purchase agreements specify the size of sawlogs that will be accepted. A minimum top diameter is nearly always mentioned. In addition, a minimum log length--commonly 8 feet--is usually mentioned or at least understood to apply except in the case of some pallet and container mills that use a bolter saw. These mills commonly specify exact lengths ranging from 3 to 8 feet and a maximum log diameter. A number of sawmills--mainly hardwood-grade mills--will accept only a limited number of 8-foot logs. Many pallet and container mills change their specifications

for log lengths quite often to conform with changes in demand for different sizes of pallets, boxes and crates.

Quality of sawlogs.--Only one-third of all sawlog purchase contracts mention sawlog quality. Nevertheless, most sawmill operators do have a policy of not accepting logs below a minimum quality standard. This policy is understood and adhered to by producers. A higher proportion of softwood-lumber mills and hardwood-grade mills specify the quality of logs they will accept than do other mills. About 12 percent of all sawmill operators buy sawlogs according to log grades. The grading of sawlogs is most common among mills that produce mainly hardwood grade. The sawmiller usually uses his own grading standards.

Quantity of sawlogs.--The volume of sawlogs to be purchased is included in slightly less than half of all sawlog contracts. The quantity of sawlogs that will be purchased is specified more frequently when there is an oversupply of sawlogs. Of those sawmill operators that regularly specify the volume they will buy, most of them agree to buy a specific volume from a producer, or a certain portion of the volume from a tract which a producer has purchased. Less than 3 percent of the sampled sawmill firms agree to buy a periodic quota of sawlogs.

Basis of measurement.--All contracts, except those with producers who are familiar with the procurement policies of the sawmill operator, indicate the unit of measure to be used. More than half of all sawlog contracts indicate that sawlogs are to be measured by one of the accepted log rules. Approximately one-fifth of the sawmill operators buy sawlogs on the basis of lumber scale.

Some use the standard cord and some pay on the basis of the number and size of railroad ties yielded. A few pallet and box mills use a face cord in buying bolts. Doyle is the rule used most frequently, followed in decreasing order of importance by Scribner or Scribner D.C., International, Minnesota Standard, and others.

Time of delivery.--The timing of deliveries is mentioned in only slightly more than one-third of all sawlog purchase contracts. However, most sawmill firms negotiated sawlog purchases within two weeks of expected delivery. The short time interval between contract negotiation and sawlog delivery is due partly to the eagerness of producers to deliver the sawlogs as soon as possible and partly to the short planning horizons of sawmill operators. The timing of deliveries is usually not specified unless the sawmiller is in urgent need of sawlogs. When the timing of deliveries is specified it is usually done to encourage producers to increase their immediate deliveries of sawlogs. A schedule of sawlog deliveries on a weekly or monthly basis is hardly ever used.

Time of payment.--Most contracts indicate the time at which payment for the sawlogs is to be made. This provision is usually accepted as standard operating procedure in sawlog contracts with regular producers. Most sawmill firms pay for logs after they are delivered and payment is usually made once each week. It is not unusual, however, for producers to have to wait two or three weeks or until the logs are sawn before they are paid. A few sawmillers regularly agree to pay for part of the sawlogs before delivery.

Logging provisions.--In addition to specifying the conditions of exchange between the producer and the sawmill firm, about 6 percent of the sawlog contracts go even further and prescribe certain logging practices which producers are to follow. Some of the logging provisions prescribed are directed to the conservation of the timber resource. Other provisions prescribe the proper method of bucking logs in order to obtain the highest grade and value yields. Nearly all of the firms that prescribe logging provisions produce more than one million board feet annually. In view of the general attitude of sawmill firms and producers regarding the enforceability of sawlog contracts, it is highly questionable whether a serious attempt is made to enforce logging provisions designed to conserve the forest resource.

Cooperative Arrangements between Sawmill and Producer Firms

Even though marketing agreements between sawmill and producer firms are usually concerned only with the exchange of a specific lot of sawlog material, cooperative arrangements are not uncommon. There are four general patterns of cooperation: sawmill operators may agree in advance to buy all or part of the sawlog material contained on timber tracts purchased by producers; sawmill firms may make advance payments on sawlogs or loan funds to be used by producers to buy stumpage or cover other expenses; other arrangements may be made for the acquisition of stumpage to be resold to sawmill operators; and sawmill firms may offer other business aids to producers.

Only 20 percent of the sampled sawlog producers reported that they usually had resale agreements with sawmill firms prior to buying timber tracts. These resale agreements, which generally represent nothing more than an indication of what sawmill firms might be willing to buy, were discussed at some length earlier in this chapter and are not given further consideration here.

Sources of credit are severely limited for nearly all producer firms. Some producers, especially those that have rather large, financially sound operations, are able to obtain financing from sawmill firms. Sawmill operators are willing to loan or advance money to producers in order to get sawlogs during periods of critical need, to keep producers going in order to recapture past debts, and occasionally to keep a good producer in business. Most loans are made not so much to help the producer as to obtain stumpage for the mill in the producer's name. In nearly all cases, producers are not charged interest on loans or advance payments received from sawmill operators. It should be kept in mind that the extension of credit is not only in one direction--from sawmill firm to the producer. It is not at all uncommon for producers to have to wait several weeks before receiving payment for sawlogs delivered to sawmill firms.

The following tabulation shows that about 10 percent of the stumpage purchased in 1960 by sampled producers was financed by sawmill firms and other sawlog buyers. Slightly less than 10 percent of the producers had received funds from sawlog buyers to finance stumpage purchases or to cover other expenses. The proportion of producers who had received financing from buyers was somewhat greater for large-scale producer firms than for producers operating on a small scale. About 18 percent of the sampled sawmill operators reported that they regularly made loans or advance payments to producers. Another 26 percent reported that they did so occasionally. There was little difference between small-scale and large-scale sawmill firms with regard to the proportion that extended credit to producers. Approximately half of the sawmill operators reported that they limited their loans or advances to $400 for each producer. The average size limitation reported by small-scale mills was about $450 and for large-scale mills it was about $1,500. These two dollar limits represent the maximum amount of credit that would be extended, on the average, to reliable producers under good business conditions. The average size of loan and advance payment is of course smaller. Furthermore, sawmill operators generally can not afford to loan up to the maximum to all their producers at one time.

Source of sawlog material acquired by producers in 1960	Percent of volume	Percent of producers
Producer's own land	6.2	24.0
Stumpage purchased by producer:		
Without buyer financing	77.2	79.8
Financed by sawmill firms or other buyers	9.5	9.0
Stumpage purchased in producer's name by sawlog buyer	5.3	2.6
Stumpage sold to producer by sawlog buyer	1.8	2.6
	100.0	

The above tabulation also reveals other ways in which sawmill firms cooperate with producers in the acquisition of sawlog material. As indicated above, about 7 percent of the stumpage acquired by sampled producers was either purchased by sawmill firms or by other buyers and resold to producers with the agreement that they would in turn resell the material as delivered sawlogs to the original buyer, or it was purchased in the producer's name by a sawlog buyer under an agreement that it would in turn be resold as delivered sawlogs to the original buyer. No more than 5 percent of the sampled producers had entered either type of arrangement with sawlog buyers in 1960. One of the most important reasons sawmill firms make these kinds of arrangements is to avoid workmen's compensation insurance and other responsibilities they would incur if they operated their own logging crews.

In addition to offering loans and advance payments to producers and other forms of cooperation in the purchasing of stumpage, about 10 percent of the sawmill operators in the sample reported that they regularly offered other business aids to producers. However, less than 2 percent of the sampled producers reported receiving any such business aids from sawlog buyers. The most common type of business aid extended to producers is the lending of logging equipment. A few sawmill firms sell logging equipment and parts to producers at cost, provide logging equipment on a rental basis, advise producers on where to buy and what to pay for stumpage, or build logging roads for producers.

Altogether, the extension of credit by sawmill firms to producers and other forms of buyer financing of stumpage acquired by producers accounted for approximately 17 percent of the sawlog material handled by sawlog producers and about 8 percent of the sawlog material acquired by sawmill firms in 1960. At most, no more than 20 percent of the sawmill firms or sawlog producers engaged regularly in any of the above four types of cooperative arrangements.

In general, marketing agreements between sawmill and producer firms do not go beyond a description of the conditions of exchange for individual lots of sawlogs.

Pricing

Sawlog prices, like stumpage prices, are generally determined separately for each transaction through the bargaining of individual buyers and sellers. Pricing decisions are based primarily upon the estimates of market price held by producers and sawmill operators. Rough estimates of the "in-use" value of the sawlog material to sawmill firms and of the total per-unit costs incurred by sawlog producers generally serve as the upper and lower limits of an acceptable price. Sources of price and other market information are limited almost entirely to contacts between individual market participants. Separate prices are usually established for each species, and prices generally vary from one lot of sawlogs to the next depending on the quality of sawlogs in each lot. (An individual lot of sawlogs normally consists of the sawlog material cut from a particular tract of timber purchased by a producer.) In some cases, prices may be based upon the average quality of sawtimber in the procurement area, but usually they depend upon the average quality of the logs in the particular lot offered for sale. Few sawmill firms pay separate prices for each grade class. For example, only 12 percent of the sampled sawmill firms regularly bought sawlogs on the basis of log grades. Whereas most sawmill firms take species and average quality into consideration when pricing sawlogs; firms with relatively nonspecific sawlog requirements, such as producers of pallets, boxes and crates, pallet material, crating, and low-grade construction lumber, pay little attention to sawlog quality or species. Although these firms commonly accept the more valuable species and sawlogs of high quality, they often do not pay a price differential for them.

Most of the sawlog material purchased from producers is priced f.o.b. mill. The vast majority of sawmill firms are apparently able to meet their needs for sawlogs without paying a price differential for logs hauled over longer distances. Price differentials based on hauling distance and other price or nonprice concessions to draw raw wood material supplies from greater distances are commonly used by pulp mills in the study region (40) and in other parts of the country. Pulp mills grant these concessions in order to uphold the long-run sustained yield capacity of the nearby forests, to acquire and maintain contacts with more distant suppliers in order to facilitate eventual expansion of mill capacity, and to combat the expansion of competing mills. Sawmill firms, most of which have short planning horizons and are too small to have an appreciable effect upon the sawlog supply of mills located in adjacent timbersheds, generally lack these incentives. However, a few sawmill firms (7 percent of those sampled) pay a bonus for logs hauled from more distant points. Ordinarily, bonuses are paid only for the more valuable species and the higher grades of sawlogs.

Some indication of the relative bargaining power held by producers and sawmill firms is given in the following tabulation:

Most common method of price determination	Purchases from producers	Purchases from landowners
	(Percent of mills)	
Sawmill's price	89	60
Producer's or landowner's price	1	9
Negotiation	8	27
Sawmill's price and negotiation	2	3
Sealed or auction bid	--	1
	100	100

Methods of price determination are compared in the above tabulation for transactions between sawmill firms and producers and between sawmill firms and stumpage sellers. The data are based upon the responses of sawmill firms when asked how prices were normally determined. It is apparent that in most cases producers accept the prices offered by sawmill operators. The fact that negotiated prices are more common in the purchase of stumpage does not necessarily mean that landowners generally hold more bargaining power than producers in dealing with sawmill firms. Sawlogs represent a more precisely defined product than stumpage and thus there is less room for disagreement regarding the species, size, and quality composition of the material. Transactions between sawmill and producer firms are far more numerous than between sawmill firms and landowners. Thus, in the first case, the two parties have a much closer understanding of market price than in the second case.

Stumpage sellers are far more ignorant than sawlog producers of their product and marketing practices; they are, therefore, more inclined to dispute offered prices. The greater reluctance of forest owners to accept offered prices may be entirely rational, since sawmill firms, in light of the presumed ignorance of stumpage sellers, may tend to offer relatively lower prices for stumpage than for sawlogs purchased from producers. The fact that stumpage is commonly purchased on a lump-sum basis has apparently little relationship to the method of price determination. Of the sawmills sampled, the method of determining stumpage prices was about the same for sawmill firms that normally purchased stumpage on a lump-sum basis as for those that usually made payment based on the volume of timber cut. These arguments do not dispel the possibility that bargaining-power relationships between producers and sawmill firms are different than those between sawmill firms and stumpage sellers. Perhaps the greatest value of the foregoing discussion is that it points out the weakness of the above measure of bargaining power.

Although the above indication of relative bargaining power is admittedly weak, there are reasons to believe that sawmill firms generally occupy a superior bargaining position in dealing with sawlog producers. In the first place, sawlogs are almost always sold on the basis of the sawmill operator's tally of volume. Producers can, of course, scale the logs before delivery is made, and often they are able to check on the sawmill operator as he does the scaling. Judging from the number of complaints lodged by sampled producers, however, it would appear that sawmill firms normally win out in disputes about the scale. The fact that sawmill firms have determination over scaling represents more of an advantage than may be apparent at first glance. There are at least eleven different log rules or other measures of sawlog volume which are commonly used in the study region. This diversity in measuring standards puts sawlog producers at a disadvantage in dealing with sawmill firms that use an unfamiliar standard of measure. Another equally important problem for sawlog producers is the fact that a particular log rule is not applied in the same way by all sawmill operators. In using the Doyle rule, for example, some firms may include both barks, some may include only one bark, and still others may not include either bark. Deductions for cull and crook are based solely on the subjective judgment of the scaler.

Although differences in the way log rules are applied may be reflected in the prices offered, it would seem that sawmill firms have an advantage over producers in determining what price differentials are needed to offset differences in the application of the log rules. The advantage held by sawmill operators is perhaps at its greatest when logs are purchased on the basis of a log-grade tally. Most sawmill firms use their own log-grading rules. Consequently, it is very difficult for producers to make comparisons among sawmills of prices quoted on the basis of log grades.

A second advantage which sawmill operators most likely have over producers is a greater ability to accurately evaluate sawlog quality. Sawmill operators have the advantage of seeing what sawlogs yield after they have been sawn, and therefore they are able to more accurately correlate the exterior appearances of the sawlog with the quality of material it will yield. Another factor which affects the competitive relationship between sawmill and producer firms is the fact that many sawmill firms have their own logging crews and can elect to do their own logging if prices demanded by producers are too high. Sawmill firms also have the alternative of hiring contract loggers.

CHAPTER 7

SAWLOG PRICES AND PRODUCTION COSTS

An attempt was made to determine the costs and profit margins involved in producing sawlog material and to evaluate the profitability of this operation. The information that could be obtained for such an analysis was very limited. Very few sawmill or producer firms had any records of logging or hauling costs or of prices they had paid for stumpage or received for the sawlog material they had produced. Nearly all price and cost data acquired for this study were based upon the recollections and estimates of the interviewees. Aside from the fact that most firms did not keep cost records and therefore could supply only estimates of their costs, there is reason to question whether each respondent included the full value of the labor contributed by himself and his family as well as all other variable and fixed costs associated with his producer operation. Another shortcoming of the available information was the infeasibility of obtaining a reasonably accurate estimate of average net investment or some other meaningful basis against which the profit margin could be compared in order to provide an indication of profitability. In view of these limitations, the prices, costs, and profit margins presented in this chapter should not be viewed as highly accurate estimates of the magnitude of these variables. They can be used with reasonable assurance, however, as indicators of relative differences among species, types of market participants, and study areas and in the formulation and initial testing of hypotheses about certain market relationships.

Sawlog and Sawtimber Stumpage Prices

The primary reason for collecting price information was so that the profit margins involved in producing various species of sawlogs could be calculated and an evaluation made of the overall profitability of producing sawlog material. The average prices paid by sampled producers for sawtimber stumpage and received for delivered sawlogs are presented in Tables 21 and 22, respectively. By way of comparison, the average prices for stumpage and delivered sawlogs reported by sampled sawmill firms are given in Tables 23 and 24, respectively. In general, a greater number of quotations for both sawlog prices and stumpage prices were received from producers than from sawmill operators, partly because some sawmill firms relied exclusively on either delivered sawlogs or stumpage purchases, whereas most producers were involved in both types of market transactions. Furthermore, the majority of sawmill firms commonly purchased stumpage on a lump-sum basis, but producers usually bought stumpage on the basis of per-unit prices and the measured volume of timber cut. Estimates of prices used in arriving at lump-sum offers are considerably less accurate than recollections of prices paid for stumpage bought on a per-unit basis. Because of the limitations of the price data obtained from sampled sawmills, the average prices reported for sawmills in Tables 23 and 24 are based on aggregated data, whereas the prices reported by producers are presented for three different log rules in Tables 21 and 22.

Table 21. Average prices paid for sawtimber stumpage by sampled saw-log producers, by species and state, 1960

Species	Log rule	Mich.	Wis.	Minn.	Ohio	Ill.	Iowa	Mo.	Kan.	All states
					(Dollars per thousand board feet)					
Hard maple	Dyl.	44.6			11.0					33.88
	Scr.	26.6	27.1							24.00
	Int.	39.5								33.00
Soft maple	Dyl.	16.2				14.8	17.9			18.94
	Int.									7.00
Mixed oak	Dyl.	11.7			11.5	12.7		9.5		10.90
	Int.									8.00
White oak	Dyl.				21.0		15.0			18.00
Red & black oak	Dyl.						13.6			13.55
Poplar, aspen & cotton-wood	Dyl.	6.4			10.9	12.4	10.0			10.28
	Scr.	8.3		6.0						6.54
	Int.	6.0		5.0						5.90
Elm	Dyl.	13.3				9.0	9.7			11.03
	Scr.	7.7	18.4							12.47
	Int.	9.9								9.33
Bass-wood	Dyl.	26.9					14.0			22.32
	Scr.	19.0	20.2							17.45
	Int.	23.2								19.17
Beech	Dyl.	18.0			8.7					14.50
	Scr.	8.4								8.40
	Int.									12.33
Ash	Dyl.									19.00
	Scr.		21.5	4.3						15.20
	Int.									14.33
Cherry	Dyl.	34.2			40.0					36.11
	Scr.									21.00
Walnut	Dyl.				47.0	55.0	37.1	65.2	148.4	76.92

Table 21. (Continued)

Species	Log rule	Mich.	Wis.	Minn.	Ohio	Ill.	Iowa	Mo.	Kan.	All states
				(Dollars per thousand board feet)						
White pine	Dyl.									21.67
	Scr.		25.5	19.0						21.60
Red pine	Scr.			19.3						20.10
Jack pine	Int.	10.7								11.75
Hemlock	Scr.		14.8							14.83
Shortleaf pine	Dyl.				9.3			14.1		13.19

Notes:

Prices for states are rounded to the nearest 10 cents. Each price is based upon at least 3 quotations. Less than 3 quotations were received for each of the species handled by producers in Indiana.

Doyle rule (Dyl.) includes the Doyle-Scribner rule used by 7 producers in Mo. Scribner rule (Scr.) includes the Scribner D.C. and the Minnesota Standard rules used by 2 producers in Minn. International 1/4" rule (Int.) includes measurement by lumber tally, reported by 2 producers in Minn. and one in Ohio, and measurement by the standard cord used by 14 producers in Mich. and five in Wis. Prices per cord were converted by multiplying by 2.22.

Table 22. Average prices received for sawlogs by sampled producers, priced f.o.b. mill, by species and state, 1960

Species	Log rule	Mich.	Wis.	Minn.	Ohio	Ill.	Iowa	Mo.	Kan.	All states
		(Dollars per thousand board feet)								
Hard maple	Dyl.	77.1			64.5					69.27
	Scr.	52.0	59.6							55.45
	Int.	71.8								65.60
Soft maple	Dyl.	55.0			45.2	52.5	56.8		43.3	49.38
	Int.									31.33
Mixed oak	Dyl.	41.1			43.6	38.1		28.8		36.71
White oak	Dyl.				52.5					68.50
Red & black oak	Dyl.				43.8		38.3			48.44
Poplar, aspen & cotton-wood	Dyl.	38.2			48.5	43.4	36.0		31.7	44.55
	Scr.	37.0		29.2						31.62
	Int.	33.7								33.21
Elm	Dyl.	38.1			42.5	30.5	34.2		32.7	37.00
	Scr.	29.3	37.5							32.27
	Int.	31.8								31.57
Bass-wood	Dyl.	65.4					36.2			57.63
	Scr.	43.4								43.38
	Int.	55.0		43.3						48.00
Beech	Dyl.	42.1			39.2					40.77
	Scr.	31.7								31.67
	Int.									35.67
Ash	Dyl.	50.0			68.1					59.12
	Scr.									40.00
	Int.									36.00
Cherry	Dyl.	71.4			90.3					84.57
Walnut	Dyl.				113.2		88.3	225.2	161.7	133.67

Table 22 (Continued)

Species	Log rule	Mich.	Wis.	Minn.	Ohio	Ill.	Iowa	Mo.	Kan.	All states
				(Dollars per thousand board feet)						
White pine	Dyl.									53.33
	Scr.		59.0	50.8						54.55
Red pine	Scr.			50.0						50.0
Hem-lock	Scr.		43.8							43.33
Short-leaf pine	Dyl.				45.0			33.3		36.00

Notes:

Prices for states are rounded to the nearest 10 cents. Each price is based upon at least 3 quotations. Less than 3 quotations were received for each of the species handled by producers in Indiana.

Doyle rule (Dyl.) includes the Doyle-Scribner rule used by 7 producers in Mo. Scribner rule (Scr.) includes the Scribner D.C. and the Minnesota Standard rules used by 2 producers in Minn. International 1/4" rule (Int.) includes measurement by lumber tally, reported by 2 producers in Minn. and one in Ohio, and measurement by the standard cord used by 14 producers in Mich. and 5 in Wis. Prices per cord were converted by multiplying by 2.22.

Table 23. Average prices paid for sawtimber stumpage by sampled sawmills, by species and state, 1960

Species	Mich.	Minn.	Ohio	Ind.	Ill.	Iowa	Mo.	Kan.	All states
				(Dollars per thousand board feet)					
Hard maple	41.6								39.48
Soft maple	30.0				22.8	20.5		14.5	22.74
Mixed oak	16.9	9.4	13.7	39.0	13.3	21.2	10.5	14.4	14.45
White oak					29.2		10.2	20.6	22.67
Red and black oak	13.8						9.9	15.9	17.15
Poplar, aspen, etc.	10.1	4.5	22.5	63.2	11.8	10.3		8.2	12.32
Elm	26.6				9.2			9.0	16.50
Basswood	31.5	11.2				16.2			26.60
Beech	14.9			23.2					16.00
Ash								13.0	16.71
Cherry	38.8		46.0					35.4	42.55
Walnut								67.4	104.12
Yellow birch									41.00
White pine	28.0	21.6							23.12
Red pine				22.6					23.42
Jack pine	8.8	16.1					19.8		17.86
Hemlock	13.0								13.80

Notes:

Prices for states are recorded to the nearest 10 cents. Less than 4 quotations for each species were received from sampled mills in Wis.

Prices are based on aggregated data. Prices per cord were converted by multiplying by 2.22. Most common standard used in each state: Mich.: 45 percent lumber scale, 29 percent Doyle; Minn.: 45 percent Scribner, 28 percent Minn. Std.; Mo.: 47 percent lumber scale, 42 percent Doyle; Iowa: 40 percent Doyle, 40 percent tie content. Doyle used by over 85 percent of mills in Ind., Ill., and Kan.

Table 24. Average prices paid for sawlogs by sampled sawmills, priced f.o.b. mill, by species and state, 1960

Species	Mich.	Wis.	Minn.	Ohio	Ind.	Ill.	Iowa	Mo.	Kan.	All states
				(Dollars per thousand board feet)						
Hard maple	66.8	59.2		59.9			47.8			64.05
Soft maple	56.7	57.3				57.5			41.2	60.07
Mixed oak	43.2	49.9	36.0	57.7	65.7	39.1	34.8	27.4	43.8	27.27
White oak						48.0		27.1	52.7	38.24
Red and black oak	42.0							27.5	40.2	36.09
Poplar, aspen,etc.	33.1	38.4	30.2	57.7		36.0	30.0		33.1	35.89
Elm	33.2	40.2				36.4	32.8		37.8	35.10
Basswood	58.2	55.3	37.4				35.8			51.50
Beech	38.2				57.5					40.92
Ash	50.0	46.2	34.5						43.1	45.00
Cherry	66.0			88.4					75.8	63.70
Walnut				127.0			87.5		122.8	117.25
Yellow birch		88.0								85.71
White pine	55.6	53.2	52.2							51.87
Red pine	47.5		49.2		52.3					50.87
Jack pine	42.2		45.6					32.5		37.55
Hemlock	40.8	55.8								49.35

Notes:

In Wisconsin, 93 percent of the mills used the Scribner or Scribner D.C. log rule. For other notes, see Table 23.

Although a considerable amount of variation is evident, prices reported for each species by sawlog producers are neither consistently higher nor consistently lower, on a state-by-state comparison, than prices reported by sawmill firms. This can be taken as an indication that the prices reported by sawlog producers are not biased consistently in either an upward or downward direction. Differences between average prices based on price quotations by producers and those based on reports by sawmill operators are most likely explained by the relatively small number of quotations received for many of the species and by the fact that some sawmill firms and producers sampled in each state had had no sales transactions with other producers or mills in the sample. In an imperfect market situation, it is not unusual for two individuals who make no sales between themselves to quote different transaction prices for the same item. Other factors which probably account for some of the differences among market participants and among states with regard to the average prices reported for each species include differences in logging costs, hauling distances, sawlog size and quality, and in other factors which affect the local demand and supply of stumpage and sawlog material. Since market conditions vary to a considerable extent among local areas, the average prices based on reports from all nine study states are only indicative of whether market prices in each study area are above or below the average for all study areas and do not indicate whether sawmill or producer firms in the various states paid or received prices above or below the average market price in their respective areas.

Perhaps the greatest value of the price data reported here is the insight they give regarding the standards of measure used by sawmill and producer firms. For sawtimber typical of the study region, if the Doyle, Scribner, and International log rules are used to measure a particular unit of sawlogs and if the rules are applied according to official prescriptions, the Doyle rule should indicate about half as much volume as the International rule and the Scribner rule should indicate about 80 percent as much volume as compared to the International rule. Therefore, if the rules are used properly by all sawmill and producer firms, we would expect prices quoted on the basis of the Doyle rule to be about twice as high as those quoted for the International rule and for prices by Scribner rule to be about 25 percent higher than prices based on International. Prices based on Doyle rule would also be about 60 percent higher than those quoted for the Scribner rule. A comparison of the prices quoted for the three different log rules, as reported for several species by producers sampled in Michigan, is made in Table 25. It is apparent that prices quoted for Doyle and Scribner relative to those quoted for International are considerably lower than what might be expected if the rules were properly used. However, the Doyle/Scribner price relationship is in general agreement with the contention that Doyle prices should be about 60 percent higher than Scribner prices if both rules are properly applied. Since there is no reason to suspect any correlation between the log rule used and factors that affect price, such as sawlog quality and the levels of supply and demand, the relationships shown in Table 25 suggest two possibilities. First, prices

Table 25. Comparison of prices reported on the basis of three different log rules by producers sampled in Michigan, 1960

Log rules compared	Hard maple	Poplar, aspen, etc.	Elm	Basswood	Beech
			(Percent)		
			Stumpage price ratio		
Doyle/Int.	113	107	134	116	--
Scr./Int.	67	138	78	82	--
Doyle/Scr.	168	77	173	142	214
			Sawlog price ratio		
Doyle/Int.	107	113	120	119	--
Scr./Int.	72	110	92	79	--
Doyle/Scr.	148	103	130	151	133

Source: Based on Tables 21 and 22.

paid for raw wood material measured by the Doyle rule are equivalent to those paid for the same material measured by the Scribner rule, but prices based on both of these rules are relatively much lower than prices based on the International rule. Second, one or more of the log rules is not applied according to official specifications so that the actual volumetric relationships are different than those indicated by standard volume tables, and thus the observed price relationships may represent a parity among prices based on the different log rules. It was observed earlier that many sampled producers and sawmill operators did not use log rules according to official specifications and that the deviations from the official application of the rules varied widely among individuals. Under these circumstances it is highly questionable whether parity exists among prices based on different log rules or among prices quoted for a particular log rule by individuals who apply the rules differently.

Logging and Hauling Costs

In addition to stumpage costs, the costs of harvesting the timber and transporting it to sawmill sites represent the major costs involved in supplying the raw wood material used by sawmill firms. The costs of contacting stumpage sellers and negotiating stumpage purchases represent a small portion of total wood procurement costs and are not included in the following analysis.

Average logging costs, including felling, bucking, and skidding, for sampled producers and sawmill firms are presented in Table 26. It is apparent that average logging costs based on the

Table 26. Comparison of average logging costs[a] reported by sampled sawlog producers and sawmill firms, 1960

Unit of measure[b]	Producers	Sawmills
	(Dollars per M bd.ft. or per cord)	
Doyle	12.87	14.67
Scribner	13.54	13.91
International 1/4"	13.35	12.64
Standard cord	5.10	--

[a]Includes all variable and fixed costs associated with logging--felling, bucking, and skidding--up to but not including loading. Each average cost is based upon at least 24 responses. Averages not reported for 3 or fewer responses.

[b]Scribner rule includes Scribner D.C. and Minnesota Standard. International 1/4" includes measurement by lumber tally.

Doyle and Scribner rules are higher for sawmill firms than for producers, whereas the opposite is true for costs based on the International rule. Since about 70 percent of both producers and sawmill firms used either Doyle or Scribner rules, it appears that average logging costs, as reported by respondents, are generally higher for sawmill firms than for producers. The difference in the average cost of logging between producers and sawmill firms may reflect actual differences in efficiency or it may be due to differences in the species handled and logging conditions. The disparity in average logging costs may also be due partly to differences in mental cost accounting procedures. It is possible that sawmill firms tend to overestimate the proportion of total sawmilling and procurement costs that result from logging operations. Another possible explanation is the fact that producers generally use a higher proportion of their own labor and family labor than do sawmill firms. If the labor provided by producers and sawmillers and their families is counted at a lower value than similar labor provided by hired help, the effect is to underestimate producers' costs relative to costs estimated for sawmill firms.

Most producers and sawmill operators were not able to provide separate cost estimates for felling, bucking and skidding. For those firms that did furnish separate estimates, the breakdown between felling and bucking costs and skidding costs was consistently 55 percent and 45 percent, respectively.

It is of interest to note that the cost relationships among the three log rules listed in Table 26 are different than what would be expected if the volumetric relationships among the log rules agreed with those for standard volume tables. The cost relationships presented in Table 26 give additional support to the contention the log rules are not used according to officially prescribed procedures.

In explanation of why barriers to entry into the markets for stumpage and sawlog material are low, it was briefly pointed out in an earlier chapter that economies of scale in logging and hauling operations are not substantially great. Further evidence of this is presented in Table 27. It appears that average logging costs and average hauling costs are not highly correlated with size of operation. A serious shortcoming of the data presented in the table is that the size classes are based only on the volume of sawlogs produced rather than the total volume of all timber products. Although total production is highly correlated with sawlog production, some of the producer firms are misclassified for purposes of evaluating scale economies of logging and hauling operations. It should also be mentioned that small-scale producer firms tend to be more labor intensive than large-scale firms and that producers operating on a small-scale use proportionally more of their own and family labor than large-scale firms. If the labor contributed by the producer and his family is valued at less than full opportunity costs, operating costs for small-scale producer firms would be underestimated relative to the costs of larger firms. In spite of the weakness of the data, if economies of scale were substantial it would appear likely that evidence to this effect would be apparent from the data presented in Table 27.

Table 27. Average logging costs and average hauling costs per mile reported by sampled producers, by size class, 1960

Log rule[a]	Production size class of producer			
	1-49 M bd. ft.	50-149 M bd. ft.	150-499 M bd. ft.	500 M bd.ft. or more
	(Dollars per M bd. ft.)			
	Average logging cost[b]			
Doyle	13.00	12.50	13.40	11.40
Scribner	12.80	15.00	13.80	--
International 1/4"	14.50	12.70	14.50	--
	Average hauling cost per mile[c]			
Doyle	0.48	0.46	0.53	0.48
Scribner	0.36	0.51	0.48	--
International 1/4"	0.70	0.70	0.66	--

[a]Scribner rule includes Scribner D.C. and Minnesota Standard. International 1/4" includes measurement by lumber tally.

[b]Includes all variable and fixed costs associated with logging up to but not including loading. Each average logging and hauling cost is based upon at least 6 responses. Averages not reported for 3 or fewer responses.

[c]Average total hauling cost (including loading and unloading) divided by average hauling distance.

In order to calculate profit margins separately for each state, individual estimates of average logging and hauling costs were compiled for each state. These estimates for sampled sawlog producers are presented in Table 28. Similar estimates for sampled sawmill firms are not presented because of the difficulty which many sawmill operators had in separating sawmilling costs from logging and hauling costs, and also because the majority of sawmill firms regularly purchased stumpage on a lump-sum basis and were therefore unable to provide reasonably accurate estimates of stumpage prices, which are needed in order to calculate profit margins. Differences among states with regard to the average logging and hauling costs presented in Table 28 are most likely due to variations among study areas as to average hauling distances, topography, logging conditions, sawtimber species and size, stand densities, and the cost of labor and other factors of production.

The average costs presented in Tables 26, 27, and 28 are based on both the estimated costs of work performed by producers or sawmill firms and prices charged by contract loggers for logging and hauling. Sampled producers estimated that costs for subcontracted logging were 35 cents per thousand board feet lower on the average than their own logging costs. Little difference was noted, however, in the cost of hauling carried out by producers and the cost of subcontracted hauling. The relationship of prices charged by contract loggers to costs incurred by producers who carry out their own logging and hauling has possible relevance as to the accuracy with which sawmill and producer firms estimated average logging and hauling costs. Unlike producers and sawmill operators, to

Table 28. Average logging and hauling costs reported by sampled producers, by state, 1960

Log rule	Mich.	Wis.	Minn.	Ohio	Ind.	Ill.	Iowa	Mo.	Kan.	All states
				(Dollars per M bd. ft. or per cord)						
				Average logging cost						
Doyle	14.1			13.6	15.0	13.9	10.4	8.1	14.3	12.87
Scribner	12.0	14.0	12.4							13.54
Internat.	16.5							8.2		13.35
Std. cord	5.2	4.9								5.10
				Average hauling cost						
Doyle	12.2			10.6	17.7	12.3	9.6	8.0	15.0	10.90
Scribner	12.2	8.9	8.8							10.04
Internat.	11.7		7.9					6.8		10.14
Std. cord	4.4	3.0								4.02

Notes:

Costs for states are rounded to the nearest 10 cents. Each average cost is based upon at least three responses.

Scribner rule includes Scribner D.C. and Minnesota Standard. International 1/4" (Internat.) includes measurement by lumber tally.

whom logging and hauling operations are only a part of their total enterprise, contract loggers must at least cover all of their logging and hauling costs in the long run. Thus we would expect costs based on subcontracting to represent a good estimate of the costs--including an allowance for normal profit--of logging and hauling operations. But even costs based on subcontracting may underestimate long-run average costs. Many contract loggers are only part-time operators. When they are not busy with other, more lucrative employment, they may very likely be willing to do some subcontract logging or hauling at prices just high enough to cover variable costs--including perhaps only a nominal charge for their own labor--with something left over to apply toward fixed equipment charges. In the long run, however, they would not be able to operate full time at these prices. The probability that many contract loggers price their services at less than their long-run average costs, plus the fact that many producers quoted a contract price as the estimate of their own costs, makes it doubtful whether the close agreement between contract prices and costs estimated by producers lends any support as to the accuracy of the cost estimates.

Some indication of the accuracy of estimated costs reported by sampled producers is provided by a cost study which was made of hardwood logging operations in the Tennessee Valley (30). That study provides tables and formulas for estimating average logging and hauling costs. The cost formulas include the following variables: factor prices, type of operation, type of equipment, tree size, topography, type of sale, skidding distance, hauling distance, and road conditions. Based on the cost formulas and factor prices presented in the Tennessee study, the following costs are estimated for logging and hauling conditions typical of the North Central Region:

	Average cost per M bd.ft. Int. ¼"
Felling and bucking (Wage = $1.37 per hour)	$ 5.50
Skidding (Wage = $2.75; av. distance = 200 ft.)	10.00
Hand loading (Wage = $1.10 per hour)	2.50
Hauling (Wage = $1.50; 22 mi. paved, 1 mi. woods roads)	14.28
Unloading (Wage = $1.50 per hour)	.21
	$32.49

The above estimate of average logging costs, including felling, bucking, and skidding, is from one to three dollars higher than those reported by sampled sawmill and producer firms. Since labor costs account for about 60 percent of the average logging cost presented in the above tabulation, differences between wage rates in the study region and those used in the Tennessee study may account for most of the difference in the average logging costs. Average hauling costs, including loading and unloading costs, based on the Tennessee data are about $6.50 higher on the average than those reported by sampled producers (Table 28). Only if wage rates are taken at near zero values would the average hauling costs based on the time study agree with the estimates provided by producers sampled in the study region. The amount by which hauling costs were likely underestimated by sampled producers may be less than is apparent from the information presented in the above tabulation and in Table 28. The reason being that truck depreciation costs experienced by sampled producers were probably somewhat lower than those reported in the Tennessee study. Nevertheless, on the basis of the above comparison, it appears that sampled producers were somewhat conservative in estimating logging costs and that they very likely underestimated hauling costs by a considerable amount.

Comparison of Costs and Prices

The costs and returns of producer operations are compared in Table 29. Similar comparisons are not made for sampled sawmill firms because of the difficulty of separating sawmilling costs from logging and hauling costs and also because over half of the sawmill firms usually purchased stumpage on a lump-sum basis and therefore had a poor idea of per-unit stumpage costs. Judging from the information presented in Tables 21-24 and 26, the costs and returns associated with producing sawlogs are not thought to be substantially different for sawmill firms than for sawlog producers.

The margins presented for each species by state and log rule in Table 29 were calculated by subtracting average stumpage price and average logging and hauling costs from average price received for sawlogs delivered f.o.b. mill. Assuming that estimated logging and hauling costs include all costs associated with these operations--including full opportunity costs of labor contributed by producers and their families--the margins represent the gross profit or loss associated with producing 1,000 board feet of the various species.

Because of insufficient information about the cost structure of producer operations, it is not possible to estimate average

Table 29. Comparisons of the average prices, costs, and margins associated with the producing activities of sampled sawlog producers, 1960

Species	State	Log rule[a]	Price re-ceived	Stump-age price	Logging & haul-ing cost	Margin[b]	Ratio of margin to: Logging & haul-ing cost	Ratio of margin to: Price re-ceived	Ratio of stumpage price to con-version return[c]
			(Dollars per thousand bd. ft.)				(Percent)		
Hard maple	Mich.	Doyle	77.10	44.60	26.30	6.20	24	8	88
	"	Scr.	52.00	26.60	24.20	1.20	5	2	96
	"	Int.	71.80	39.50	28.20	4.10	14	6	91
	Wis.	Scr.	59.60	27.10	22.90	9.60	42	16	74
	Ohio	Doyle	64.50	11.00	24.20	29.30	121	45	27
Soft maple	Mich.	Doyle	55.00	16.20	26.30	12.50	48	23	56
	Ill.	"	52.50	14.80	26.20	11.50	44	22	56
	Iowa	"	56.80	17.90	20.00	18.90	94	33	49
Mixed oak	Mich.	Doyle	41.10	11.70	26.30	3.10	12	8	79
	Ohio	"	43.60	11.50	24.20	7.90	33	18	59
	Ill.	"	38.10	12.70	26.20	-0.80	-3	-2	107
	Mo.	"	28.80	9.50	16.10	3.20	20	11	75
White oak	Ohio	Doyle	52.50	21.00	24.20	7.30	30	14	74
Red and black oak	Iowa	Doyle	38.30	13.60	20.00	4.70	24	12	74

Table 29. (Continued)

Species	State	Log rule[a]	Price re-ceived	Stump-age price	Logging & haul-ing cost	Margin[b]	Ratio of margin to: Logging & haul-ing cost	Ratio of margin to: Price re-ceived	Ratio of stumpage price to con-version return[c]
			(Dollars per thousand bd. ft.)				(Percent)		
Basswood	Mich.	Doyle	64.40	26.90	26.30	12.20	46	19	69
	"	Scr.	43.40	19.00	24.20	0.20	1	--	99
	"	Int.	55.00	23.20	28.20	3.60	13	7	87
	Iowa	Doyle	36.20	14.00	20.00	2.20	11	6	36
Poplar, aspen and cottonwood	Mich.	Doyle	38.20	6.40	26.30	5.50	21	14	54
	"	Scr.	37.00	8.30	24.20	4.50	19	12	65
	"	Int.	33.70	6.00	25.00	2.70	11	8	69
	Minn.	Scr.	29.20	6.00	21.20	2.00	9	7	75
	Ohio	Doyle	48.50	10.90	24.20	13.40	55	28	45
	Ill.	"	43.40	12.40	26.20	4.80	18	11	72
	Iowa	"	36.00	10.00	20.00	6.00	30	17	62
Elm	Mich.	Doyle	38.10	13.30	26.30	-1.50	-6	-4	113
	"	Scr.	29.30	7.70	24.20	-2.60	-11	-9	151
	"	Int.	31.80	9.90	25.00	-3.10	-12	-10	146
	Wis.	Scr.	37.50	18.40	22.90	-3.80	-17	-10	126
	Ill.	Doyle	30.50	9.00	26.20	-4.70	-18	-15	209
	Iowa	Doyle	34.20	9.70	20.00	4.50	22	13	68
Beech	Mich.	Doyle	42.10	18.00	26.30	-2.20	-8	-5	114
	"	Scr.	31.70	8.40	24.20	-0.90	-4	-3	112
	Ohio	Doyle	39.20	8.70	24.20	6.30	26	16	58

Table 29. (Continued)

Species	State	Log rule[a]	Price received	Stumpage price	Logging & hauling cost	Margin[b]	Ratio of margin to Logging & hauling cost	Ratio of margin to Price received	Ratio of stumpage price to conversion return[c]
			(Dollars per thousand bd. ft.)				(Percent)		
Cherry	Mich.	Doyle	71.40	34.20	26.30	10.90	41	15	76
	Ohio	"	90.30	40.00	24.20	26.10	108	29	61
Walnut	Ohio	Doyle	113.20	47.00	24.20	42.00	174	37	53
	Iowa	"	88.30	37.10	20.00	31.20	156	35	54
	Mo.	"	225.20	65.20	16.10	143.90	894	64	31
	Kan.	"	161.70	148.40	29.30	-16.00	-55	-10	112
White pine	Wis.	Scr.	59.00	25.50	22.90	10.60	46	18	71
	Minn.	"	50.80	19.00	21.20	10.60	50	21	64
Red pine	Minn.	Scr.	50.00	19.30	21.20	9.50	45	19	67
Hemlock	Wis.	Scr.	43.80	14.80	22.90	6.10	27	14	71
Shortleaf pine	Ohio	Doyle	45.00	9.30	24.20	11.50	48	26	45
	Mo.	"	33.30	14.10	16.10	3.10	19	9	82

[a] For description of log rules see notes for Table 22.

[b] Margin equals price received minus average total costs (stumpage price plus logging and hauling costs).

[c] Conversion return equals price received minus costs of logging and hauling.

rates of return on invested capital. It is possible, however, to compare profit ratios, expressed as the ratio in percent of margin to price received, for producing sawlogs with the profit ratios associated with producing other timber products in the North Central Region. Profit ratios for producing pine and aspen sawlogs are somewhat higher than the profit ratios reported by Manthy and James (40) for pine and aspen pulpwood produced in the Lake States. According to information presented by Massie and James (42), producing white oak stave bolts in Ohio appears to be considerably more profitable than producing white oak sawlogs. Profit ratios reported by Massie (41) are higher for most species of quality veneer logs produced in the study region than the ratios presented in Table 29 for the same species of sawlogs. However, on the whole, profit ratios for producing sawlogs do not appear to be substantially different than those for the same species of other timber products.

It is also possible to gain a general impression of the relative profitability of producing various species of sawlogs. The ratio of margin to operating costs appears to be a better criterion for this task than the ratio of margin to price received because the second criterion tends to underestimate the relative profitability of producing high-priced species as compared to low-priced species.[1] On

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[1]For example, under the assumption that logging and hauling costs are the same, a producer would be as well off with a $3 margin on a species that sells for $60 as for a species that sells for $30. There is no reason to believe that risks or capital requirements would be greater for producing the $60 species, yet according to the margin to selling price criterion, the $60 species, with a profit ratio of 5 percent, would appear relatively less profitable than the $30 species, with a profit ratio of 10 percent.

the basis of the ratios of margins to logging and hauling costs presented in Table 29, it is apparent that it is generally unprofitable to produce elm and beech sawlogs, whereas the most profitable species appear to be walnut, cherry, soft maple, white pine, and red pine. Caution should be used, however, in making comparisons of profitability among species because, for the most part, logging and hauling costs were based on the average costs for all species handled by producers sampled in each state rather than upon the costs associated with each individual species. Since most stumpage purchases contain several different species, it is also possible that producers accept low margins on some species by offering a higher stumpage price than what a particular species is worth by itself as long as the loss is more than made up for by higher margins on other species.

The data presented in Table 29 also shed some light on the pricing of sawtimber stumpage. The last column in the table compares the stumpage price and conversion return associated with each species. Conversion return is defined here as the average price received for sawlogs delivered f.o.b. mill minus average logging and hauling costs. It is made up of the price paid for stumpage plus the profit margin received by the producer. Whereas prices received for sawlogs are generally set by the sawmill operator, producers have a great degree of influence in establishing stumpage prices. It is very likely, therefore, that most producers make estimates of conversion return to serve as guides in the pricing of sawtimber stumpage. With the exception of elm and beech, for which producers appear to expend all, or in excess, of the conversion return for these species, it appears that producers generally expend between 50 and 80 percent of the estimated conversion return for stumpage. Although it is not possible to make a judgment as to the equity of the division of conversion return between profit margin and stumpage price, it is apparent from Table 30 that sampled producers in Michigan who used the Doyle rule generally realized a larger profit margin relative to conversion return than producers who used the Scribner or International log rules. In four out of five species for which comparative data were available, a smaller proportion of the conversion return was paid out as the price for stumpage by producers who used the Doyle rule than by producers who used the other two rules. It appears that forest landowners, at least in Michigan, are at a greater disadvantage when selling stumpage on the basis of the Doyle log rule as compared to the Scribner and International rules. In view of the landowners' lack of understanding of the various log rules and the lack of standardization in the application of the different rules, this conclusion seems wholly justified.

Table 30. Ratio of stumpage price to conversion return for three different log rules used by producers sampled in Michigan, 1960

Species	Doyle	Scribner	International
		(Percent)	
Hard maple	88	96	91
Poplar, aspen and cottonwood	54	65	69
Elm	113	151	146
Basswood	69	99	87
Beech	114	112	--

Source: Table 29.

CHAPTER 8

EVALUATION OF MARKET PERFORMANCE

Market performance (efficiency) refers to the results of the competitive interactions among firms within a market which directly affect the welfare of the participants in the market and society as well. Industry performance has the same connotation except that the unit of inquiry is the industry rather than the market or markets in which the industry operates.[1] For certain types of market structure, the relationship of market structure to conduct and conduct to performance is fairly well established, at least on theoretical grounds. For example, in the case of a monopolized industry, output is almost sure to be restricted and excess profits earned, with the result that relatively too few resources are employed in the monopolized industry and the monopolist receives a disproportionately large share of total income. In markets which are neither

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[1]Most writers in the field of market structure analysis use the term industry performance interchangeably with market performance, although the latter term is used more frequently. Some performance dimensions, such as production efficiency, technological progressiveness, and the costs of sales promotion, relate more to the industry than to the market or markets in which the industry operates. The performance of the industry in these dimensions, however, affects the welfare of other participants in these same markets and, therefore, such dimensions legitimately constitute part of the performance of these markets. In keeping with convention, those dimensions which refer primarily to the sawmilling industry rather than to both the supply and demand sides of the markets for sawlog material and sawmill products are referred to as industry performance.

purely competitive nor monopolistic in structure, economic theory is less conclusive. Industrial organization theory is, nevertheless, a useful analytical framework for investigating the economically significant attributes of atomistic or slightly oligopolistic markets and for evaluating the performance of these markets.

The evaluation of performance involves four steps: (1) identifying the crucial dimensions of performance, (2) measuring actual performance for each dimension, (3) establishing theoretical and operational norms of ideal performance, and (4) evaluating actual performance in terms of these norms. The dimensions of performance recognized in this study are those which have been identified by the theoreticians of market structure analysis, Sosnick (68) and Bain (2) in particular. Most of the operational norms used in this analysis are also taken from the work by Sosnick. The norms are operational in the sense that they refer to economic attributes which can be verified empirically and classified as to whether they represent acceptable or unacceptable performance. They relate to and in some cases are developed from the theoretical norms derived from economic theory. The indications of the actual performance of the markets for sawlog material and sawmill products are limited for the most part to deductive inferences as to the kind of performance that is likely to result from the observed structure and conduct of the markets. A thorough quantification of actual performance in any one of its dimensions would constitute a formidable endeavor in itself and is beyond the scope of this study.

The dimensions of market performance which are considered below are restricted to the following: the amount and quality of sales promotion, the level of earnings of sawlog producers, production efficiency, technological progressiveness, exchange efficiency, product suitability, participant rationality, and conservation. The discussion begins with those dimensions for which little quantification of actual performance was possible or for which the deductive inferences based upon the extant market structure and conduct were less clear. It ends with those dimensions (product suitability, participant rationality, and conservation) for which it was possible to measure or at least deduce the nature of actual performance with a reasonable degree of reliability. Four other performance dimensions identified by Sosnick--unethical practices, labor relations, level of output, and external effects--are not discussed. Other than the possibility of cheating in the measurement of sawlogs and lumber and certain logging methods which deviate from good conservation practices, interviews with producers and sawmill operators failed to reveal that unethical practices constitute an important aspect of market performance. Insufficient information was obtained in order to determine actual performance with regard to labor relations. As for external effects and level of output, the norms presented by Sosnick are more theoretical than operational and do not lend themselves to the kinds of tests that are possible in this study.

Production Efficiency

Production efficiency involves such questions as the scale of plants and firms, degree of plant utilization, vertical integration, control of input and output inventories, utilization of by-products, equalization of marginal costs among plants, coordination among firms and the cost of adapting to uncertainty, the regularity of operations, and the rate of turnover among firms and other losses due to discontinuities. Given such a multiplicity of attributes and a nearly infinite variety of economic situations and alternative ways of adjusting to each situation, Sosnick (68) correctly asserts that the optimum or minimum cost adjustment in each case is not ascertainable. He suggests that although it may be possible to detect some gross inefficiencies with regard to integration and plant utilization, operational norms should not refer to minimum costs but should merely specify that no real costs persist that are clearly unnecessary to produce the goods and services that are being provided. Although no analysis has been made specifically to identify any such unnecessary costs associated with producer and sawmill operations, certain questions can reasonably be raised and hypotheses proposed regarding the efficiency of these operations. The fact that many producers and sawmill operators keep no records of costs and returns and that many operate only part time and thus are not likely to acquire a high degree of managerial competence is perhaps the most obvious indication that sawmill and producer operations are not likely to be highly efficient.

A considerable amount of excess sawmill capacity existed within the study region in 1960 and probably still exists today. The survey of sawmill firms revealed that only 47 percent of the firms operated at 75 percent or more of capacity (eight-hour shift); 29 percent operated between 50 to 75 percent of capacity, and 24 percent operated at less than 50 percent of capacity. Persistent excess capacity which is not needed to meet periodic increases in demand is generally considered to represent inefficiency because more resources are allocated to the industry than are needed and fixed costs are higher than necessary. In the case of the sawmilling industry in the study region, the important issue is whether new mills going into operation are utilized at full capacity. This does not refer to new entries resulting from changes in the ownership of old, previously existing sawmills because no inefficiencies are necessarily involved in this type of entry--except for possible temporary interruptions in production--as long as the new owner values the mill at its probable, less-than-full-capacity output. Current excess sawmill capacity may indicate a misallocation of resources in the past; its persistence may indicate only that old sawmills are worth more in the periodic production of lumber than as scrap iron. However, there is the likely possibility that ignorance of alternative investment opportunities, uncertainty, and inertia against relocation of labor and entrepreneurs prevent many sawmill operators from liquidating their sawmill assets and reinvesting in more remunerative enterprises.

It is not possible in practice to determine what is the optimum scale for sawmill or producer firms. The optimum scale would of course vary throughout the region depending on the species, size, and quality composition of the forest resource, stand densities, the contiguity of the forest resource, the types of products produced, the degree of vertical integration, and other factors. It was pointed out in Chapter 4 that although some economies of scale exist within the regional sawmilling industry, they are not as great as those realized by the sawmilling industry based on the old-growth resource in the western states. It was also revealed that cost data reported by sampled producers failed to show any apparent correlation between size of producer operation and average logging and hauling costs. Undoubtedly this was partly due to the fact that there was little difference in the relative amounts and types of equipment used in small producer operations as compared to large operations. It is quite likely that larger investments in special loading devices, crawlers and other types of tractors suitable for skidding, special skidding equipment, and faster and more powerful trucks would bring about lower average logging and hauling costs.

The gains to be realized from increasing the size of a sawmill operation are not so much associated with efficiencies realized from the manufacturing process as they are with marketing and managerial efficiencies. The scale economies of a sawmill operation conceivably include the following: (1) the ability to attract a greater number and variety of buyers; (2) a larger geographical market, thus greater insurance against fluctuations in local markets; (3) the possibility of higher average prices for large-volume orders because of procurement savings realized by buyers; (4) the feasibility of selling a greater proportion of output in product lots which are homogeneous with respect to species, grade, and size and which attract buyers who are willing to pay premium prices for homogeneous lots; (5) the feasibility of hiring lumber graders and thus breaking the sawmill firm's dependence on the buyer's scale; (6) a reduction in the volume of high-value material which, because of insufficient volumes, is sold along with material of lower value; (7) the possibility of sorting out all sawlog material according to its most suitable product use and either reselling it or integrating into other product lines; (8) the feasibility of dividing managerial responsibilities among several individuals who could specialize in such areas as sales and marketing, manufacturing, and wood procurement; and (9) the ability to acquire greater amounts of financing--possibly by changing to a corporate form of ownership--and the possibility of obtaining financing more cheaply. Although the scale economies of an individual sawmill plant are limited by the increasing marginal cost of sawlog material as plant scale increases, the economies of scale of firms consisting of several mills and other facilities are far less restricted. Several large producers of pallets and containers, flooring stock, and finished flooring have found it economical to operate several portable or stationary mills that ship their output to one or more company-owned facilities where the material is graded, sorted, usually processed further, and sold. In view of the small-scale, single-mill character of most sawmill firms in the study area and the possible marketing, managerial, and financial economies to be realized from increasing the scale of such firms, it appears that most sawmill firms in the region are operating at a smaller than optimum scale.

Except for firms that produce pallets and containers and "other" manufactured products and the few that operate separate retail yards, most sawmill firms in the region have not integrated forward beyond the stage of producing rough or surfaced lumber and other remanufactured products. About two-thirds of the sawmill firms do some or all of their own logging and hauling, but very few sawmill or producer firms supply a substantial portion of their sawtimber requirements from their own lands. The advantages of vertical integration--in theory at least--include: avoidance of the costs of exchange such as advertising, search, haggling, collecting debts, and dishonesty; coordination in the exchange of information and in scheduling; and marginal-cost pricing (68). The economies to be realized in the sawmilling industry, however, appear to be those associated more with scale (as discussed above) than with vertical integration. One advantage that is associated with both of these two phenomena is that realized by sawmill firms that do their own logging in order to keep their personnel employed full time and thus avoid personnel losses to jobs offering steadier employment. Closely related to the question of vertical integration are the issues of product diversification and the utilization of by-products. The heterogeneity of the forest resource with regard to the size, species, and quality of trees and the quality variation found within individual sawlogs strongly suggest the desirability of product diversification. Although a diversity of sawmill products are produced by most sawmill firms in the study region, there are few instances of the integration of sawmilling with the production of veneer or plywood, charcoal, particle board, wood pulp, or other wood products. The North Central Region has lagged behind the South in the utilization of by-products such as slabs and edgings in producing pulp-based wood products. A study of coarse sawmill residues (slabs, edgings, and trims) revealed that about 450,000 cords of this material were produced in the three Lake States in 1959 (48). Most of this material was either given away or sold at low prices for residential and industrial heating. The small size and widely dispersed locations of sawmills in the study region make it costly for pulp and paper plants and other potential, large-volume users to procure the material. It is possible that under a less atomistic market structure, sawmill residues might profitably be used in producing products more valuable than fuelwood.

Contractual agreements and other devices offer alternatives to vertical integration by ownership as a means of coordinating marketing functions and of adapting to uncertainty. It has been demonstrated that transaction agreements between landowners and stumpage buyers, between producers and sawmill firms, and between sawmill firms and product buyers are generally considered to be unenforceable and are usually concerned only with the very short run.

It is recognized that the ongoing process of firm turnover and discontinuities in the production process produce social wastes, but the real issue is whether they represent from the social standpoint the least costly adjustments to changes in economic conditions. The question is unanswerable in practice but some clarification is possible in the case of the sawmilling industry. Although there is a rapid rate of birth and demise of both sawmill and producer firms, much of the so-called turnover represents the reactivation and discontinuation of activities of intermittent operators. The production of sawlogs and sawmill products is highly seasonal, resulting mainly from seasonal changes in logging conditions and secondarily from seasonal opportunities in alternative forms of employment--both of which depend upon weather conditions. The periodic discontinuation and reactivation of sawmill and producer operations does not in itself constitute a diseconomy, for such behavior may represent the most efficient adjustment to changing economic conditions under the existing market structure. For instance, many sawmill firms shut down during the poor logging season because they are unable to finance a sufficiently large build-up of sawlogs to carry them through this season. Although the inability of many sawmill firms (and producers) to obtain sufficient financing may be an accurate reflection of the high risks of their operations, it also calls into question the efficiency of a market which is constantly plagued by discontinuities in production which could be substantially reduced through the greater availability of financing. Furthermore, it may be questioned whether adjustments in the level of industry output might better be effected by fluctuations in the output of stable, full-time firms operating at eight-hour shift capacity most of the time and at more than one shift per day during periods of high demand. Such an industry structure would result in a more efficient utilization of plant and equipment, but fluctuations in the derived demands for labor and sawlog material would not necessarily be reduced substantially. Some reduction in the variability of the demand for labor may be expected because labor inputs per unit of output are smaller in the case of larger, more-capital-intensive firms. Thus fluctuations in output cause smaller fluctuations in the demand for labor as compared with smaller, more-labor-intensive firms.

Although it is possible to speculate endlessly about the implications which the observed market structure and conduct have with regard to production efficiency, in fact, little is known about the actual level of efficiency, to what extent and in what areas production efficiency can be improved, and the degree of disparity between actual and optimum efficiency. Most of the remaining performance dimensions are no less complicated; the norms for some, however, are more suitable for empirical investigation.

Technological Progressiveness

Technological progressiveness is an important aspect of an ever changing economy. This performance dimension refers to the rate at which firms develop and adopt new or improved production techniques and products. No meaningful operational norms are available for the rate of discovery of new production methods and products because the rate of discovery depends upon the opportunities for discovery, which are not only unknown but are also unknowable. It is also a difficult task to measure the actual rate of invention and development. However, the level of expenditures for research and development serves at least as an index of the amount of resources devoted to the discovery and innovation of new techniques and products. A recent study of forestry research reported the following expenditures on product research by private industry in the fiscal year 1959-1960: pulp, paper, and other fiber products, $42.0 million; lumber and lumber products, $8.0 million; plywood, veneer, and adhesives, $4.2 million; and all other forest products industries, $5.6 million (67). Expenditures on forest management research amounted to an additional $2.2 million for all forest products industries combined. Using these data, Zivnuska (104) estimated that the amount invested in product research for each thousand cubic feet of wood used was $17.10 for the pulp and paper industry, $5.75 for the plywood and related industries, and only $1.50 for the lumber industry. In comparison to the total amount spent on research in the United States in 1960, total private and public expenditures for research in the field of forestry amounted to 0.35 percent of what the primary forest products industries contributed to GNP, whereas all research amounted to 2.5 percent of total GNP (67). Few sawmill firms and probably no sawlog producers in the study region maintain organized research programs. Nearly all firms in the region are financially unable to invest in research. Planning horizons are usually too short to justify investments in research which yield substantial benefits only after years of knowledge accumulation. Another factor which discourages research investments by individual firms is the fact that investing firms cannot easily prevent research findings from being disseminated to competitors. However, the ideal rate of research expenditures, from a social standpoint, does not depend upon the rate that is feasible under a given market structure. Rather, it depends upon the potential benefits to be realized from more or less investment in research. Although the ideal rate of research expenditures is not ascertainable, in view of the fact that the relative amount expended on research by the sawmilling industry in the study region is far below the national average for all research as well as for research by the plywood and pulp and paper industries, it is reasonable to hypothesize that research expenditures by the sawmilling industry in the study region are below a socially desirable rate.

Before leaving the subject of technological progressiveness, some consideration should be given to three departures from ideal performance recognized by Sosnick (68). They include: errors made in investment because inappropriate tests are used in evaluating profitability or for failure to consider or acquire information about benefits and costs which is available at a reasonable cost; the suppression of inventions such as by refusing to inform others or by charging exorbitant license fees; and the inadequate diffusion of innovations. There appears to be little conscious suppression of inventions in the sawmilling industry of the study region. On the other hand, it is questionable whether technological changes are rapidly disseminated throughout the industry and whether innovations are readily introduced from outside the industry or region. The same factors which cause market information to be inadequate also impede the flow of information about technological changes. There appears to be little doubt that well-advised evaluations of investment opportunities are also thwarted by inadequate information about costs and returns.

Earnings of Sawlog Producers

It is a commonly accepted contention in economics that profits in excess of a "normal" or "socially desirable" profit rate should not persist and that losses should be only moderate and short-lived. Prolonged excess profits are considered to be undesirable because enterprise owners receive a disproportionately large share of total income and because, under monopolistic or oligopolistic market structures, excess profits are thought to be associated with output restriction. Likewise, persistent losses indicate a failure of market forces to effect a relocation of resources to more profitable endeavors, and severe losses may result in bankruptcy and the spread of losses to creditors. However, neither periodic excess profits nor moderate, short-lived losses are undesirable. Moderate losses are therapeutic to the extent that they help to eliminate excess capacity. Periodic excess profits are not generally thought to be undesirable, especially if they represent windfall profits or result from invention or innovation.

Since what constitutes a socially desirable profit rate is a matter of debate and since actual profit rates for the sawmilling industry are unknown, a norm for the profitability of producer operations is suggested which refers to the gross earnings of producers and their employees rather than to profits. The return to the labor contributed by the producer and his family is without doubt the major source of income realized in most producer operations. On the basis of the study of logging costs in Tennessee (30) it is estimated that labor constitutes about 53 percent of total logging and hauling costs. Producers and members of their families usually contribute the major share of the labor themselves. For instance, nearly two-thirds of the sampled producers were not assisted on a full-time basis by either family or non-family members. Of the full-time laborers hired, 45 percent were members of the producer's immediate family. A reasonable norm for judging whether returns from producer operations are acceptable from a social standpoint is whether the average income by labor in this industry is comparable to that received by similar labor in other industries and at least equal to the minimum wage established by the federal government.

The tabulation which follows shows the percentage distribution for 40 sampled producers--those who received all of their income from producing timber products and hired no full-time family or non-family employees--according to the estimated average gross income received for the labor contributed by the producer. (Similar information for producers who hired full-time family or non-family employees is not meaningful because full-time employees of producers who operated only part of the year may have received income from other sources.) The estimates are based upon the weighted average logging and hauling costs reported by sampled producers and the proportion of total costs represented by labor as reported by the Tennessee study (30). After deducting an allowance of 6 percent return on investment, it is estimated that on the average labor accounts for $12.45 of average logging and hauling costs. Adding to this the weighted average margin realized per thousand board feet of $5.95 gives $18.40 as an estimate of the average amount payable to labor per thousand board feet. (The margin--average price received for delivered sawlogs minus average costs for stumpage, logging, and hauling--supposedly represents the return on investment plus economic profit. It is highly questionable, however, whether cost estimates by producers included all costs--especially all labor costs.)

Gross income per producer	Percent of producers
(Dollars)	
Less than 2,600	31
2,600 - 3,999	15
4,000 - 4,999	2
5,000 - 7,499	30
7,500 - 9,999	12
10,000 or more	10
	100

According to the above tabulation, approximately 31 percent of the sampled producers who received no income from other sources and hired no full-time employees received incomes smaller than the annual equivalent of the Federal minimum wage of $1.25 per hour. In comparison to the nation-wide average income of $3,820 received by nonsupervisory employees of logging camps and contractors (81), about 45 percent of the above group of producers received a lower income. Comparisons with other industries are too hazardous because labor inputs vary tremendously in quality from industry to industry. In spite of the fact that the incomes reported in the above tabulation are not net of wages paid to part-time employees, the data suggest that sawlog producers in the study region receive incomes comparable to those received by loggers throughout the nation. Nevertheless, it appears that an unreasonably high proportion of the above group of producers received smaller incomes than a socially acceptable minimum. It is not known whether the above group of producers is representative of the entire region or whether some failed to report social security, welfare or other income or were just having a bad year. The available evidence suggests, however, that a significant proportion of sawlog producers earn less than the established minimum wage. To the extent that producers earn subminimum wages because they are ignorant of alternative employment opportunities, fraught with uncertainty about relocating for more lucrative employment opportunities, or financially unable to meet the costs of relocation, market performance, or perhaps more accurately, the performance of the whole economy is less than ideal.

Sales Promotion

The question of sales promotion, as a dimension of market performance, is concerned with the level of advertising expenditures, the content and objectives of advertising, the use of salesmen, and expenditures on distributive services in excess of what customers would be willing to pay for if they had a choice. The last two issues also represent aspects of the performance dimensions: exchange efficiency and product suitability. Although some political economists condemn high ratios of advertising costs to total costs or to total sales revenue, the generally accepted norm for advertising is that informative advertising, for instance, that which is found in newspapers and which contains information about prices, the availability of new styles or new products, new market outlets, and changes in business ownership or location, is desirable and necessary. On the other hand, persuasive advertising, especially rivalrous advertising of established products, and misleading advertising are wasteful and undesirable from a social standpoint.

Throughout the nation as a whole, the lumber industry, in comparison with many or most other manufacturing industries, expends a small proportion of total operating costs on sales promotion (102). In comparison with the stone, clay, and glass products industry group, which competes in many markets with sawmill firms, advertising costs by the lumber and wood products industry group averaged 0.4 percent of total sales revenue during the period 1952-58, whereas the ratio for the competing industry group ranged from 0.7 to 0.9 percent (49). Advertising costs amounted to only 0.2 percent of sales revenue for the lumber and wood products group during the years 1945-48 (49), as compared with 12 out of 20 industries studied by Bain (2) which had ratios of advertising costs to sales of from 1 to 10 percent during approximately the same period. Similar data are not available for the study region, but since the vast majority of sales promotion expenditures by the national lumber industry are made by a relatively few large firms located in the West, it is apparent that sales promotion costs represent an insignificant portion of the total operating costs of sawmill firms in the study region.

The fact that sales promotion costs are relatively small does not mean that the industry performs well in this regard. The quality of sales promotion and the relationship of social benefits to social costs associated with more or less sales promotion must also be considered. On the first account, with apparently little or no persuasive or misleading advertising for sawlog material or sawmill products, market performance appears to be very good indeed. The lack of persuasive or brand-name advertising is not at all surprising in view of the small size and financial weakness of most sawmill and producer firms and the difficulty of inscribing sawlog material and sawmill products with firm-associated characteristics. On the second account, however, it is questionable whether adequate information or desired services are provided. Whereas specialized sales personnel and departments, regional and national networks of sales offices and lumber yards, special telephone and teletype connections between buyers and sawmill firms, price and stock lists, and reasonably adequate market news reporting are typical of the western lumber industry, such distributive activities and facilities are sorely lacking in the sawmill-products market in the North Central Region. Questions regarding the adequacy of distributive services and of informative advertising and other forms of market information are related more specifically to the performance dimensions: product suitability and participant rationality. They will be discussed in somewhat greater detail later on in this chapter.

Exchange Efficiency

Exchange efficiency is concerned with the costs of transferring inputs and products among market participants. It involves such issues as the costs of distribution and assembly, cross-hauling, price flexibility, the distribution among buyers and sellers of the gains of trade, and such transfer costs as brokers' commissions, yardage, record keeping, and taxes. Sosnick (68) offers several propositions which provide a basis for at least a partial evaluation of exchange efficiency within the limitations of this study. (1) Firms should not persistently ship essentially perfect substitutes into each other's market areas. (2) The costs of price formation and the pairing of buyers and sellers should not be needlessly inflated as a result of prolonged haggling, an unreasonable number of free price estimates, or inadequate information about market prices or about the demands and offerings of buyers and sellers. (3) Prices for an essentially homogeneous commodity at any two spatially separated points should not differ by more than the per-unit transportation costs between the points.

In general, sawmill firms and producers acquire their sawlog requirements within a procurement radius of 25 to 30 miles. The timbersheds of several firms may overlap in part, but with the exception of a few firms that specialize in the upper grades of the more valuable species, little sawlog material is transported across intervening timbersheds to more distant mills. Construction lumber and other sawmill products for home and farm use are usually sold directly to final consumers within the vicinity of the individual mills. Except for a few large softwood-lumber manufacturers in the Lake States, there is apparently little interpenetration of these local markets by firms located in the study region. Of course, most of the lumber used in construction within the region is imported from western states, but this lumber is considerably different than that produced within the study region with regard to species, size, and grade composition, seasoning, and availability in large-volume lots. The largest share of the volume of sawmill products produced within the study region is used in manufacturing or for shipping purposes. Little is known about the procurement areas of commercial buyers of sawmill products. However, the distribution patterns and short shipping distances reported by sampled sawmill firms suggest that manufacturers and industrial users generally obtain their requirements for sawmill products from sawmills so situated as to minimize assembly costs. Except for the real possibility that near-by buyers and sellers may be ignorant of each other's existence, cross-hauling in these highly atomistic markets for sawlog material and sawmill products does not appear to be a problem.

With regard to the other two operational norms of exchange efficiency listed above, the markets for sawlog material and sawmill products do not fare so well. The spatial separation of market transactions, the infrequency of sales, the large number of buyers and sellers, the lack of adequate market news reporting, and the inadequacy of standardization of measurements and exchange provisions--all increase the cost of buyer-seller pairing and price formation. For instance, it was demonstrated in Chapter 6 that sawmill operators and producers were able to reach agreement on price more quickly between themselves than with landowners, partly because landowners were much more ignorant than either producers or sawmill operators about market conditions, buying practices, and standards of measure. The inadequacy of market information also calls to question whether prices for identical species and grades of sawlogs and sawmill products at all sawmills differ only by unit transportation costs. Since many full-time producers make contact with several different sawmill firms at fairly frequent intervals, it would appear that the relationship among sawlog prices paid by different sawmill firms would approximate the ideal. On the other hand, contacts between sawmill firms and the commercial buyers of sawmill products are not as easy because of the greater spatial separation. Exchange of information about product prices among sawmill firms is probably less frequent and less thorough than the exchange of price information among sawmill firms and producers simply because most sawmill firms are not dependent upon each other for goods and services. In view of the inadequacy of market news reporting and the limited number of contacts between sawmill firms and commercial buyers, it would seem that commercial buyers of sawmill products would be able to establish prices with a considerable degree of immunity to the prices received by other sawmills.

Product Suitability

This dimension of market performance embraces the general level of product quality, the rate and frequency of product change and improvement over time, and the adherence of products to size and grade standards. Again, Sosnick (68) offers three norms for evaluating market performance: (1) product inventions, whether new products or improvements on old products, should not be suppressed; (2) sellers should offer no less than the highest quality that is available for a given price; and (3) worthless and bothersome differences among competing products should not persist.

The problem of firms suppressing discoveries of new products or product improvements is hardly a concern in an industry which spends very little on research of any kind. The structure of the industry obviously has a depressing effect upon inventions and innovations of all types, but what is at issue here is whether individual firms suppress inventions of new products in order to preclude

their production by competitors or to maintain a status quo more favorable to the inventing firm. In view of the almost total absence of research in the sawmilling industry of the study region, it would appear that the absence of substantial improvements in the industry's products over time is an indication neither of the opportunities for product invention and improvement nor of the suppression of inventions; rather, it indicates a lack of effort devoted to invention and innovation.

Whether sawmill firms and sawlog producers offer the maximum quality of product that is available at a given cost is a matter of speculation. Empirical evidence bearing on this question is restricted to the following example. Sawlog quality is determined not only by the inherent quality of the wood contained in the tree but also by the way that the tree is cut up into individual sawlogs. Most sawlog producers do not specialize in any one type of timber product such as high-quality sawlogs, and most producers have fewer opportunities than sawmill operators to observe the relationship between sawlog characteristics and lumber-grade yields. Consequently, many sawmill firms that use predominantly high-quality sawlogs do most of their own logging because they cannot depend on producers to supply the highest quality of sawlog material that can be derived from the timber resource. Since it is no more expensive to cut up a tree so as to yield the highest grade recovery than to cut one up indiscriminately, sawlog producers, properly instructed as to bucking techniques which yield the highest grade recovery, would be able to increase the quality and value of sawlogs offered with virtually no increase in cost. Nevertheless, fewer than 6 percent of the sampled sawmill operators indicated that they provided such instructions for producers. In this one instance at least, there is a clear indication that sawmill and producer firms fail to provide the highest quality that is available for a given cost.

An often heard criticism nationally of the lumber industry is the failure of the industry to provide adequate quality control. A recent study of wood products manufacturers that bought sawmill products from sawmill firms located in the Northeast reported that many sampled firms indicated that the lumber they purchased often failed to meet grade, size, or seasoning specifications (99). Because of similarities in market structure, it is very likely that the markets for sawmill products in the study region are plagued with many of the same problems that occur in the Northeast. Substantial variation within product grades is a prime example in the sawmilling industry of the kind of worthless and troublesome product variation which should not persist. Deviations from standard with regard to product dimensions and moisture content is to be expected from the antiquated equipment so common in the study region. Failure to meet overall grade specifications would be a likely result of the small size of most sawmill firms and, as a consequence, their inability to hire competent graders. The failure to even consider measures to improve returns by improving sawtimber quality is well documented for the supply side of the stumpage market. Whatever the causes and whatever the degree of poor product performance, the fact that many sawmill operators and producers are in business only periodically to supplement their incomes from other employment or social security suggests that the regional sawmilling industry does not attract entrepreneurs and managerial personnel who vigorously pursue every profitable opportunity to increase product quality and reduce annoying variations in product characteristics.

Participant Rationality

Choices in the markets for sawlog material and sawmill products do not depend to any great extent upon the tastes of buyers and sellers; rather, they depend largely upon appraisals of how well the sawtimber, sawlogs, or sawmill products measure up to quantitative product characteristics. The opportunity to make rational comparisons among prices and product characteristics requires that the following be adequate: standards of identity and measurement, grading, standardization of quotations, price posting, market news, and product inspection and testing.

Lumber and most other sawmill products are sold by volume measured in thousands of board feet. Pallets, railroad ties, and some other products are sold by the piece. Uniform standards of measure are used throughout the region. Uniform grade standards, at least for lumber, are also used in all parts of the study region. Many sawmill operators are incapable of applying the grade standards, but this appears to be a result of insufficient instruction and experience rather than an indication of a deficiency in the standards.

In contrast to the acceptable measurement and grading standards for lumber, measurement standards for sawlogs and sawtimber are snarled with a diversity of standards and a lack of uniformity in the use of the different standards. At least eleven different measurement standards are used: the Doyle, Scribner or Scribner D.C., International, Doyle-Scribner, Minnesota Standard, and Wisconsin Standard log rules, the standard cord, face cord, lumber tally, tie content, and tonnage. Although a single log rule usually predominates in any given area, sufficient intermixture of standards occurs throughout the region to cause serious problems in making price comparisons. This is especially true for the average landowner who sells stumpage so infrequently that he is not only ignorant of the conversion relationships among the various standards but does not even know that different standards exist. The lack of uniformity in the application of the various measurement standards probably represents an even greater hindrance to participant rationality. Producers and especially forest landowners cannot easily make rational comparisons of the prices offered by two sawmill operators using the same log rule if one measures inside the bark and the other includes both barks in the measurement. Rational comparisons are impossible if the seller is unaware that measuring practices differ, which is probably the rule rather than the exception in the case of forest landowners. The fact that stumpage is sold by two different methods--price per measured unit and lump-sum payment for an unspecified volume--also contributes to the stumpage seller's problem of choosing among alternative offerings. Each method has both advantages and disadvantages, but the use of both methods in any given area adds to the problem of evaluating alternatives.

A lack of standardization of sawlog grades is even more prevalent. Most sawmill and producer firms do not use sawlog grades, and those that do usually use their own grading system rather than standards published by the U.S. Forest Service or state agencies. Comparisons among alternative offerings are confounded not only by the great number of different standards used but also because the individual standards are ill-defined, often known to only one of the parties, and not infrequently subject to self-interested manipulation. Whether the greater use of a uniform log-grade standard, as opposed to the present situation where most logs are sold ungraded, would increase marketing efficiency is a moot point. In view of the tremendous heterogeneity of the timber resource, however, it seems that uniform log grading, especially where quality is important, would offer many opportunities to reduce uncertainties about product characteristics and to sharpen price-product comparisons.

The inadequacy of information about prices and other market conditions for sawmill products, sawlogs, and stumpage has been discussed at some length in this chapter and in Chapter 4. Under conditions of spatially separated market transactions, many buyers and sellers participating in the market only infrequently, very little advertising, and infrequent, dated, and oversimplified market news reporting, participants in the markets for sawmill products, sawlogs, and stumpage frequently have inadequate information to make well-advised choices among competing alternatives. All things considered, there is no doubt that the markets for sawlog material and sawmill products perform poorly with regard to the opportunities offered buyers and sellers for making rational marketing decisions.

Conservation

Conservation, as a dimension of performance, refers to the appropriate production techniques and the optimum time pattern of production and investment spending needed to maximize net social benefits over time. Ideal conservation performance cannot be determined mainly because the sum of all possible social benefits and costs and the social rate of time preference--how strongly present satisfactions are preferred to future satisfactions--can be only roughly estimated. This does not mean that there are no meaningful normative concepts or criteria for identifying good and bad conservation practices.

Questions regarding forest conservation have traditionally been concerned with three general areas: wood utilization, forest management practices, and harvesting practices--one of the most important aspects of management. Good conservation with regard to wood utilization involves the introduction of equipment and production techniques to utilize mill residues and to reduce wood wastes during logging and milling operations, and appropriate scales of operation and marketing methods to insure that all sawlog material and sawmill products are sold for their most valuable uses. Good conservation requires that the productive capacity of the forest land and growing stock be at least maintained and preferably improved and that all investments be undertaken which yield a rate of return which is at least equal to the lowest rate of return accepted on other investments of equal risk. Harvesting practices should not impair the productive capacity of the forest resource. Current investments and other expenditures should not be curtailed to the point that future costs are raised disproportionately. Examples of practices that impair the productive capacity of the forest resource or raise future costs disproportionately include: failure to provide adequate watershed protection during logging, thus resulting in soil erosion; delaying reseeding or planting of cut-over sites until brush has been established and therefore making reforestation more expensive; and failure to remove weed species and wolf trees with the result that the growing space available for marketable species declines. Using the above criteria, several propositions regarding the relationships between market structure and conservation performance may be explored.

1. The majority of the commercial forest land in the study region is held in thousands of private ownerships. With an average tenure of from 10 to 15 years, the owners of these properties have rather shortsighted goals and generally find it difficult to justify investing in forest management practices which commonly yield no benefits for the first 10 or more years. Likewise, average life expectancy, based on the sampled firms, is about 12 years for producer firms and 15 years for sawmill firms. Because of the short life expectancy, there is little incentive for the average producer or sawmill firm to incur any greater logging costs which might be associated with good conservation practices or to forego current consumption of timber which would result in greater yields only in the distant future.

2. About 60 percent of the commercial forest land occurs in small holdings of less than 500 acres in size. Most of these small holdings are not only below an optimum size for maximum profitability

but they are often associated with farming and other enterprises which yield a low return. Small-woodland owners with low incomes and high propensities to consume are generally not interested in making investments in forestry, most of which yield rather low and distant returns. Profits received by producers and sawmill firms are believed to be only moderate at best. Under conditions of low profits, few firms are willing to give up present consumption of timber or to assume higher harvesting costs in order to receive proportionally larger returns in the future. Furthermore, profits received by most sawmill firms apparently are not large enough to provide substantial investment funds, and loans are both difficult to obtain and costly because of the limited collateral and high rate of turnover of sawmill firms. As a result of the high costs of investment funds, sawmill firms are further discouraged from making investments in new sawmilling equipment that would reduce saw curf and wastes resulting from mismanufacturing, and other equipment such as barkers and chippers needed to utilize residues.

3. Entry into the markets for sawlog material and sawmill products is very easy and thus competition within these markets is very keen. Competition is especially strong for the limited and dwindling inventory of high-quality sawtimber. Because competition is unrestricted, firms are likely to adopt the philosophy of capturing as much of this resource as possible before competitors do likewise. This kind of competitive behavior typically leads to high grading and, as a result, a deterioration in stand composition and decline in productivity.

4. Locational flexibility--the ability of sawlog producers, portable sawmills, and many small "stationary" sawmills to easily relocate--has both a direct and indirect effect on conservation performance. It affects conservation indirectly by lowering the barriers to both entry into and exit from the markets for sawlogs and stumpage. Lowering the barriers to entry may encourage excessive competition and poor conservation performance as a result. On the other hand, lowering the barriers to exist (relocation) enables firms to leave areas of overcutting in favor of other market areas where timber supply is more abundant. The ease with which sawlog producers and many sawmill firms are able to relocate their operations may also have a direct and adverse effect on conservation performance if a "cut out and get out" philosophy results.

5. A large proportion of the forest landowners receive only a minor share of their incomes from their forest properties. Approximately 40 percent of the sampled producers received less than half of their income from producing timber products and about 30 percent of the sawmill operators received some income from sources other than sawmilling. Those individuals who receive only a minor proportion of their total income from forestry-based activities are apt to be indifferent toward even those conservation practices that would produce greater incomes in the near future.

6. Most forest owners, sawlog producers, and sawmill firms have little understanding of forest management and the effect which cutting practices have on future forest yields.

7. Only a small proportion of the total commercial forest land in the study region is owned by sawmill firms and full-time sawlog

producers. Sawmill firms and producers obtain 90 percent or more of their sawlog requirements from properties owned by other individuals. Because of short planning horizons, producers and sawmill firms very likely are little concerned about the future productivity of these properties.

8. Because of the small size of their operations, sawmill operators and sawlog producers are likely to believe that their individual acts of conservation or waste have no appreciable effect on the total resource. Furthermore, the small size of forest ownerships and of sawmill firms often results in the production of such small quantities of scarce, high-value sawlogs and sawmill products that they cannot be sorted out and sold for the highest-paying uses of these products. These products, therefore, are partly wasted because their highest use potential is not realized.

On the basis of the above propositions, it is apparent that the market structures for sawmill products and sawlog material do not favor good conservation performance. Observations of the trends in the forest resource and of the effects of cutting practices provide additional evidence that conservation performance is far from ideal. It was pointed out in Chapter 3 that the volume of hardwood sawtimber in Grade No. 1 and Grade No. 2 logs decreased by 5 percent and 25 percent, respectively, from 1953 to 1963 while the volume in Grade No. 3 logs increased by 11 percent. Total sawtimber volume increased by 10 percent, but this can hardly be taken as an indication of good conservation when the increase is accomplished in part by less-valuable timber taking the place of more-valuable timber. The decline in sawtimber quality was due partly to a decline in tree size, which does not necessarily indicate poor conservation unless growing trees to larger sizes would actually be more profitable. If however, the decline in quality reflects overall deterioration of the resource as a result of poor management practices, then poor conservation is indicated. This latter proposition is supported by two studies in Michigan of the silvicultural effects of logging practices on recently cut tracts. Yoho, James, and Quinney (101) classified cutting practices on 60 percent of the privately owned tracts of the northern half of the Lower Peninsula as being poor--expected to result in stand deterioration. James (29) found cutting practices to be poor on about half of all private and public holdings throughout the state.

CHAPTER 9

SUMMARY AND CONCLUSIONS

The objectives of this study are to identify and describe the important elements of the structure and conduct of the markets for sawtimber, sawlogs, and sawmill products in the North Central Region, to provide an analytical framework for investigating the performance of these markets, and to evaluate performance on the basis of norms adapted to empirical investigation. The major recent trends in the forest resource and in the sawmilling industry of the study region, the important elements of market structure and conduct, the apparent quality of market performance produced by the observed market structure and conduct, and the policy implications of these findings are summarized below.

Recent Trends in Lumber Production and Consumption and in the Forest Resource

Since 1939, the level of regional lumber production and the regional share of national production have been fairly constant from decade to decade. Production of hardwood lumber has fluctuated around 80 percent of total regional production. In the past 30 years, the region's share of national hardwood production has remained around 20 percent while its share of softwood production has amounted to only 1 to 3 percent.

It is estimated that total annual consumption of lumber within the region has remained about the same since 1940 and that the region's share of national lumber consumption has decreased slightly. Approximately 90 percent or more of the softwood lumber consumed in the region is imported. The majority of the imported volume comes from western states and most of the remainder comes from southern states and Canada. In contrast, regional production and consumption of hardwood lumber are approximately equal. It is estimated that half or more of the hardwood lumber consumed within the region is also produced within the region. Somewhat more than half of the lumber produced in the region is used in the manufacture of wood products; most of the remainder is used in the construction industry. The manufacture of pallets, wooden containers, and furniture represent the major manufacturing uses of lumber produced in the study region. The volume of lumber consumed annually in the manufacture of pallets within the region has increased tremendously since 1948, while the amounts consumed by the other two major uses have probably declined or remained about the same.

Total sawtimber volume on commercial forest lands in the region increased from 108.5 billion board feet in 1953 to 119.3 billion board feet in 1963. The proportion of hardwood volume decreased slightly from 86 percent to 84 percent. Although sawtimber volumes of most of the more valuable species have increased since 1953, current growth-drain relationships suggest that some of these species may not hold their own in the near future. While sawtimber volume per acre has increased, average size and quality of sawtimber trees have decreased substantially since 1953. Other than a slight decrease in proportion of total commercial forest land owned by farmers, there have been no substantial changes in the pattern of landownership in the past 10 years.

The Structure of the Sawlog and Sawmill-Products Markets

Sawmill firms operating in the study region are, with few exceptions, small, localized enterprises, are usually owned by individual proprietors, and usually consist of only one sawmill per firm. The highly atomistic structure of the sawmilling industry is illustrated by the fact that, of the 9,035 active sawmills in the region in 1958, less than 2 percent employed 20 or more workers and only 7 mills employed 100 or more employees apiece (79, 80). Moreover, the vast majority of sawmill firms produce less than 500 thousand board feet annually. Of the sampled mills that produced more than 500 thousand board feet in 1960, less than 2 percent produced more than 4 million board feet. Only 15 percent of the sampled sawmill firms indicated that they owned more than one mill and less than 5 percent claimed ownership of more than 2 mills. The low degree of concentration in the production of sawmill products is further indicated by the concentration ratios for the geographical area actually covered by the sawmill survey. It was estimated that the four largest firms produced about 7 percent, the eight largest firms produced about 10 percent, and the 20 largest accounted for approximately 16 percent of the total lumber production in the surveyed area. Concentration ratios for the entire study region are undoubtedly much smaller than these estimates.

The number and size distribution of producer firms exhibit an even more highly atomistic structure than that for sawmill firms. The typical producer operation is owned and managed by one person; it usually consists of one truck, a tractor, one or two chain saws, and ordinarily not more than one employee. There are an estimated 20,000 to 30,000 sawlog producers in the region. Nearly three-fourths of the sampled producers handled less than 150 thousand board feet of sawlogs in 1960. On the average, sampled sawlog producers sold 131 thousand board feet of sawlogs in 1960 and about 116 thousand board feet of other products such as pulpwood, veneer logs, cooperage bolts, fuelwood, posts, poles, and piles. Nearly two-thirds of the sampled producers reported that they hired no full-time employees, and only one-fifth reported hiring more than one full-time worker. About half of the sampled producers employed part-time personnel.

The demand side of the markets for sawmill products produced in the study region is characterized by a large number of different types of firms and a low degree of concentration. Located within the study region are thousands of noncommercial final consumers and retailers and hundreds of wholesalers, brokers, manufacturers and industrial users. However, because of the small size of their operations and limited information about market outlets, most sawmill firms sell to no more than two or three commercial buyers.

Approximately 1.2 million private forest ownerships and a few hundred federal, state, county, and municipal ownerships make up the supply side of the stumpage market. Privately owned holdings contain 72 percent of the total commercial forest land and 81 percent of all sawtimber volume in the region. Forest ownerships of less than 500 acres in size contain 61 percent of all commercial forest acreage. Associated with the large number of small, independently owned forest ownerships are the following disadvantages: higher costs of search, sales negotiation and logging, and greater variability and uncertainty of sawtimber supply as a result of diverse management objectives, short planning horizons, and uncoordinated cutting schedules.

The forest resource is perhaps the most important structural element of the markets for sawlog material and sawmill products. In the study region the forest resource consists of a large number of small, noncontiguous stands which are generally poorly stocked and contain several species and a great variety of quality classes. The small size of the sawtimber, small and scattered woodlots, and relatively sparse stocking contribute to the higher logging, hauling, and milling costs, limit economies of scale in logging and milling, and encourage small, flexible producer and sawmill operations. The product mix of sawmill firms and the variety of timber products handled by producers are determined largely by the species, size and quality composition of the timber resource, the considerable variability of stand composition, and the variability of quality within the individual sawlogs. Moreover, the heterogeneity typical of most stumpage purchases complicates logging operations, the regulation of sawlog and lumber inventories, and milling and shipping operations. Finally, the scarcity and lack of concentration of highly valued species and quality classes often result in the use of this material at lower than its maximum potential value.

Conditions of entry into and exit out of the markets for sawtimber, sawlogs, and sawmill products are very easy. The major factors which are responsible for easy conditions of entry are the absence of product differentiation based on firm-associated characteristics and the lack of substantial economies of scale. Since the manufacture of sawmill products results in a tremendous loss of weight and since the raw material is geographically dispersed, the production of sawmill products is carried out at numerous, small, widely scattered processing plants. The economies of scale in manufacturing are limited by the small size and variability of the sawlog material. As sawmill scale increases, rising costs of raw material assembly soon outstrip any economies of scale realized in manufacturing. Since economies of scale are not substantial for either logging or milling operations, investment requirements are rather low--less than $20,000 for a new sawmill and frequently less than $5,000 for a producer firm. Moreover, a firm entering the market has no appreciable effect on supply and market price, and thus established firms do not try to prevent new entries. Other factors which contribute to easy entry conditions include: (1) many sawmills and all producer operations are highly mobile; (2) locational requirements, especially for producers, are easily met; (3) the technology involved in logging and milling is simple and easily acquired; (4) wood-using firms own or control only a small proportion of the total timber resource; (5) long-term or exclusive marketing agreements for either sawlogs or sawmill products are uncommon; and (6) there are no severe shortages of any critical factors of production.

Market information, that is, the availability, distribution, and adequacy of information about prices, buyers' demands, and market outlets, ranks in importance with forest-resource characteristics and ease of market entry as an element of market structure. The undesirable quality of market information is exemplified by: (1) inadequate means of communicating specific information between buyers and sellers--in particular, the overwhelming reliance on face-to-face encounters--and (2) market news reports which occur rather infrequently, are a month or more out of date, and lack sufficient detail. Basic factors which underlie the difficult problem of communicating market information about stumpage, sawlogs, and sawmill products include: the difficulty of identifying quality variations within these products, the difficulty of describing and measuring these products in both quantitative and qualitative terms, the proliferation of measuring standards and lack of uniformity in their application, the infrequency of market transactions (in particular, stumpage sales by landowners), the high proportion of part-time producers and sawmill operators who are out of touch with the market for long periods, the great variability of the timber resource, and the spatial separation of market transactions.

Several additional structural factors are noteworthy because of their influence on one of the dominant characteristics of sawmill and producer operations: seasonal and cyclical instability. Elements of market structure which foster discontinuities in the production of sawlogs and sawmill products include: the divisibility of the production process into separate steps; good storage qualities of logs and sawmill products; the low ratio of fixed to total costs; poor financial strength of most producer and sawmill firms; a small degree of vertical integration backward through forest landownership and consequent lack of control over stumpage supply; and the highly variable demand for some sawmill products.

Market Conduct in the Production and Marketing of Sawmill Products

Most sawmill firms produce two or three different products or groups of similar products--the differentiation being based primarily on species and grade. The product diversification typical of the industry does not represent an attempt to reduce the risks associated with fluctuations in the demand for various products; rather, it represents a passive reaction to the variability in the species and grade composition of the sawlog supply. Few firms limit sawlog procurement to only certain species and grades of sawlogs which are suitable for producing a particular line of products. Hardwood grade, crating and blocking, hardwood construction lumber, railroad ties, and pallets accounted for about two-thirds of the total volume produced by sampled mills in 1960.

In addition to producing a variety of sawmill products, many sawmill firms engage in other enterprises. Nearly half of the sampled small-scale firms and about 16 percent of the large-scale firms reported working part time as farmers, common laborers, producers of sawlogs and other timber products, contract loggers, and as wholesalers of sawmill products produced by other firms. The prevalence of alternative occupations is due partly to the fact that many occupations--especially farming--are complementary with sawmilling in their use of labor and equipment so that a combination of sawmilling and another enterprise will often yield a higher net return than either enterprise separately. Many sawmill operators also do custom sawing and act as dealers of raw wood products. About half of the sampled sawmills did some custom sawing, the sum of which amounted to only 4 percent of total production in 1960. Slightly more than one-fourth of the sampled firms sorted out and resold some of the raw wood material received by them. The volume resold amounted to 4 percent of the total volume received in 1960.

One of the dominant characteristics of the sawmilling industry in the study region is the highly seasonal nature of its operations. Seasonal variations in the rate of sawmill output, sawlog deliveries, and in the level of product and sawlog inventories are caused primarily by the effects of the weather on logging conditions and secondarily by seasonal variations in the opportunities for alternative employment and in the demand for sawmill products. The necessity of maintaining low inventories of sawlogs and sawmill products during the summer in order to reduce losses due to degrade also affects the seasonality of operations. Fluctuations in the volumes of sawmill products and sawlogs produced are effected largely by changes in the number of active firms, in the number of employees per firm, or in the number of days worked per week, rather than by changes in the number of shifts operated per day by a constant number of active firms.

The great variability of the rates of sawmill output and sawlog deliveries intensifies the problems of inventory management. About one-fifth of the sampled sawmill operators reported that financial limitations and the opportunity costs of maintaining product and sawlog inventories often prevented them from maintaining desired inventory levels. Limitations of storage space were also mentioned by about the same number of firms. Limitations imposed by biological factors such as stain, checking, and insects were reported by about half of the firms sampled.

The vast majority of the volume produced by sampled sawmill firms in 1960 was sold within the study region to manufacturers, industrial users, and wholesalers. The market shares for five types of buyers were as follows: manufacturers, 41 percent; wholesalers, 19 percent; industrial users, 20 percent; and the remaining 20 percent was sold to noncommercial final consumers and retailers. Few sawmill firms fit the classic example of the "captured mill" controlled by a product buyer through partial ownership or financial obligations. However, because of the small size of most sawmill operations and the inadequacy of market information, sales accounts with commercial buyers are generally limited to only two or three accounts. For example, 90 percent of the small-scale firms sampled and about two-thirds of the large-scale firms sold to less than five manufacturers apiece in 1960, and over 60 percent of both size classes sold to no more than one industrial user, wholesaler, or retailer. The average size of commercial account ranged between 30 and 55 thousand board feet depending on size of sawmill. It is estimated that most sawmill firms make no more than two or three sales per commercial buyer in the course of a year.

The majority of sawmill firms reach only the market outlets located within their respective home states, and very few reach markets outside the study region. The maximum distance the sampled firms shipped their products in 1960 averaged 172 miles. The small size of market territories may be partly due to the relatively small volume of sawmill products sold to wholesalers. Increased sales to wholesalers would seem to offer sawmill firms a greater choice of potential market outlets and an efficient means of improving their knowledge of market conditions.

Nearly all product sales are made at the mill, and they are usually handled by the sawmill operator who acts as both production manager and sales manager. Very few sawmill firms operate a separate retail or wholesale yard or a sales office apart from the mill. Only the largest firms have an organized sales department which maintains continuous contact with major wholesale markets. The use of price or stock lists and advertising in trade publications are uncommon among all but the largest sawmill firms.

Most sawmill firms, except those that produce primarily pallet material and crating, and pallets, boxes and crates, sell out of product inventories rather than on a prior-order basis. In pricing product offerings, little attention is given to operating costs; pricing decisions are based almost entirely on the firms' understanding of current market prices. Knowledge of current market conditions is usually poor because most sawmill firms make sales infrequently and market news reporting is inadequate. On the other hand, pricing of products sold on a prior-order basis depends primarily on the sawmill firm's estimate of operating costs. Pallets, boxes, and crates are often sold on the basis of bids submitted by competing sawmill firms. With few exceptions, prices for products sold to commercial buyers are established by the buyers. The sales experiences of sampled sawmills indicate that the greater the number of buyers a sawmill firm deals with, the more knowledge it will have of market conditions, and the better will be its bargaining position.

Market Conduct in the Procurement of Sawlog Material

Sawmill firms acquire sawlog material from their own land, by stumpage purchases from other landowners, and by sawlog purchases from producers and occasionally from dealers. Sawmill firms and producers generally handle all marketable species in their wood procurement areas, yet they tend to concentrate on certain species depending upon the market outlets they have developed. Although quality specifications vary according to the principal products produced, most sawmill firms do not have highly restrictive quality specifications and generally accept all grades above a certain minimum.

Sawmill firms acquire their sawlog requirements from smaller, more localized market areas than the market areas for the products they produce. The wood procurement activities of most sawmill firms are confined to a 30-mile radius of the mill. Large mills and mills that buy scarce, high-value sawlogs generally have larger procurement areas than other mills. Procurement areas of sawlog producers are similar in size to those of sawmill firms. Slightly over half of the sampled producers had procurement areas of no more than 20 miles in radius in 1960 and less than 10 percent operated in an area greater than 50 miles in radius. Slightly over

90 percent of the sawlog material delivered to sampled mills in 1960 was transported by truck. Railroads accounted for 5 percent of the total volume delivered.

It is estimated that both sawlog producers and sawmill firms acquire about 6 percent of their sawlog requirements from their own lands. The vast majority of sawlog material is obtained from other privately owned land and less than 20 percent is acquired from public landownerships. Sawlog producers provided nearly half of the sawlog material procured by sampled mills in 1960. Nearly 90 percent of the volume acquired from producers was purchased on a f.o.b. mill basis. Sawmill firms logged and hauled somewhat over 40 percent of their sawlog requirements themselves; contract loggers provided nearly 10 percent; and dealers provided less than half of one percent. Many sawmill firms, especially those that produce hardwood grade, conduct their own logging operations because they have more skill and experience than the average producer in locating, buying, and logging the highly valued species and grades that are preferred. Most small sawmills do their own logging and hauling in order to utilize their employees more efficiently and also to retain competent employees by using them for both the milling and logging operations and thus offering them longer periods of employment.

About three-fourths of the sampled sawmill firms and nearly all but the smallest producer firms acquired part or all of their sawlog requirements in 1960 through stumpage purchases. Sawlog producers and sawmill firms use essentially the same methods in procuring sawtimber stumpage. Purchases of privately owned stumpage are almost always negotiated by a face-to-face encounter with the landowner. Sawtimber from public lands is acquired either by bidding in competition with other buyers or by bilateral negotiation with the public agency. The vast majority of sawmill and producer firms rely entirely on personal contacts in locating potential stumpage sellers. Less than 2 percent of the sawmill firms sampled and none of the producers hired stumpage buyers or regularly paid commissions to persons who informed them of potential stumpage sellers.

Producers and sawmill operators generally follow similar stumpage contract provisions. However, sawmill firms use lump-sum purchases more frequently than sawlog producers. Purchases of public stumpage are almost always covered by formal, detailed, written contracts specified unilaterally by the public agency concerned. Stumpage contracts negotiated with private landowners are usually brief, do not follow a standardized form, and normally contain only a few oral or written statements concerning the price or fee to be paid, the basis for payment, the time of payment, and the species, size, and quantity of timber to be cut. Written contracts are usually used when partial or full payment is made in advance of harvesting, when the landowner is not trusted, at the landowner's request, or in order to gain the confidence of a suspicious forest owner.

Stumpage prices are determined through negotiations between a buyer and seller for each individual sale rather than by a market price established by the unrestricted interaction of all buyers and sellers in the study region. Each tract has its pecular characteristics with regard to the species, size, and quality composition of the timber, the ease with which the tract can be logged, and the distance to the nearest sawmill. It is essential, therefore, that landowners receive price quotations from several buyers or at least the advice of a knowledgeable appraiser when making stumpage sales. Most landowners, however, make stumpage sales on the basis of only one price quotation and without any other means of judging the reasonableness of the offer. Sawmill operators and producers, who normally make from 5 to 20 stumpage purchases per year, have far more experience than private landowners in evaluating the inherent worth of various sawtimber stands, and they are more familiar with market conditions. There is little doubt that producers and sawmill firms generally occupy superior bargaining positions when negotiating stumpage purchases from private forest owners.

Marketing agreements between sawmill and producer firms are generally concerned only with the short-run demand situation of the sawmill firm or the short-run supply situation of the producer. Most agreements are negotiated for an estimated volume which a producer has to sell, the volume in a particular tract of timber purchased by a producer, or a portion of a sawmill firm's sawlog requirements for a period of several days to two weeks. Under conditions of elastic supply, long term sawlog purchase agreements offer little advantage to sawmill firms because sawlog requirements can easily be fulfilled by small price increases or simply by increasing individual producer allotments. The high variability of the supply and, to a lesser extent, the demand for sawlogs also discourages long-term marketing agreements between producers and sawmill firms.

Nearly 40 percent of the total volume of sawlogs purchased by sampled mills in 1960 was bought without making purchase agreements with producers prior to sawlog delivery. Most of the remainder was purchased under oral agreements. With few exceptions, both oral and written sawlog contracts are not considered by either party to be legally binding. Most contracts mention the price to be paid, the species and sizes that will be purchased, the basis of measurement, and the time of payment.

Although marketing agreements between sawmill and producer firms are usually concerned only with the exchange of a specific lot of sawlog material, cooperative arrangements are not uncommon. About one-fifth of the sampled producers reported that they ordinarily had resale agreements with sawmill firms prior to buying timber tracts. Slightly less than 10 percent of the producers reported receiving financing from sawmill firms and other buyers. A few producers also reported that buyers purchased stumpage in the producer's name or sold stumpage to producers with the agreement that they would in turn resell the material as delivered sawlogs to the original buyer. Sawlog material which was financed in some way by sawmill firms or other buyers amounted to 17 percent of the total volume handled in 1960 by sampled producers.

Sawmill firms appear to occupy a superior bargaining position in dealing with sawlog producers. In the first place, sawlogs are almost always sold on the basis of the sawmill operator's scale. Most sawmill firms probably have a greater ability than the average producer to accurately evaluate sawlog quality. In general, sawmill firms have the option of doing their own logging or hiring a contract logger if prices demanded by producers are too high. However, sawlog producers are not wholly dependent on sawmill firms. Two-thirds of the sampled sawlog producers handled other timber products which accounted for slightly less than half of the total volume of raw wood material handled in 1960. Moreover, nearly 60 percent of the producers indicated that they worked at other occupations or operated other business enterprises. Most producers have a considerable degree of latitude in switching from one timber product to another as relative prices change or in alternating between their producing operations and other employment as opportunities change.

Sawlog Prices and Production Costs

The cost and price estimates obtained from sampled firms are useful primarily in the formulation and initial testing of hypotheses about the parity of prices quoted on the basis of the three log rules most commonly used in the study region. On the basis of the volumetric relationships among the three log rules as indicated by standard volume tables for timber typical of the study region, it would be expected that prices based on Doyle should be about twice as high as prices based on International and 60 percent higher than prices based on Scribner. Scribner prices should be about 25 percent higher than prices quoted for International. Comparisons for both stumpage and sawlog prices for five common species in Michigan revealed that Doyle prices were only slightly higher than International prices and Scribner prices were generally somewhat lower than prices based on the International rule. The relative prices for Doyle and Scribner, however, were about as would be expected based on standard volumetric relationships. These findings suggest that either: (1) prices based on the Doyle rule are equivalent to prices based on the Scribner rule, but prices based on both of these rules are relatively much lower than prices based on the International rule; or (2) one or more of the log rules is not applied according to official specifications so that the actual volumetric relationships among the rules are different than those indicated by standard volume tables, and thus the observed price relationships may represent a parity among prices based on the different log rules.

Comparisons of stumpage prices as a percentage of conversion return for four common species in Michigan revealed that a much smaller proportion of conversion return was paid for stumpage for all four species when purchased by Doyle rule than when purchased by either Scribner or International rule. It would appear that, at least in Michigan, forest landowners are at a greater disadvantage when selling stumpage on the basis of the Doyle rule as compared to the Scribner and International rules.

Market Performance

The evaluation of market performance in this study is based primarily on deductive inferences as to the kind of performance that is likely to evolve from the observed market structure and conduct and secondarily on qualitative and quantitative measures of actual performance. Poor market performance is strongly indicated on the basis of the following dimensions: production efficiency, technological progressiveness, exchange efficiency, product suitability, participant rationality, and conservation. Market performance with regard to sales promotion and the earnings of market participants is not clearly either good or poor.

The structure and conduct of the markets for sawlog material and sawmill products suggest that performance with regard to production efficiency is poor. It would appear that mistakes are commonly made in the allocation of resources in view of the fact that many producers and sawmill firms keep no records of costs and returns and many operate only part time and thus are not likely to acquire a high degree of managerial competence. A considerable amount of excess sawmill capacity exists. This may indicate nothing more than a misallocation of resources in the past, but extant inefficiency is indicated to the extent that sawmill operators are prevented from leaving the industry because of ignorance of alternative employment or investment opportunities, uncertainty, and inability to finance the costs of relocation. Furthermore, it is also apparent that most sawmill firms and, to a lesser degree, producer firms could realize substantial marketing, managerial, and financial economies by expanding the scale of their operations. Finally, the sawmilling industry in the study region has lagged behind some other regions of the country in the utilization of mill residues for other than low-value fuelwood.

Due to the financial weakness, short planning horizons, and lack of market power typical of nearly all sawmill and producer firms in the study region, the proportion of total expenditures devoted to research by the regional sawmilling industry is far below the national average for the sawmilling industry, the plywood industry, and pulp and paper industry. Although there appears to be no conscious suppression of inventions, in view of poor cost accounting and poor channels of communications it is questionable whether accurate evaluations of investment opportunities are generally possible and whether innovations are readily introduced and rapidly disseminated throughout the industry. For these reasons, technological progressiveness is judged to be poor.

The atomistic structure of the markets for sawlog material and sawmill products and the existence of considerable excess capacity suggest that profit rates would tend to be no more than, and very likely less than, the norm of pure competition. Observations of 40 full-time producers who hired no full-time employees indicated that nearly one-third of the producers earned less than the minimum wage of $1.25 per hour. Market performance, or perhaps more accurately, the performance of the regional or national economy is less than ideal if producers earn subminimum wages because they are ignorant of employment alternatives, immobilized by uncertainty, or financially unable to meet the costs of relocation.

On the question of sales promotion, the absence of persuasive or misleading advertising of sawmill products and sawlog material indicates good performance. It is questionable, however, whether informative advertising of prices and of the demands and offerings of buyers and sellers is adequate.

Performance with regard to the adherence of products to size and grade standards and the rate and frequency of product change and improvement over time appears to be poor. Research expenditures for product development and improvement, in both absolute and relative terms, lag far behind expenditures by other industries as well as by the lumber industry of the West. Sawlog producers often fail to obtain the highest grade recovery possible because they use improper bucking methods. Moreover, worn-out milling equipment, small size of firms and consequent inability to hire competent graders, and the part-time nature of many firms undoubtedly lead to poor quality control.

The ability to make rational comparisons among prices quoted for sawlogs and stumpage is severely hampered by the following: at least eleven different measurement standards are used; individual standards of measure are not applied uniformly; and sawmill firms and producers usually devise their own sawlog grade standards. Forest landowners in particular are at a disadvantage under these circumstances because most landowners are not only ignorant of the conversion relationships among the various log rules, but they also do not even know that different rules exist. In addition to inadequate standardization of measurements and exchange provisions, other factors such as inadequate market news reporting, the spatial separation of market transactions, the infrequency of transactions of many of the market participants, and the large number of buyers and sellers contribute to the problem of making rational choices among alternatives and add to the cost of buyer-seller pairing and price formation.

Poor conservation performance is indicated by the fact that sawtimber quality has decreased substantially since 1953, and studies of cutting practices have reported that half or more of the logging operations investigated were expected to result in stand deterioration (29, 101). Poor conservation performance is also suggested by the following aspects of market structure and conduct: (1) average forest land tenure and average life expectancy of sawmill and producer firms are short; (2) most forest holdings are too small for maximum efficiency; (3) many landowners have low incomes and high propensities to consume; (4) apparent low profits and high costs of financing of sawmill firms discourage investment in new equipment to reduce residues and utilize wastes; (5) very easy market entry invites destructive exploitation of the forest resource; (6) high firm mobility is likely to encourage a "cut out and get out" philosophy; (7) most forest landowners and many producers and sawmill operators receive a small share of their total incomes from forestry-based activities and therefore are not likely to be willing to incur higher costs or forego present consumption in order to preserve future income from forestry; (8) the vast majority of landowners, producers, and sawmill operators have little understanding of forestry; (9) sawmill and producer firms obtain most of their sawlog requirements from land which they do not own and therefore are not likely to be concerned about its future productivity; and (10) because of the atomistic structure of the industry, sawmill operators and producers probably believe that their individual acts of conservation or destruction have no appreciable effect on the forest resource.

Public Policy Implications

Several elements of market structure and conduct which appear to result in poor market performance have been identified. The policy implications of these findings cannot be fully determined without further studies in depth of the various structure-conduct-performance relationships identified in this study. It is possible, however, to distinguish the areas in which public policy most likely should be concerned. The recommendation of alternative programs and the selection of those which are likely to be most successful must necessarily depend upon detailed analyses of the various problems and initial tests of alternative remedial programs.

The inadequacy of market information is one of the major deficiencies of the markets for stumpage, sawlogs, and sawmill products. Programs to increase the frequency, accuracy, and detail of market reports for local areas should be considered. Particular attention should be given to exploring ways of making market information available to a greater number of market participants. Although price reporting for stumpage may be infeasible, better knowledge of delivered sawlog prices would be useful to landowners who are able to do their own logging and hauling or hire a contract logger. Regulatory legislation and programs to reduce the number of measurement and grading standards for sawlogs, to enforce uniform application of the standards, and to promote greater standardization of exchange provisions should also be considered.

Many of the problems of the industry stem from the small size of forest holdings, continuing deterioration of timber quality, and relatively low stand densities. Programs to educate and assist landowners in forest management and timber marketing apparently have not been especially successful. The consolidation of forest ownership would appear to offer a solution, but present trends in landownership do not indicate that landownership consolidation could be accomplished without public incentive programs of major proportions. Research as to the advantages of greater consolidation of forest ownership and the barriers to consolidation would be useful. Consideration should also be given to investigations of the advantages offered by forest landowner cooperatives, especially with regard to managerial ability, diversified marketing, and the assimilation and use of market information. Destructive cutting practices represent a major obstacle to profitable forest management and the conservation of the forest resource. Measures to control destructive competition, such as selective licensing of sawmill and producer firms, and to regulate cutting practices should not be overlooked.

Studies of the marketing, managerial, and financial advantages of large, diversified sawmill firms would be useful. Special attention should be given to raw material requirements and other locational factors, optimum product combinations, and the potential markets for primary products and by-products. Consideration should also be given to the problems of sawmill operators and producers who are willing but are unable to leave the sawmilling industry and relocate for other, more remunerative occupations.

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APPENDIX A.

SAWMILL FIRM INTERVIEW SCHEDULE

CONFIDENTIAL

Date________________
Recorder______________
State________________

NCM-27 Project

SAWMILL SCHEDULE[1]

Name of firm____

Address____

A. General:

1. Is your sawmill portable or stationary? Portable_____ Stationary_____

2. How many years has your firm been operating at this location? (For portable mills eliminate phrase "at this location") _____ years.

3. Does your firm operate other wood-using mills? Yes____No____
   If YES, how many?_____
   If YES, how many in the study area?_____

4. Is your firm engaged full time in the processing of timber products? Yes____No____
   If NO, what other business or occupation is your firm engaged in? (specify)_____
   If NO, what percentage of your firm's gross revenues in 1960 was realized from the sale of forest products? _____percent.

5. What were the principal final products of your firm at this location in 1960?

6. How many full-time employees did you have at this location in 1960?_____

7. How many seasonal employees did you have at this location in 1960?_____

8. Were any of your wood receipts in 1960 (sawlogs or other wood products) resold in the same form in which they were received? Yes____No____
   If YES, what species, products, and amounts?
   If YES, why was this wood not processed at your mill?

---

[1]The interview schedule presented here has been abbreviated by deleting spaces for recording data for many of the questions.

B. Quantities of sawlog receipts: (volume by_____log rule)

1. What was the total volume of sawlog receipts at your mill in 1960? (List volume by species.)

2. What was the seasonal pattern in volume of sawlog receipts at your mill in 1960?
   a. Peak-use months and amounts (aver.)_______
   b. Lowest-use months and amounts (aver.)_____
   c. Other months and amounts (aver.)__________

3. Do you consider the seasonal pattern in volume of sawlog receipts at your mill in 1960 to be a typical pattern? Yes____ No____
   If NO, why not?

4. Do you prefer seasonal variations in the volume of sawlog receipts at your mill? Yes___No____
   If YES, what is your preferred pattern of receipts?

5. How do you explain the seasonal variations in the typical pattern of sawlog receipts at your mill?

6. What percentage change in the annual volume of your sawlog receipts has taken place in the last five years?
   No change_____
   Increase_____%
   Decrease_____%

7. Did your mill do any custom sawing of logs in 1960? Yes___No____
   If YES, what species, products, and amounts?
   If YES, did you receive as payment a portion of the wood processed? Yes___No____
   If YES, what percentage?_____percent.

C. Inventories of sawlogs:

1. What was the seasonal pattern in sawlog inventories on hand at your mill in 1960?

   a. Peak-inventory months and amounts (aver.)_______
   b. Lowest-inventory months and amounts (aver.)_____
   c. Other months and amounts (aver.)_______________

2. Do you consider the seasonal pattern in sawlog inventories at your mill in 1960 to be a typical pattern? Yes___No____
   If NO, why not?

3. Do you prefer seasonal variations in the volume of sawlog inventories on hand at your mill? Yes___No____
   If YES, what is your preferred pattern of inventories?

If NO, do you have an objective of maintaining a fixed ratio in the volume of sawlog inventories to annual receipts?
Yes___ No___

If YES, what is the ratio?

If NO, do you have an objective of maintaining a fixed ratio in the volume of sawlog inventories to annual manufactured product sales? Yes___ No___

If YES, what is this ratio?

4. Is there a limit to the volume of sawlog inventories that can be stored in yard economically? Yes___ No___
   If YES, what is the nature of the limitation?
   If YES, what is the maximum volume?

5. Is there a physical and time limit to the volume of sawlog inventories that can be stored in yard because of insects, fungi, etc.? Yes___ No___
   If YES, what is the nature of the limitation?
   If YES, what is the maximum volume?

D. Sources of sawlog receipts:

1. What was the 1960 sawlog supply area for your mill? (List counties or states. State radius of operations in miles.)
   a. Counties or states.________________
   b. Radius of operations (maximum).______

2. Have there been any significant changes in the sawlog supply area for your mill in the last five years? Yes___ No___
   If YES, what were the changes?

3. What is the ownership of the forest land from which the 1960 sawlog supply was obtained? (Estimate volume of wood or percentage of total volume obtained from each source.)

	Volume	%		Volume	%
a. Own land*			d. Nat. forest		
b. Farmer			e. State forest		
c. Other private			f. Other public		

*Include subsidiary company ownership.

4. Have there been any significant changes in the sawlog supply obtained from different forest landownership sources in the last five years? Yes___ No___
   If YES, what were the changes?
   If YES, what explanations can you give for these changes?

5. From which sources was your 1960 sawlog supply obtained? (Estimate volume of wood or percentage of total volume obtained from each source.)

Volume %

a. Employees on own firm's payroll:
   (1) From own lands ____
   (2) From other lands ____
b. Producer ____
c. Dealer ____
d. Other agent (specify) ____
____

6. Have there been any significant changes in the above sources of your sawlog supply in the last five years? Yes____ No____
   If YES, what were the changes?
   If YES, what explanations can you give for these changes?

E. Sawlog procurement methods and policies:

1. What percentages of your firm's 1960 sawlog purchases were obtained under the following types of agreements? %
   a. Written contract ____
   b. Oral contract ____
   c. No prior agreement ____

QUESTIONS 2 TO 6 APPLY ONLY TO WRITTEN CONTRACTS FOR SAWLOG PURCHASES. IF THERE WERE NO SUCH CONTRACTS, SKIP TO QUESTION 7.

2. How far in advance of the beginning of sawlog deliveries are contracts usually negotiated?

3. What are the details of standard written contracts for sawlog purchase? (Obtain printed copies where possible. Check the following items which are included in contract specifications; then describe as much as possible.)

   a.____Kind of wood ____
   b.____Amount of wood ____
   c.____Size of wood ____
   d.____Quality of wood ____
   e.____Time or period of delivery ____
   f.____Method of payment ____
   g.____Time of payment ____

4. Are there any differences in the sawlog purchase contracts made with different groups of suppliers? Yes____ No____
   If YES, what are these differences?

5. Does the standard sawlog purchase contract specify any logging provisions under which timber is to be harvested? Yes____ No____
   If YES, what are the conditions?

6. How binding are the provisions of standard written contracts for sawlog purchases (i.e., how much leeway is given suppliers

in completing terms of contract and how much leeway does your firm allow itself in terminating contracts)?

QUESTIONS 7 TO 11 APPLY ONLY TO ORAL CONTRACTS FOR SAWLOG PURCHASES. IF THERE WERE NO SUCH CONTRACTS, SKIP TO QUESTION 12.

7. How far in advance of the beginning of sawlog deliveries are contracts usually negotiated?

8. What are the details of oral contracts for sawlog purchases? (Check the following items which are included in agreements; then describe as much as possible.)

   a.____Kind of wood________________
   b.____Amount of wood________________
   c.____Size of wood________________
   d.____Quality of wood________________
   e.____Time or period of delivery________________
   f.____Method of payment________________
   g.____Time of payment________________

9. Are there any differences in the oral contracts for sawlogs purchases made with different groups of agents? Yes____ No____
   If YES, what are these differences?

10. Does the oral contract for sawlog purchases specify any logging provisions under which timber is to be harvested?
    Yes____ No____
    If YES, what are the conditions?

11. How binding are the provisions of oral contracts for sawlog purchases (i.e., how much leeway is given suppliers in completing terms of contract and how much leeway does your firm allow itself in terminating contracts)?

QUESTIONS 12 TO 16 APPLY ONLY TO SAWLOG STUMPAGE PURCHASES BY YOUR FIRM. IF NO STUMPAGE PURCHASES ARE MADE, SKIP TO QUESTION 17.

12. What percentages of your firm's 1960 sawlog stumpage purchases (in terms of volume) were obtained under the following types of agreements?

    %
    a. Written contract with public landowners________
    b. Written contract with private landowners________
    c. Oral agreement ________

13. What are the details of your firm's standard contracts for sawlog stumpage purchases from private landowners? (Check the following items which are included in agreements; then describe as much as possible.)

    a.____Species________________
    b.____Amount of timber________________

c._____Size of timber____________________
d._____Quality of timber____________________
e._____Time or period of harvest____________________
f._____Method of payment____________________
g._____Time and basis of measurement____________________

14. If the standard contract for sawlog stumpage purchases from private landowners is a written contract, and if oral contracts are also made, how does the oral contract differ in its provisions from the written contract?

15. Are there any differences in the details of sawlog stumpage purchase contracts made with different groups of private landowners? Yes____ No____
    If YES, what are the differences?

16. Does the standard contract for sawlog stumpage purchases from private landowners specify any logging provisions under which timber is to be harvested? Yes____ No____
    If YES, to what percentage of your 1960 private purchases do these specifications apply? _____percent.
    If YES, what are the specifications?
    If NO, are there any harvest conditions your firm will accept in contracts for sawlog stumpage purchases upon a private landowner's insistence?
       If YES, what are the conditions?

QUESTIONS 17 TO 23 APPLY TO ALL SAWMILLS

17. What percentages of your sawlog purchases (when first initiated) were obtained through negotiations initiated by your firm or initiated by sellers?

	Sawlogs (percent)	Sawlog Stumpage (percent)
a. Mill		
b. Sellers		
c. Indefinite		

18. When your firm takes the initiative in negotiating sawlog purchases, what are the methods you use in contacting potential suppliers?

19. When your firm takes the initiative in negotiating stumpage purchases, what are the methods you use in contacting potential suppliers?

20. From how many different persons or agencies was your 1960 sawlog supply purchased?

	No.		No.
a. Nonproducer landowner	_____	c. Dealer	_____
b. Producer	_____	d. Other agent (specify) __________	_____

Was 1960 a typical year? Yes____ No____
If NO, why not?

21. What quantities of your 1960 sawlog receipts were purchased on the stump, roadside, and delivered?

	Quantity	%
On the stump		
Roadside		
F.o.b. railroad		
Delivered to mill		

22. Did the points of purchase of 1960 sawlog receipts vary by persons or agencies supplying sawlogs? Yes____ No____
If YES, how did they differ?

23. To what degree does your firm perform the following functions in regard to sawlog procurement?

a. Logging?
b. Hauling?

24. Are many producers offered payments (loans) in advance of time of payment specified in a standard contract? Yes____ No____
If YES, is this the usual procedure adopted by your firm? Yes____ No____
If YES, does the producer pay interest on such prepayments or loans? Yes____ No____
If YES, what is the size limitation on the prepayments or loans offered?

25. Are any producers offered other business aids by your firm? Yes____ No____
If YES, is this the usual procedure adopted by your firm? Yes____ No____
If YES, what are these business aids?

QUESTIONS 26 AND 27 APPLY ONLY TO SAWLOG PURCHASES FROM DEALERS OR EQUIVALENT AGENTS.

26. Are any dealers offered payments (loans) in advance of time of payment specified in standard contract? Yes____ No____
If YES, is this the usual procedure adopted by your firm? Yes____ No____
If YES, does the dealer pay interest on such prepayments or loans? Yes____ No____
If YES, what is the size limitation on the prepayments or loans offered?

27. Are any dealers offered other business aids by your firm? Yes____ No____
If YES, is this the usual procedure adopted by your firm? Yes____ No____
If YES, what are these business aids?

F. Prices:

1. What prices were paid per unit of volume (price scale at end of 1960) for wood purchased by your firm? (Fill in as many items as possible, by species and quality classes.)

   Species and quality classes

   a. Stumpage
   b. Roadside
   c. Trucked at yard

2. Are there any differences in prices paid for delivered wood on basis of distance of haul? Yes___ No____
   If YES, what are these differences (and which distances do the prices quoted in Item 1 above refer to?)

3. Are the prices you pay for sawlogs most often the result of: (check the correct explanation below)

   a. ____your offered price? c.____negotiation?
   b. ____the seller's price? d.____other (specify)_____?

4. Are the prices you pay for stumpage most often the result of:

   a.____your offered price? c.____negotiation?
   b.____the seller's price? d.____other (specify)_____?

5. Are the prices received for your principal products sold most often the result of: (check the correct explanation below)

   a.____your price? c.____negotiation?
   b.____the buyer's price? d.____other (specify)_____?

6. What prices per unit of volume were obtained by your firm at the end of 1960 for the processed products you sold? (List by principal products.)

7. Have the prices you paid for sawlogs changed frequently during the 3-year period 1958-60? Yes___ No____
   If YES, how many times have the prices changed?_____times.

8. Have the prices received for the principal products sold by your firm changed frequently during the 3-year period 1958-60? Yes___ No____
   If YES, how many times have the prices changed?_____times.

9. What was the total dollar value of sawlogs (including stumpage, logging and hauling) delivered to your mill in 1960?

G. Costs:

1. What logging costs (felling and bucking and skidding) per unit of volume applied to sawlogs delivered to your mill at the end of 1960? (Estimate prevailing contract rates, if logging costs were not paid for directly by your firm.)

2. What truck hauling costs per unit of volume applied to sawlogs delivered to your mill at the end of 1960? (Estimate prevailing contract rates, if hauling costs were not paid for directly by your firm.)

   (1) Average cost?____________________
   (2) Min. cost?____________________
   (3) Max. cost?____________________
   (4) Cost by distance zones?____________________

3. Do truck hauling costs above include the cost of loading?
   Yes___ No____
   If NO, what is the estimated loading cost per unit or volume?
   If NO, who pays the cost of loading?

4. Do truck hauling costs direct to mill include the cost of unloading? Yes___ No____
   If NO, what is the estimated unloading cost per unit of volume?
   If NO, who pays the cost of unloading?

5. What was your cost per unit of volume for wood purchasing activities (not including the price of wood) in 1959?

H. Transportation:

1. What percentages of the volume of your sawlog receipts in 1960 were delivered to your mill by different methods of transportation? %

   a. Truck
   b. Railroad
   c. Other (specify_________

2. What were the truck-hauling distances to your mill in 1960 in direct-to-mill wood hauls?

   Miles

   a. Average distance
   b. Min. distance
   c. Max. distance

3. What changes in the distances of haul for truck deliveries of sawlogs to your mill have occurred in the past five years?

I. Sales of processed products:

1. What was the total volume of production at your mill in 1960? (List by products.)

2. What percentage of mill capacity did your 1960 production represent? ______percent.

3. What was the gross sales value of processed products at your mill in 1960?

4. What was the seasonal pattern of production at your mill in 1960 (in terms of volume)?

   a. Peak-production months and amounts (aver.)______________
   b. Lowest-production months and amounts (aver.)____________
   c. Other months and amounts (aver.)________________________

5. Do you consider the seasonal pattern of production at your mill in 1960 to be a typical pattern? Yes____No____
   If NO, why not?

6. What was the seasonal pattern in processed product inventories on hand at your mill in 1960?

   a. Peak-inventory months and amounts (aver.)_______________
   b. Lowest-inventory months and amounts (aver.)_____________
   c. Other months and amounts (aver.)________________________

7. Do you consider the seasonal pattern in processed product inventories at your mill in 1960 to be a typical pattern? Yes____No____
   If NO, why not?

8. Do you prefer seasonal variations in the volume of processed product inventories on hand at your mill? Yes____No____
   If YES, what is your preferred pattern of inventories?
   If NO, do you have an objective of maintaining a fixed ratio in the volume of processed product inventories to product sales? Yes____No____
      If YES, what is this ratio?

9. Is there a limit to the volume of processed product inventories that can be stored in yard economically? Yes____No____
   If YES, what is the nature of the limitation?
      If YES, what is the maximum volume?

10. Is there a physical and time limit to the volume of processed product inventories that can be stored in yard because of insects, fungi, etc.? Yes____No____
   If YES, what is the nature of the limitation?
      If YES, what is the maximum volume?

11. What percentages of the volume of your principal products in 1960 were produced to fill previously obtained orders?

Product	%

12. What area did your sales territory cover in 1960? (List by principal products. List counties or cities, or outermost states or cities. State Maximum distances.)

13. Have there been any significant changes in the product market areas for your firm in the past five years? Yes____ No____
    If YES, what were the changes?

14. To which types of buyers did sales of your principal products in 1960 go? (Estimate, by products, the volume or percent of total volume.)

	Volume	%	Volume	%	Volume	%
a. Manufacturer						
b. Wholesaler						
c. Retailer						
d. Industrial user						
e. Other (specify)						

15. Have there been any significant changes in the volumes of products going to different types of buyers of your principal products in the past five years? Yes____ No____
    If YES, what were the changes?
    If YES, what explanations can you give for these changes?

16. How many different buyers of your products did you sell to in 1960?

	No.		No.
a. Manufacturer	________	d. Industrial user	________
b. Wholesaler	________	e. Other (specify)	________
c. Retailer	________	__________	________

17. Have there been any significant changes in the numbers of buyers of your principal products in the past five years? Yes____ No____
    If YES, what were the changes?
    If YES, what explanations can you give for these changes?

18. What is the typical time interval between receipt of an order from a buyer and the filling of that order? (List separately by principal products, if time interval varies.)
    a. How much variation from the typical time interval occurs?
    b. What are the causes of variations from the typical time interval?

J. Producer or agent sources of sawlogs, 1960:

Name	Address

APPENDIX B.

SAWLOG PRODUCER INTERVIEW SCHEDULE

CONFIDENTIAL

Date____________
Recorder____________
State____________

NCM-27 Project

TIMBER PRODUCER-SAWLOGS[1]

Name of timber producer____________________________

Address____________________________

A. General:

1. How many years have you been operating as a timber producer? _____years

2. Are you a full-time timber producer? Yes____ No____
   If NO, what other business or occupation are you engaged in?

   a. Sawmill operator _____
   b. Operator of other wood-using mill (specify)______ _____
   c. Store operator _____
   d. Farmer _____
   e. Wage earner _____
   f. Other (specify) _____

   If NO, what percentage of your gross revenues in 1960 was realized from your business as a timber producer? ____percent.

3. What were the principal raw timber products you handled in 1960?

4. Is your timber-producing business typically a year-round business? Yes____ No____
   If NO, what are the typical months of operation?

5. How many full-time employees (including family members) in your timber-producing business did you have in 1960? ____employees.
   How many members of your family? ____employees.

6. How many seasonal employees in your timber-producing business did you have in 1960? ____employees.
   How many are members of your family? ____employees.

7. What volume of sawlogs did you produce in 1960? (Volume by _________ log rule).

Species	Volume	Species	Volume

[1]The interview schedule presented here has been abbreviated by deleting spaces for recording data for many of the questions.

B. Quantities of sawlog stumpage purchases: (volume by____log rule)

1. Did you purchase any stumpage as a basis for your sawlog-producing business in 1960? Yes____No____
   If YES, what volume, by species, was purchased as stumpage in 1960?

Species	Volume	Species	Volume

   Was 1960 a typical year? Yes____No____
   If NO, why not?

C. Sources of sawlog supply:

1. Where was your 1960 sawlog supply area located? (List counties. State radius of operations in miles.)

   a. Counties________________
   b. Radius of operations (maximum)________________

2. Have there been any significant changes in your sawlog supply area in the last five years? Yes____No____
   If YES, what were the changes?

3. What is the ownership of the forest land from which your 1960 sawlog supply was obtained? (Estimate % of total volume from each source.)

	%		%
a. Own land	____	d. National forest	____
b. Farmer	____	e. State forest	____
c. Other private	____	f. Other public	____

4. Have there been any significant changes in your sawlog supply from different forest landownership sources in the last five years? Yes____No____
   If YES, what were the changes?
   If YES, what explanations can you give for these changes?

D. Sawlog procurement methods and policies:

1. What percentages of your 1960 sawlog supply were obtained by the following stumpage acquisition methods?

	%
a. Stumpage from own lands	____
b. Stumpage purchased by you	____
c. Stumpage sold to you by buyer of your sawlogs	____
d. Stumpage purchased in your name by buyer of your sawlogs	____

QUESTIONS 2 TO 15 APPLY ONLY TO SAWLOG STUMPAGE PURCHASES BY PRODUCER. IF NO STUMPAGE PURCHASES WERE MADE, SKIP TO QUESTION 17.

2. What percentages of your 1960 sawlog stumpage purchases (in terms of volume) were obtained under the following types of agreements? %

   a. Written contract with public landowners _____
   b. Written contract with private landowners _____
   c. Oral contract _____

3. What are the details of your standard contracts for sawlogs stumpage purchases from private landowners? (Check the following items which are included in agreements; then describe as much as possible.)

   a._____Species_____
   b._____Amount of timber_____
   c._____Size of timber_____
   d._____Quality of timber_____
   e._____Time or period of harvest_____
   f._____Method of payment_____
   g._____Time and basis of measurement_____

4. If the standard contract for stumpage purchases from private landowners is a written contract, and if oral contracts are also made, how does the oral contract differ in its provisions from the written contract?

5. Does your standard contract for sawlog stumpage purchases from private landowners specify any logging provisions under which timber is to be harvested? Yes___No___
   If YES, to what percentage of your 1960 purchases do these specifications apply? ___percent
   If YES, what are the specifications?
   If NO, are there any harvest conditions your firm will accept in contracts for sawlog stumpage purchase upon a private landowner's insistence? Yes___No___
      If YES, what are the conditions?

6. How binding are your contracts for stumpage purchase (i.e., how much leeway do you allow yourself in terminating contracts)?

7. How far in advance of the beginning of harvest operations are sawlog stumpage purchase contracts usually negotiated?

8. Do you buy sawlog stumpage only when you hold a contract for the sale of products? Yes___No___
   If NO, explain your policy of stumpage purchases in advance of contracts for the sale of products.

9. What percentages of your 1960 sawlog stumpage purchases were obtained through negotiations initiated by you or initiated by landowners? %
   a. Producer _____
   b. Landowner _____
   c. Indefinite _____

10. When you take the initiative in negotiating sawlog stumpage purchases, what are the methods you use in contacting potential supplies?

11. How many sawlog stumpage purchase agreements did you make in 1960? _____agreements.
    Was 1960 a typical year? Yes___ No____
    If NO, why not?

12. From how many different persons or agencies did you obtain your sawlog stumpage purchases in 1960? _____persons or agencies.
    Was 1960 a typical year? Yes___ No____
    If NO, why not?

13. Is there a minimum volume per acre below which you will not consider sawlog stumpage purchase? Yes___ No____
    If YES, what is this minimum?

14. Is there a minimum volume per tract below which you will not consider sawlog stumpage purchase? Yes___ No____
    If YES, what is this minimum?

15. Is there a minimum value of sawlog stumpage per tract below which you will not consider stumpage purchase? Yes___ No____
    If YES, what is this minimum?

16. Did you receive funds from any of your sawlog buyers for stumpage purchases in 1960? Yes___ No____
    If YES, what portion of your total sawlog stumpage purchases in 1960 did these funds cover?

ALL SUBSEQUENT QUESTIONS REFER TO ALL SAWLOG PRODUCERS

17. Did you subcontract some or all of the logging operations in your sawlog-producing business in 1960? Yes___ No____
    If YES, what percentage of the volume handled was subcontracted? _____percent.
    If YES, did subcontracting apply to:

    a. Felling and bucking? Yes___ No____
    b. Skidding? Yes___ No____

    If YES, why didn't you handle all the logging operations yourself? (Check. If more than one reason, number in order or importance.)

    (a) _____Lacked necessary equipment
    (b) _____Lacked logging experience
    (c) _____Inadequate family or hired labor available
    (d) _____Believed subcontracting to be the cheaper method
    (e) _____Producer's time more valuable for other purposes
    (f) _____Other demands on producer's time
    (g) _____Other (specify)______________________________

18. Did you subcontract some or all of the hauling operations in your sawlog-producing business in 1960? Yes___ No____

    If YES, what percentage of the volume handled was subcontracted? _____percent.

    If YES, why didn't you handle all of the hauling operations yourself? (Check. If more than one reason, number in order of importance.)

    (a) _____Lacked necessary equipment
    (b) _____Lacked hauling experience
    (c) _____Inadequate family or hired labor available
    (d) _____Believed subcontracting to be the cheaper method
    (e) _____Producer's time more valuable for other purposes
    (f) _____Other (specify)____________________________

19. Did you receive in 1960 funds from any sawlog buyers in advance of time of payment specified in a standard contract to facilitate your logging or hauling responsibilities? Yes____ No____

    If YES, for what purposes?

20. Did you receive in 1960 any other business aids from any sawlog buyers to facilitate your logging or hauling responsibilities? Yes____ No____

    If YES, what aids?

E. Prices Received:

1. What prices did you receive per unit of volume for sawlogs you sold in 1960? (Fill in as many items as possible, by species and quality classes.)

    Species and quality classes

    a. Roadside
    b. Trucked to mill

2. To which agents did you sell the species and quality classes listed above? (Check appropriate cells.)

    (a) Dealer
    (b) Concentration yard
    (c) Other intermediate agent
    (d) Sawmill
    (e) Other producer
    (f) Other (specify)

3. Did you have difficulty in obtaining sufficient market price information as a basis for your business decisions?

    a. On the stumpage you have to buy? Yes____ No____
    b. On the sawlogs you have to sell? Yes____ No____

    If YES to a. or b., explain.

F. Costs:

1. What stumpage costs per unit of volume applied to the sawlogs you handled in 1960? (Estimate cost imputed by you if you used your own stumpage.)

Species and quality classes	Purchased stumpage	Own stumpage

2. What logging costs (felling and bucking and skidding) per unit of volume applied to the sawlogs you handled in 1960? (Estimate cost imputed by you if you performed your own logging.)

Species and quality classes	Subcontracted logging	Own logging

3. What truck-hauling costs per unit of volume applied to the sawlogs you handled in 1960. (Estimate cost imputed by you if you performed your own hauling.)

Species and quality classes	Subcontracted hauling		Own logging	
	Cost	Distance	Cost	Distance

G. Sales of sawlog products:

1. What was the gross sales value of sawlogs sold by you in 1960?

2. What were the seasonal variations in your sawlog deliveries in 1960?

   a. Peak months and amounts (aver.)
   b. Lowest months and amounts (aver.)
   c. Other months and amounts (aver.)

3. Do you consider the timing in your sawlog deliveries in 1960 to be a typical pattern? Yes____ No____
   If NO, why not?

4. Was the timing in your sawlog deliveries in 1960 required by your product buyers? Yes____ No____
   If YES, would you have preferred a different timing of deliveries? Yes____ No____
   If YES, what is your preferred timing of deliveries?
   If NO, how do you explain the timing of your deliveries?

5. Have there been any significant changes in the annual volume of your sawlog sales in the past five years? Yes___ No___
   If YES, what were the changes?

6. What explanations can you give for annual fluctuations in your sawlog sales?

7. To which types of buyers did sales of your sawlogs in 1960 go? (Estimate by % of total volume)

	%		%
a. Sawmill	____	c. Dealer	____
b. Concentration yard	____	d. Other (specify) ________	____

8. Have there been any significant changes in the annual volumes of your sawlogs going to different types of buyers in the past five years? Yes___ No___
   If YES, what were the changes?
   If YES, what explanations can you give for these changes?

9. How many different buyers of your sawlogs did you sell to in 1960?

	No.		No.
a. Sawmill	____	c. Dealer	____
b. Concentration yard	____	d. Other (specify) ________	____

10. Have there been any significant changes in the numbers of buyers of your sawlogs in the last five years? Yes___ No___
    If YES, what were the changes?
    If YES, what explanations can you give for these changes?

11. Did you have a contract (s) to sell prior to your harvesting of sawlogs in 1960? Yes___ No___

12. What is the typical time interval between date of a sale agreement with a buyer and sawlog delivery?

    a. How much variation from the typical time interval occurs?
    b. What are the causes of variations from the typical time interval?

H. Other producers of sawlogs, 1960:

Name Address

APPENDIX C.

DETAILS OF PRODUCT GROUPS AND OF PURCHASE CONTRACTS FOR STUMPAGE AND SAWLOGS

Table I. Number of sawmills sampled in each product group, by state, 1960

Product group[a]	Mich.	Wis.	Minn.	Ind.	Ohio	Ill.	Iowa	Mo.	Kan.	Total
	(Number of sawmills)									
Hardwood grade	32	13	3	17	17	5	9	3	8	107
Pallets, boxes, and crates	20	2	1	--	8	2	2	7	2	44
Pallet material and crating	13	4	11	5	6	6	1	6	1	53
Manufactured products except pallets, boxes, and crates	3	3	1	2	--	--	--	4	--	13
Low-grade hardwood lumber	5	--	8	11	12	13	4	16	5	74
Softwood lumber	5	13	30	--	--	--	--	7	--	55
Railroad ties	--	--	--	1	6	--	10	26	--	43
Flooring stock	--	--	--	--	1	--	--	13	--	14
Unclassified	--	7	--	2	8	--	--	--	4	21
Total	78	42	54	38	58	26	26	82	20	424

[a]Product groups are based upon the product or group of similar products which represented the largest portion of the firm's total value of production. The following definitions were used:

Hardwood grade: includes predominantly #2C and better, sold mainly for furniture stock.

Pallets, boxes, and crates: includes pallets, boxes, and crates of any size made from lumber or sawn veneer of any thickness.

Pallet material and crating: also includes box and crate material, blocking, and dunnage.

Manufactured products except pallets, boxes, and crates: includes products other than pallets, boxes, and crates which are processed beyond the stage of flat surfaced lumber, e.g., flooring, furniture and furniture parts, cabinets, and grain doors.

Table I. (Continued)

Low-grade hardwood lumber: includes low-grade lumber, usually rough, which is not included in the above categories and is usually used for construction.

Softwood lumber: mostly rough or surfaced construction lumber, and other lumber from coniferous species not included in above categories.

Railroad ties: also includes mine ties.

Flooring stock: unmanufactured hardwood lumber of various sizes, usually 3A or better in quality, and sold for flooring stock.

Unclassified: insufficient information to classify.

Table 2. Details of stumpage purchase contracts negotiated by sampled sawmill firms with private landowners

Provision	Percent[a]
Species of timber:	
Not included	15.4
All marketable species	44.9
Only specified species	27.9
All except specified species	3.1
Provision included; no explanation	8.7
	100.0
Size of timber:	
Not included	13.1
Minimum stump diameter	53.2
Minimum stump diameter; differs by species	1.8
Minimum DBH	6.4
Minimum stump diameter; minimum top diameter	8.9
Minimum DBH; minimum top diameter	0.7
Provision included; no explanation	15.9
	100.0
Quality of timber:	
Not included	87.9
Total number that included provision	12.1
	100.0
Quantity of timber:	
Not included	28.6
All marketable volume	55.0
Specific volume of specified species	5.6
Estimated number of trees	2.4
Provision included; no explanation	8.4
	100.0

Table 2. (Continued)

Provision	Percent[a]
Method of payment:	
Not included	6.4
Per M bd. ft.	22.5
Lump sum	34.2
Per standard cord	0.4
Per M bd. ft. and lump sum	25.4
Provision included; no explanation	11.1
	100.0
Time of payment:	
Not included	2.9
Per-unit purchase:	
Total payment after harvesting	11.6
Total payment before harvesting	0.4
Partial payment before harvesting	4.1
Lump-sum purchase:	
Total payment before harvesting	23.6
Partial payment before harvesting	1.2
Lump-sum: total payment before harvesting; per-unit purchase: total payment after harvesting	15.7
Lump-sum: total payment before harvesting; per-unit purchase: partial payment before harvesting	2.1
Lump-sum: partial payment before harvesting; per-unit purchase: total payment after harvesting	0.8
Lump-sum and per-unit purchase: partial payment before harvesting	37.6
	100.0

Table 2. (Continued)

Provision	Percent[a]
Place of measurement:	
Not included	48.4
Scaled in woods	9.9
Scaled at mill	27.4
Scaled in woods or at mill	3.7
Provision included; no explanation	10.6
	100.0
Period of harvest:	
Not included	21.3
Less than 6 months	0.4
Six months to 1 year	26.8
One year to 2 years	34.2
More than 2 years	7.0
Provision included; no explanation	10.3
	100.0

[a]Percentage of sampled sawmill firms that usually included the indicated provision in stumpage purchase contracts with private landowners.

Table 3. Logging provisions commonly prescribed in private stumpage purchase contracts by sampled sawmill firms

	Logging provision	Percent of sawmills
1.	Exercise care to preserve growing stock	7.5
2.	Clear slash from roads, boundaries, etc.	3.9
3.	Repair damage to fences and gates	11.0
4.	Repair damage to roads, waterways, fences, etc.	11.0
5.	Agree to location of logging roads and restrictions to travel across fields	2.1
6.	Numbers 2 and 3	2.5
7.	Numbers 2 and 4	2.8
8.	Numbers 2 and 5	3.9
9.	Numbers 3 and 5	1.4
10.	Numbers 4 and 5	4.6
11.	Numbers 2, 4, and 5	4.3
12.	No provisions included	45.0
		100.0

Table 4. Details of stumpage purchase contracts negotiated by sampled sawlog producers with private landowners

Provision	Percent[a]
Species of timber:	
Not included	11.2
All marketable species	44.5
Only specified species	24.3
All except specified species	3.3
Provision included; no explanation	16.7
	100.0
Size of timber:	
Not included	20.9
Minimum stump diameter	45.9
Minimum DBH	2.9
Minimum stump diameter; minimum top diameter	10.2
Trees with 1 or 2 bolts to a 4" or 5" top diameter	9.0
Provision included; no explanation	11.1
	100.0
Quality of timber:	
Not included	88.9
Total number that included provision	11.1
	100.0
Quantity of timber:	
Not included	28.3
All marketable volume	54.1
Specific volume of specified or unspecified species	5.3
Estimated number of trees	4.1
Provision included; no explanation	8.2
	100.0

Table 4. (Continued)

Provision	Percent[a]
Method of payment:	
Not included	1.7
Per M bd. ft.	50.5
Lump sum	13.0
Per standard cord	4.7
Per M bd. ft. and lump sum	19.0
Per standard cord and lump sum	2.1
Provision included; no explanation	9.0
	100.0
Time of payment:	
Not included	0.7
Per-unit purchase:	
Total payment after harvesting	53.2
Partial payment before harvesting	5.0
Lump-sum purchase:	
Total payment before harvesting	15.6
Partial payment before harvesting	1.4
Per-unit purchase: total payment after harvesting; lump-sum purchase: total payment before harvesting	21.3
Per-unit purchase: total payment after harvesting; lump-sum purchase: partial payment before harvesting	0.7
Provision included; no explanation	2.1
	100.0

Table 4. (Continued)

Provision	Percent[a]
Place of measurement:	
Not included	22.4
Scaled in woods	14.2
Scaled at mill	55.2
Scaled in woods or at mill	3.6
Provision included; no explanation	4.6
	100.0
Period of harvest:	
Not included	39.6
Less than 6 months	2.7
Six months to 1 year	30.2
One year to 2 years	16.2
More than 2 years	1.8
Provision included; no explanation	9.5
	100.0

[a]Percentage of sampled sawlog producers that usually included the indicated provision in stumpage purchase contracts with private landowners.

Table 5. Logging provisions commonly prescribed in private stumpage purchase contracts by sampled sawlog producers

	Logging provision	Percent of producers
1.	Exercise care to preserve growing stock	5.1
2.	Clear slash from roads, boundaries, etc.	6.4
3.	Repair damage to fences and gates	11.5
4.	Repair damage to roads, waterways, fences, etc.	12.7
5.	Agree to location of logging roads and restrictions to travel across fields	4.3
6.	Numbers 2 and 3	0.8
7.	Numbers 2 and 4	0.8
8.	Numbers 2 and 5	0.4
9.	Numbers 3 and 5	1.7
10.	Numbers 4 and 5	0.8
11.	Numbers 2, 4, and 5	4.7
12.	No provisions included	50.8
		100.0

Table 6. Details of sawlog purchase contracts of sampled sawmills

Provision	Percent[a]
Species of sawlogs:	
Not included	14.0
Only specified species	37.4
Whatever species are in demand	7.8
All except specified species	7.3
Only high quality hardwoods	1.7
Low quality hardwood only with high quality hardwoods	2.2
Only low quality hardwoods	3.9
Hardwoods only	2.2
Softwoods only	0.6
Provision included; no explanation	22.9
	100.0
Size of sawlogs:	
Not included	5.1
Minimum top diameter	34.2
Minimum top diameter; minimum length of 8 ft.	26.7
Minimum top diameter; maximum length of 8 ft.	1.1
Minimum top; maximum butt diameter; maximum length 8 ft.	2.3
Minimum top diameter; minimum length 8 ft.; limited percent of 8 ft. logs	5.7
Minimum top diameter; length specified	9.6
Provision included; no explanation	15.3
	100.0

Table 6. (Continued)

Provision	Percent[a]
Quality of sawlogs:	
Not included	66.1
High quality only	0.6
Low quality only with high quality	0.6
Pays on the basis of log grades and:	
Buys high quality only	4.5
Buys low quality only with high quality	3.4
Buys high quality and low quality	4.5
Provision included; no explanation	20.3
	100.0
Quantity of sawlogs:	
Not included	56.3
Yearly quota	0.6
Monthly quota	0.6
Weekly quota	1.1
Specified volume or portion of producers' supply at irregular intervals	20.9
Provision included; no explanation	20.5
	100.0
Basis of measurement:	
Not included	12.0
Per M bd. ft., log rule	53.1
Per standard cord	5.5
Per M bd. ft. and cord	7.6
Provision included; no explanation	21.8
	100.0

Table 6. (Continued)

Provision	Percent[a]
Time of delivery:	
Not included	61.9
No set pattern, varies with circumstances	12.0
Specified quantity per week or day	0.5
Specified quantity by specified date	0.5
Estimated quantity for coming week	0.5
Specify deliveries to start within 15 days	2.2
Provision included; no explanation	22.4
	100.0
Time of payment:	
Not included	11.0
After delivery of logs:	
After each load of logs	7.0
Each day	3.5
Each week	38.5
Every 8 to 21 days	4.6
Every 22 to 35 days	0.6
Other	22.1
After total quantity specified in purchase agreement has been delivered	1.7
Part before delivery, remainder after delivery	2.9
Provision included; no explanation	8.1
	100.0

[a]Percentage of sampled sawmill firms that usually included the indicated provision in stumpage contracts with private landowners.