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AN INVESTIGATION OF THE MARKET FOR FOREST LANDS IN NORTHERN MINNESOTA, THE MISSOURI OZARKS, AND MISSISSIPPI

By

Robert James Moulton

A DISSERTATION

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ABSTRACT

AN INVESTIGATION OF THE MARKET FOR FOREST LANDS IN NORTHERN MINNESOTA, THE MISSOURI OZARKS, AND MISSISSIPPI

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This study describes and evaluates trends in forest land prices in Northern Minnesota, the Missouri Ozarks, and in Mississippi from 1965 through 1981. Although of paramount importance in allocating land to various uses, little previous emperical work has been completed on this topic.

The study is based on a total of 982 confirmed and field inspected, "arms-length" sales of forest land to private buyers. Observations were confined to wooded tracts located outside of the immediate influence of urban areas and having no agricultural acreage, structures, mineral value influence, or water frontage, except in Minnesota where wooded tracts with lake frontage were studied.

Forest land prices were found to have increased in all locations at an average, annual, compound rate of 15 percent during the study period, almost 8.5 percent faster than general inflation. Correspondence was found between periods of economic recession in 1970-71 and 1974-75 and forest land prices. Decreasing real prices for forest lands were noted in all areas after 1979.

Woodland prices in Mississippi averaged $100 per acre in 1965 and $750 in 1981. By comparison, tracts in Minnesota and Missouri averaged about $20 per acre in 1965 and $205 and $280 per acre, respectively, in 1981. Prices for Minnesota tracts with lake frontage sold for 7.5 as much as comparable nonlake tracts and showed similar, but slightly lower, rates of price increase.

Timber buyers accounted for 8 out of 10 purchases in Mississippi and market prices were highly correlated with pine sawtimber volumes. Better timber also enhanced tract prices in Minnesota and Missouri, but tracts with better timber tended to be acquired for recreation. Differences in tract size generally did not influence per acre selling prices in Mississippi, but had minor, though persistent, effects on prices in the other locations. Access was important primarily only for extremes such as paved versus dirt access.

Questions were raised as to the efficiency of the market in allocating lands to various uses, and it was predicted that forest land prices and their effects on timber production will receive increased attention.

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CHAPTER I

INTRODUCTION

The Problem

The early 1960's witnessed an important turning point in the history of American forestry. It was in this period that the area of commercial timberland,[1] which had been increasing since about 1920, peaked and started to decline. In 1962 the United States had an estimated 509 million acres of commercial forest land; by 1977, the latest year for which data are available, the figure had dropped to 482 million acres, a decrease of 5 percent.[2]

Many factors have contributed to the decline in total commercial forest land area. Forests have yielded to spreading urbanization, to highways, powerlines, and reservoir projects. The 1960's ushered in the recreation boom and an increased demand for recreational

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[1]USDA Forest Service defines commercial timberland as forest lands capable of growing at least 20 cubic feet of wood per acre per year and suitable and available for timber harvest now or in the future.

[2]Brian Wall, Trends in Commercial Timberland Area in the United States by State and Ownership, 1952-77, with Projections to 2030, (U.S. Department of Agriculture, Forest Service, General Technical Report WO-31, 1981) p. 7.

homesites in a forested setting. Large areas of public lands, particularly in the national forests, have been set aside for parks, wilderness and other recreational uses. Expanding agriculture has resulted in the clearing of extensive areas for crops and pasture.

Losses have been especially great for timberlands held by nonindustrial private owners. While remaining as the majority owners (58 percent in 1977), timberlands held by these owners declined by 26.2 million acres (minus 8.6 percent) between 1962 and 1977.[3] This reflects the traditional role of timber production as a residual use of land; prospects of higher economic returns promote the employment of land in other uses. As Barlowe has observed, "Land resources tend to move to those operators who bid the most for their control and to those uses that offer the highest return for their utilization."[4]

Sales of commercial timberland acreage do not necessarily result in declassification. Firms in forest industry increased their commercial timberland holdings by about 7 million acres (from 61.6 million acres to 68.8 million acres) between 1962 and 1977,[5] primarily as the

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[3]Wall, adapted from Table 2 on p. 21.

[4]Raleigh Barlowe, Land Resource Economics, 3rd ed. (Englewood Cliffs: Prentice Hall, Inc., 1978) p. 193.

[5]Wall, adapted from Table 2 on p. 21.

result of purchases of commercial timberland from nonindustrial private owners. Public agencies also acquire commercial timberland for uses permitting its continued classification as commercial; more often, such lands, in combination with adjoining publicly-owned lands, have been withdrawn from commercial timberland use. Overall, commercial timberland held by public agencies has declined by about 8 million acres (143.7 million acres in 1962 vs. 135.7 million acres in 1977).[6] On balance, sales by nonindustrial private owners reduce commercial timberland acreage as it is these lands that are most apt to be involved in the succession to other uses.

Despite the importance of the real estate market in determining how forest land will be used, there is little current information on the subject. Row has characterized research on forest and rangeland prices as virtually nonexistent.[7] Healy and Short have termed knowledge of the market for rural lands as fundamental to the understanding of rural planning issues, but note that little emperical work has been done.[8] De Steiguer has observed that the

---

[6]Wall, adapted from Table 2 on p. 21.

[7]Clark Row, "Balancing Supplies and Demands," Research in Forest Economics and Forest Policy, ed. Marion Clawsen, Wash. Resources for the Future 1977, p. 126.

[8]Robert Healy and James Short, "Market Trends and Planning Implications," Journal of American Planning Association, (Wash., DC, July 1979) p. 305.

lack of information on forest land prices has commonly resulted in the cost of land being overlooked in analyses of forestry investments.[9]

Currently, the only readily available information on forest land prices is published by USDA Economic Research Service in their Farm Real Estate Market Development reports issued each summer and supplemented each spring. As the name of the publication suggests, it is oriented to agricultural land. The prices reported apply to woodlands in agricultural areas and are average prices for multiple-state regions such as the Corn Belt, Delta, and Appalachia. Tract size is the only physical feature for which data are reported. Moreover, the designation of "forestry" is based, not on current usage, but on probable use five years after purchase; other probable uses are agriculture only, recreation, rural residential, subdivision, commercial/industrial, and other. Some land reported as having a probable use of forestry are not wooded at the time of sale, and many sales of woodland properties are reported in the other categories.

The general lack of information on forest land prices and forest land markets presents a serious limitation to forestry analysts and policy makers. It means that

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[9]J. E. de Steiguer, "Forestland Market Values," Journal of Forestry, (Bethesda, Md., April 1982) p. 214.

estimates of future timber supplies must be based upon projected historical trends without benefit of knowledge about behavioral aspects of the marketplace which cause lands to be allocated to various alternate uses.

Scope and Objective of Study

This study investigates the private market for forest lands in selected areas of Northern Minnesota, the Missouri Ozarks and in Mississippi. (See Figure 1.1.)

The objectives of the study are to: (1) define and describe trends in forest land prices in the study areas, and (2) analyze causal factors underlying the identified price trends. Particular emphasis is given to the impact the market for forest lands has on timber production.

Study Design

Data

Information on private purchases of forest land was obtained from various national forest field offices in the study areas. This information has been assembled by staff and independent private appraisers under contract with the Forest Service for use in making market value appraisals of specific properties for acquisition, exchange, special-use fee determinations, and other purposes.

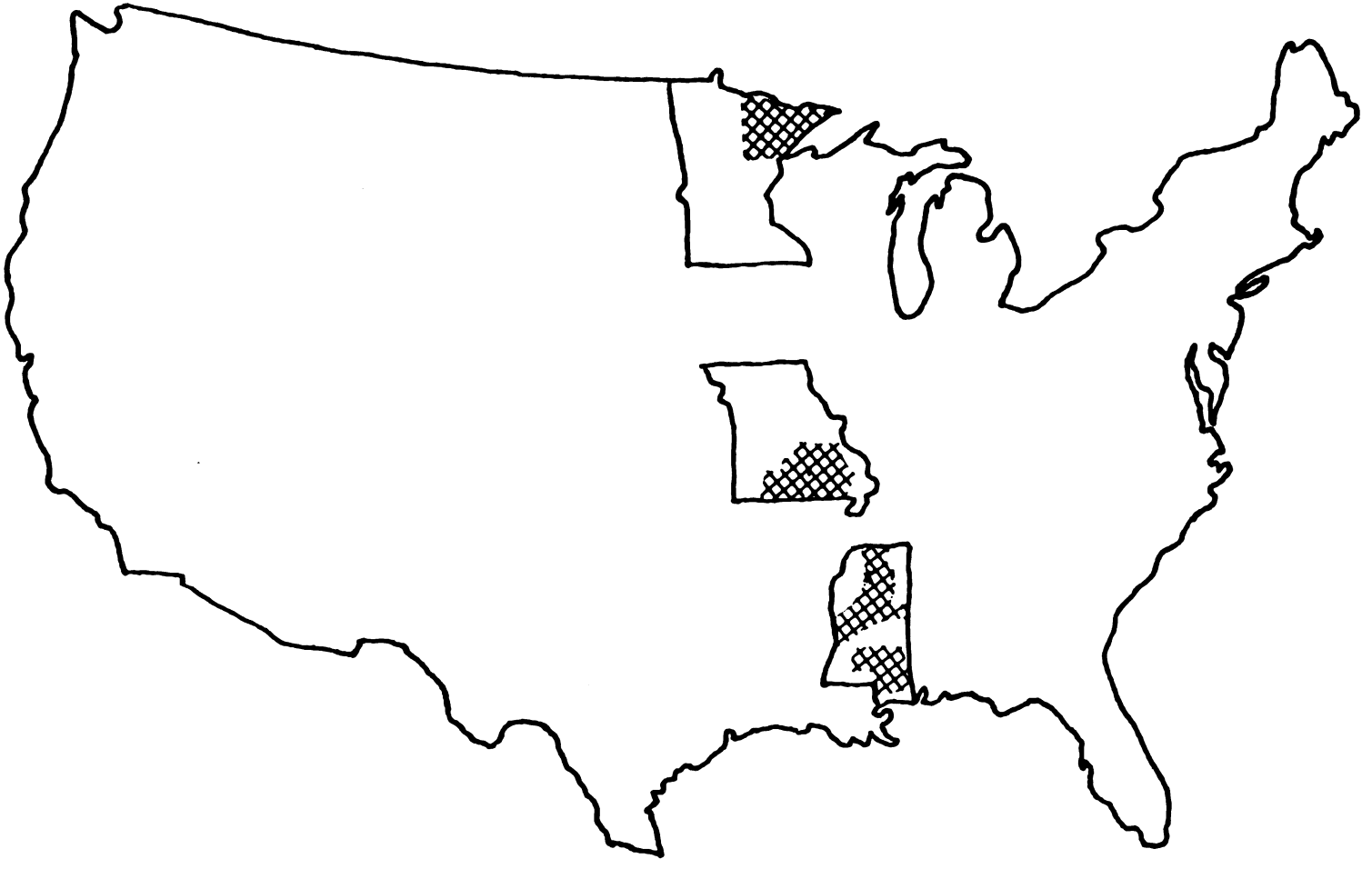


Figure 1.1: Study Locations

Except as otherwise indicated in this report, all sale properties were acquired in fee title and have been confirmed by interview with buyer/seller for: (1) price; (2) terms of sale (owner financing is common); (3) intended use by buyer; and (4) to ensure the sales were "at arms-length" (to eliminate in-family sales, hardship sales, etc.). The sales have been field inspected, and the findings documented on transaction evidence forms. (See Figure 1.2.) These forms also contain the date of sale, names and addresses of parties to the sale, legal description of the property, and recording information.

Study Locations

Sales information for the primary study areas was provided by Lands Staff personnel on the Superior National Forest in Minnesota, the Mark Twain National Forest in Missouri, and the National Forests of Mississippi.

Sufficient information is available on private purchases of forest land, both within and outside of the national forest boundaries, in each of these areas to support a detailed study. It was concluded, however, that a more useful study would result if a number of different geographic areas were included.

Northern Minnesota is a major timber producing area and the location of an active recreation-oriented real

U S FOREST SERVICE
TRANSACTION EVIDENCE
89-5400-6 (REV 7/22/71)

CONFIDENTIAL YES NO | TRANSACTION NUMBER R-218 | SIZE 90 ac. | DATE 3-76

TOTAL PRICE PAID $21,250.00 | TOTAL PRICE PER ACRE $236.11

LAND VALUE TOTAL -- | PER ACRE -- | TIMBER VALUE -- | IMPROVEMENT VALUE --

BOOK NO 271 | PAGE NO 193-194 | TYPE OF DEED | COUNTY Phelps | STATE Missouri

DESCRIPTION T39N, R9W, Section 36: All NE¼ lying North of County Road and part of East side of County Road #13

SELLER Victor E. & A. Robeson, h/w | ADDRESS

BUYER Gale H. & Janet Papen, h/w | ADDRESS Route 1, Rolla, Missouri 65401

AREA OF STREAM -- | LENGTH OF FRONTAGE -- | PRICE PER FRONT FOOT --

ROADS ADJOINING PROPERTY [ ] BLACKTOP [XX] GRAVEL OR COUNTY ROAD [ ] DIRT ROAD OR WOODS TRAIL [ ] NONE

AVAILABILITY OF ELECTRICITY yes | TELEPHONE yes

ENCUMBRANCES County Roads

LOCATION TO TOWNS ETC 6½ miles to Rolla

COVER TYPE AND VOLUME OF MERCHANTABLE TIMBER poor quality hardwood timber

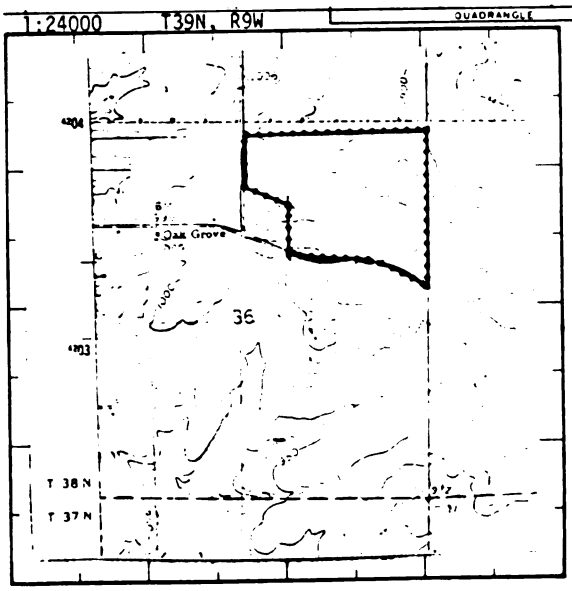
SOIL TYPES

TERMS OF SALE

[ ] INSIDE OF NATIONAL FOREST [XX] OUTSIDE OF NATIONAL FOREST

EXAMINED BY Richard R. Greatorex | DATE 3-18-77 | PHOTOS [XX] YES [ ] NO

1:24000 T39N, R9W | QUADRANGLE



REMARKS

Rolla Quadrangle - Phelps County

Reason for Selling: Owner transferred.

Reason for Purchase: Future homesite.

No improvements on this tract and access by gravel road. Topography is moderate slopes. Electricity and telephone available.

Figure 1.2: Sample Transaction Evidence Form

estate market. Mississippi was selected as a southern timber producing state for study because the terrain and cover types on private lands, within and in the vicinity of the National Forests in Mississippi, are fairly representative of the state as a whole. This contrasts with the situation in Georgia, the Carolinas, and other states along the Appalachian Mountain chain where national forests occupy the most extreme terrain. The Missouri Ozarks are the middle ground between North and South; recreation and agriculture influence Missouri's forest land prices.

Study Period

The sales information used in this study was assembled early in 1982 and spans the period from 1965 through 1981.

Sampling Procedure

Sale data were obtained from the cooperating national forests at five year intervals for the period 1965-1975 and for each of the last three years ending with 1981. The main study years thus are:

1965
1970
1975
1979
1980
1981

Sales of larger properties occur less frequently than smaller sales. To increase the number of observations of large sales, the data banks for the intervening years were also screened for sales of 200 acres and larger.

Sales selected by the above procedure were excluded from further consideration if they were: (1) located within or in the immediate vicinity of urban areas; (2) contained buildings or other improvements of value; (3) were agricultural tracts with improved pastures or cropland; or (4) had lake or river frontage (except in Northern Minnesota where woodland tracts with lake frontage were studied separately).

Additions and modifications to the sales selection criteria are discussed in the introductions to the individual study areas.

CHAPTER II

NORTHERN MINNESOTA

Description of Study Area

The study area is comprised of St. Louis, Lake, and Cook Counties, the northeastern most counties in Minnesota. The area generally lies east of U.S. Highway 53 connecting Duluth, located on the western tip of Lake Superior, with International Falls on the Canadian border. The area is bounded on the north by the Providence of Ontario and on the east by Lake Superior. This tri-county area is 9500 square miles in size. St. Louis County, alone, contains 6,092 square miles and, thus, is somewhat larger than the combined area of Connecticut (4,862 sq. mi.) and Rhode Island (1,049 sq. mi.).[1]

The 1980 population of the study area was 239,364 (as compared to 237,467 in 1970) of which 92,811 reside in Duluth. Other larger communities in the area are Hibbing (population 21,193) and Virginia (11,056). International Falls, Babbitt, Ely, Grand Marais, and Two Harbors have populations under 5,000. Minneapolis is 153 miles

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[1]Land area and population statistics cited in this section were obtained from U.S. Bureau of Census reports.

south of Duluth on Interstate Highway 35, while Chicago lies about 500 miles to the southeast.

The study area is almost entirely forested. The 1978 Census of Agriculture indicates that 0.2 percent of Cook County, 0.6 percent of Lake County and 5.3 percent of St. Louis County are in farms. Timber products, mining (especially for iron ore) and tourism are the mainstays of the rural economy.

Minnesota is unique among eastern states in that the majority (54 percent for the entire state; 62 percent in the northern half) of commercial forest land is publicly owned. In 1977 there were 13.7 million acres of commercial forest land in the state of which the public controlled 7.3 million acres, forest industry 0.8 million acres, and nonindustrial owners 5.6 million acres. Public ownership is expected to stabilize at near current levels (this follows rather substantial withdrawals for areas such as the Boundary Waters Canoe Area and Voyageurs National Park); forest industry is expected to continue to accumulate lands; and acreage held by nonindustrial owners is expected to continue to decline.[2]

---

[2]Brian Wall, Trends in Commercial Timberland Area in the United States by State and Ownership, 1952-77, with Projections to 2030, (U.S. Department of Agriculture, Forest Service, General Technical Report WO-31, 1981) p. 13.

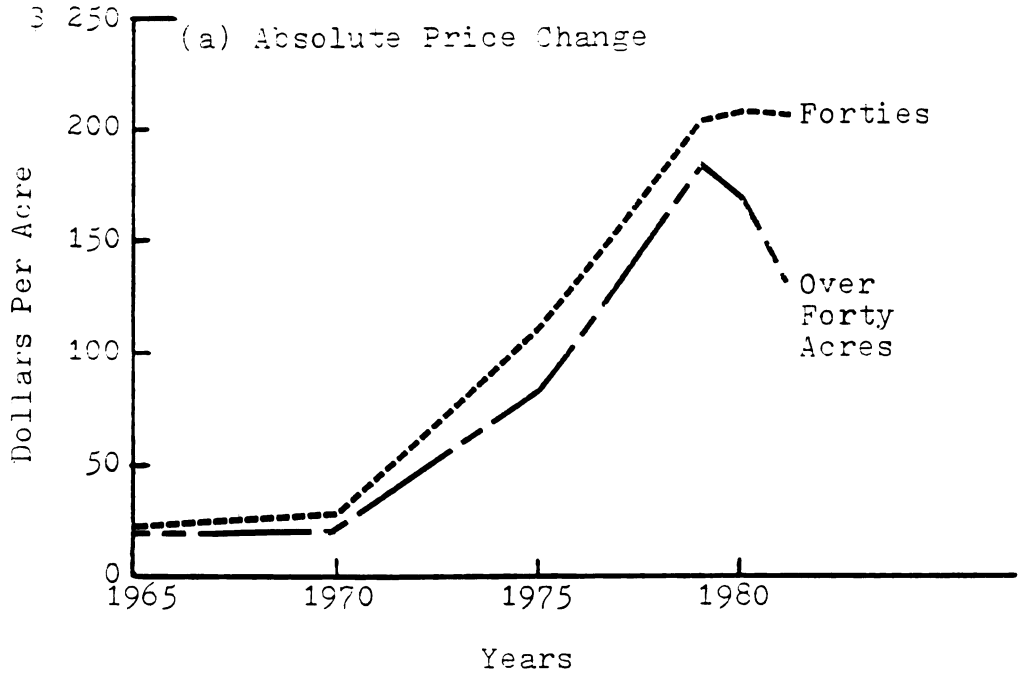
Price Trends

As indicated in Chapter I, this study is basically concerned with sale of unimproved woodland properties located outside of the immediate influence of urban areas. The study area in Northern Minnesota is affected by two other factors: mining and water frontage (especially lakes). Sales influenced by mining activity (including land with minerals or recognized mineral potential, as well as auxiliary lands used for plant locations, water storage reservoirs, tailings disposal, etc.) were excluded from study, but tracts with lake frontage are included.

Woodland Sales

The trend in average selling prices for woodland properties without lake or river frontage during the period 1965 to 1981 is featured in Figure 2.1 and Table 2.1 on the following pages. As a preliminary test of the effects of tract size on price, separate price trends are shown for (1) wooded forties and (2) wooded tracts larger than forty acres.

Panel a and panel b of Figure 2.1 are both based on the mean selling prices listed in Table 2.1, but have somewhat different appearances due to a difference in vertical scale. Panel a emphasizes absolute changes in price, as reflected by uniform dollar increments on the



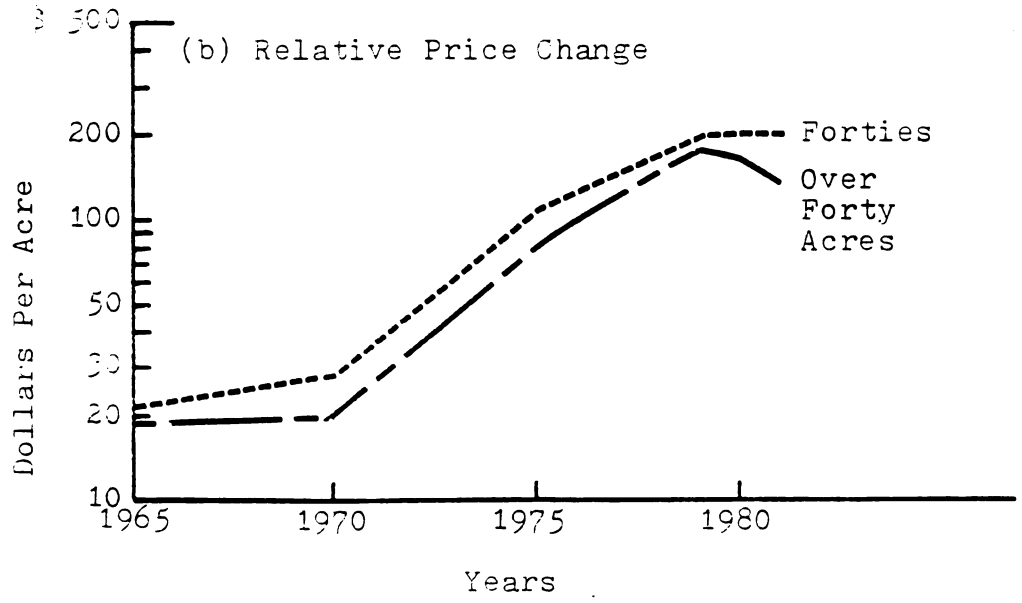


Figure 2.1: Average Prices for Northern Minnesota Woodlands (Excluding Waterfrontage Tracts), 1965-1981

vertical scale, while panel b emphasizes proportional changes in price. (For example, in panel b the vertical distance between $20 and $40 is the same as the distance between $100 and $200 as both require a doubling in price.) The curves in panel b are steeper than those in panel a from 1965 to 1970, when price levels were relatively low, but flatter at the higher price levels following 1970. Thus, the curves are straighter in panel b than in panel a.

The observed sales attest to dramatic increases in the price of general woodland tracts in Northern Minnesota during the study period and, in particular, during the 1970's. The observed mean per acre selling price for forties was $22 in 1965 and $28 in 1970. By 1979 the mean selling price for forties stood at $203 per acre. Thereafter, the mean price for forties faltered--it increased by only $5 to reach $208 in 1980 and then fell to $206 in 1981. In comparison, the observed mean per acre price for wooded tracts larger than forty acres was $19 in 1965, had risen to $183 by 1979, and closed at $134 in 1981.

Table 2.1: Average Prices for Northern Minnesota Woodlands (Excluding Water Frontage Tracts), 1965-1981

Year	Forties			Over Forty Acres			
Year	n	Mean	Median	n	Mean	% of Forty Mean	Median
1965	20	$ 22	$ 22	7	$ 19	86%	$ 18
1970	35	$ 28	$ 23	38	$ 20	71%	$ 19
1975	35	$100	$ 92	18	$ 83	83%	$ 75
1979	23	$203	$156	9	$183	90%	$180
1980	9	$208	$173	10	$168	81%	$167
1981	11	$206	$200	4	$134	65%	$122

It is worthy of note that the mean per acre prices for wooded forties are consistently higher than for larger wooded tracts, affirming the generally held belief that tract size and per acre prices are inversely related.

Panel a of Figure 2.1 and Table 2.1 indicate that prices for forties, as compared to prices for larger tracts, diverged as the market advanced. Prices were about the same in 1965--$22 for forties and $19 for larger tracts--but, for example, were $203 and $183 per acre, respectively in 1979. In terms of price ratios, however, larger tracts sold for 86 percent of the price of forties in 1965 and 90 percent in 1979. In various years, the mean per acre prices varied from 65 percent to 90 percent of the price for forties and averaged about 80 percent.

Another observation that can be made is that the price of larger woodland tracts lagged behind the price of forties in reflecting price increases early in the study period (i.e., 1965-1970), but responded earlier and more strongly to the apparent flattening or down-trend of the market in the late 70's and early 80's. Possibly, this is simply a chance occurrance attributable to the small number of observations, in particular, for larger tracts in 1965 and 1981. On the other hand, in a later section of this chapter which addresses the reasons why forest lands are purchased, it will be shown that there is apparently a different market for large and small woodland tracts.

In addition to mean prices for woodland sales, Table 2.1 also lists the price for the median transaction. The median prices convey the same general impression as do the mean prices--that prices have increased dramatically during the study period. There are, however, some important differences. For example, in moving from $22 to $23 per acre from 1965 to 1970, the medians show smaller increases than do the mean figures for this period. Also note that the median price for forties in 1979 is substantially smaller than the mean price ($156 vs. $203) and that the median price for larger tracts exceeds the median price for forties in 1979.

Not infrequently, the median is a better descriptor of economic data than is the mean since such data, including land prices, tend to include extreme values and have skewed distributions which affect the mean more than the median. In the instance of the Northern Minnesota data, however, scatter diagrams showed that, in those years in which differences between the two averages occurred, the causal factor was not skewing, but the tendency for the values to cluster erratically or near both ends of the distribution. Under these conditions the median is less reliable (i.e., has a larger sampling error) than the mean and, hence, was rejected. Much the same conclusion was reached concerning the price of the median acre as a descriptor. In certain years, a single sale was so large (e.g., a 8403 acre sale in 1965 and a 19,796 acre sale in 1975) that the median acre fell within the transaction. Given the many factors influencing the price paid for a specific property, the use of a single sale to represent the selling price for a given year has obvious limitations.

The relative magnitude of price changes for the observed Northern Minnesota woodland sales can be expressed in a number of ways. Table 2.2 is a display of the

change in mean per acre market prices in terms of compound rates while Table 2.3 illustrates the trend in real prices following adjustment for inflation using the Gross National Product (GNP) deflator.

Table 2.2: Compound Rates of Price Change for Northern Minnesota Woodland Sales (Excluding Water Frontage Tracts), 1965-1981

Period	Compound Rate of Change: Forties (%)	Compound Rate of Change: Over Forty Acres (%)
1965-1970	4.9	1.0
1970-1975	29.0	32.9
1975-1979	19.4	21.9
1979-1980*	2.5	-8.2
1980-1981*	-1.0	-20.2
Overall		
1965-1981	15.0	13.0

*The reported figures for these years are simple rates as the calculations are based on annual compounding.

The data in Table 2.2 reveal that forty acre woodland sales achieved a compound price appreciation rate as high as 29 percent (1970-1975) and experienced an overall compound price appreciation rate of 15 percent. Wooded tracts larger than forty acres achieved a maximum compound price appreciation rate of 32.9 percent (also 1970-1975) and an overall compound rate of 13 percent. Alternate calculations for the period 1965-1980 (made to eliminate 1981, a year with limited observations for tracts over

forty acres in size) resulted in an overall rate of 16.2 percent for forties and 15.6 percent for larger tracts. Thus, while it has been observed in the earlier discussion that forties tend to sell for higher unit prices than do larger tracts, there is little evidence to support that their rates of price change have been appreciably different; a compound rate of 15 percent per year could reasonably be applied to both forties and larger tracts.

It is interesting to compare the rate of price appreciation for Northern Minnesota woodland sales with some of the more common indexes of inflation. From 1965 to 1981, the all commodity Consumer Price Index (CPI) advanced from 95.7 to 253.6 for an average annual compound rate increase of 6.3 percent; the Producer Price Index (PPI) for lumber and wood products increased from 95.9 to 232.8 (5.7 percent compound rate); and the GNP index posted an average compound gain of 6.2 percent in moving from 74.4 to 193.6. Prices for Northern Minnesota woodlands, thus, have increased at a faster rate than inflation over the term of the study period.

The major effect of inflation can be readily seen by the difference between the nominal and real prices, as expressed in constant 1965 dollars, in Figure 2.2 and Table 2.3. As compared with nominal prices, real prices

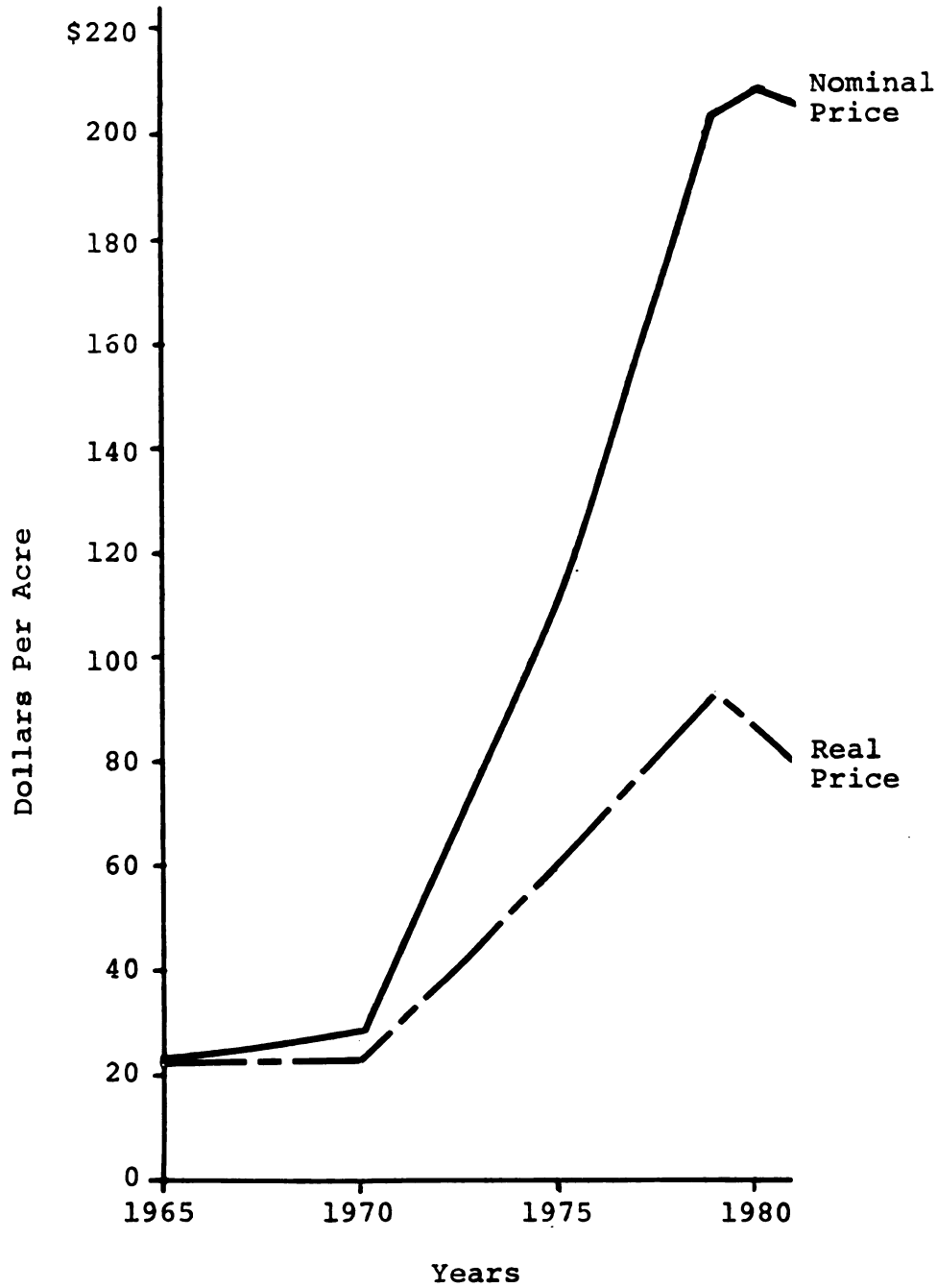


Figure 2.2: Average Nominal and Real Prices for Northern Minnesota Forties (Excluding Waterfrontage Tracts), 1965-1981

increased more slowly and suggest a decline, rather than a mere plateauing, after 1979.

Table 2.3: Nominal and Real Prices for Northern Minnesota Woodlands (Excluding Water Frontage Tracts), 1965-1981

	Forties		Over Forty Acres	
Year	Nominal	Real*	Nominal	Real*
1965	$ 22	$22	$ 19	$19
1970	$ 28	$23	$ 20	$16
1975	$100	$59	$ 83	$49
1979	$203	$93	$183	$84
1980	$208	$87	$168	$70
1981	$206	$79	$134	$52

*Expressed in constant 1965 dollars based on Gross National Product implicit deflator.

Nonetheless, Northern Minnesota woodland forties posted an 8.3 percent compound real growth rate between 1965 and 1981 while larger tracts show a 6.3 compound rate in real price growth. For the period 1965-1980 the rate of real price increase was 9.6 percent for forties and 9.1 percent for larger tracts.

Woodland Sales of 200 Acres and Larger

Table 2.4 contains a year-by-year summary of the mean per acre prices paid for wooded tracts of 200 acres and larger during the study period. Figure 2.3 compares

the price performance of these tracts with that of forties and all tracts over forty acres.

Table 2.4: Average Prices for Northern Minnesota Woodlands of 200 Acres and Larger (Excluding Water Frontage Tracts), 1965-1981

Year	N	Per Acre Price Nominal	Per Acre Price Real*
1965	5	$21	$21
1966	1	$23	$22
1967	-	--	--
1968	3	$33	$30
1969	1	$34	$29
1970	9	$18	$15
1971	2	$20	$16
1972	5	$31	$23
1973	2	$66	$46
1974	6	$55	$35
1975	3	$58	$34
1976	3	$38	$21
1977	1	$54	$29
1978	1	$90	$45
1979	-	--	--
1980	-	--	--
1981	-	--	--

*In 1965 dollars - GNP deflator.

The observed price trend for 200 acre tracts is more erratic than for the other classifications. This is consistent with expectation, given that some years are represented by only a single sale (n = 1 to 9). Moreover, the observations for 200+ acre tracts are presented for each year, as contrasted to the five-year interval applicable to the other price trends. Thus, the observations for 200+ acre tracts may reflect annual variations in market prices not shown by the other sales. It is of interest

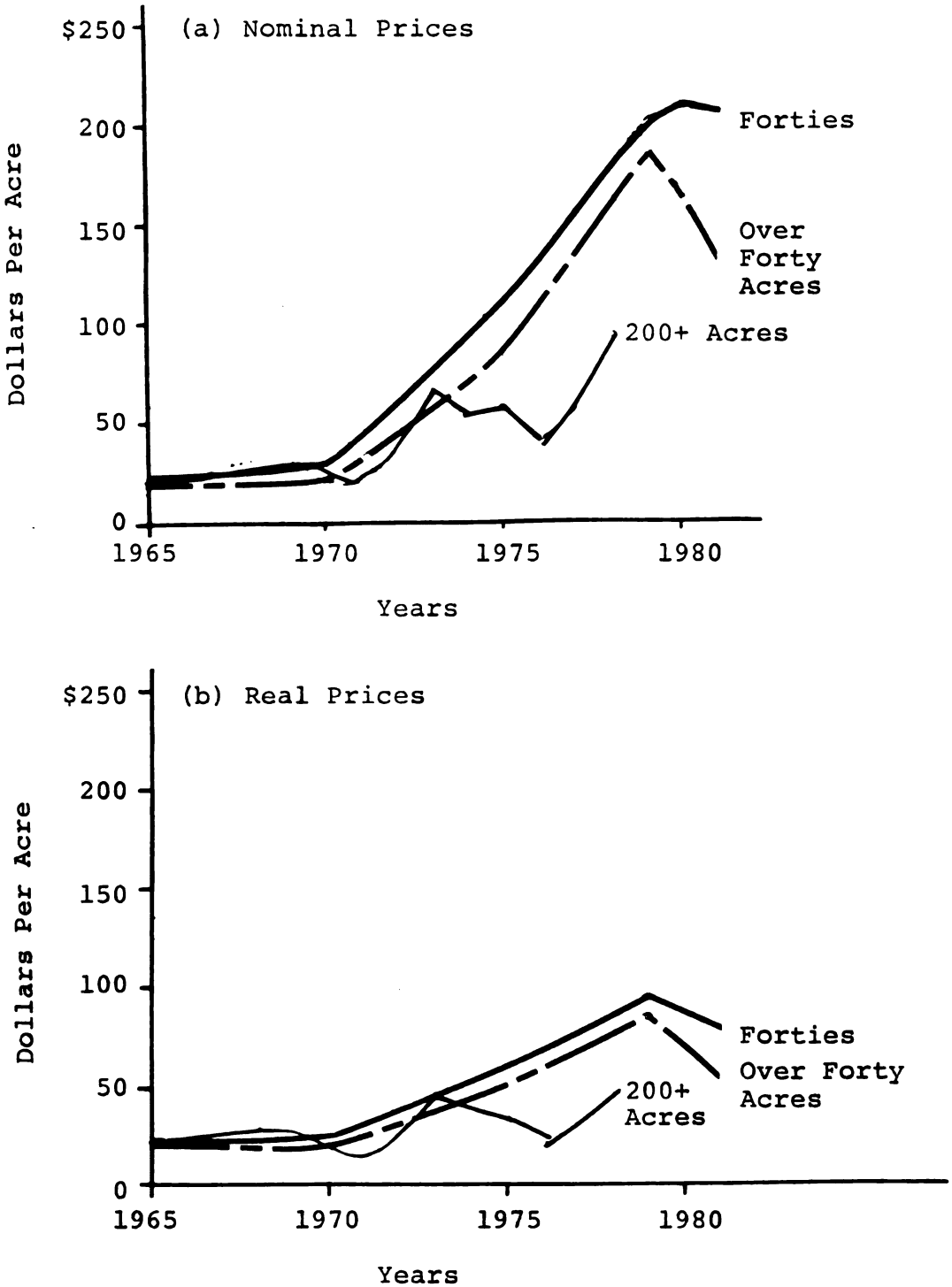


Figure 2.3: Average Prices for Northern Minnesota Woodlands of 200 Acres and Larger as Compared to Smaller Tracts (Excluding Waterfrontage Tracts), 1965-1981

to note that the lows (troughs) in the price line correspond with the recessionary periods of 1970-71, 1974-75 and 1980. In fact, a pattern of decreased market activity and stable or declining prices for woodlands was rather widely reported by appraisers during these periods.[3]

The prices paid for wooded tracts of 200 acres and larger from 1965 to 1970 appear to be highly competitive with those paid for smaller tracts. After 1970, the prices paid for 200+ acre tracts are rather consistently lower than for the other tracts. Indeed, if a line was entered on Figure 2.3 connecting only observations for tracts of 200 acres and larger for the years 1970, 1975 and 1979 (last year of observation), it would be lower, but closely parallel, the lines for the smaller tracts.

In advancing from $21 per acre to $90 per acre (nominal prices), the prices for woodland tracts of 200 acres and larger increased at an average annual compound rate of 11 percent as compared to 15 percent for smaller tracts. However, given the limited number of observations for these tracts and the similarities in performance

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[3]Personal Communication with Rodney F. Young, Assistant Director of Lands (Valuation, Appeals and Regulatory Acts, 1971 to present), USDA Forest Service, Washington, DC, December 1982.

after 1970, this likely should not be regarded as conclusive evidence that market prices for 200+ acre tracts increased at a slower rate than did smaller tracts.

Lake Frontage Tracts

Since 1975 relatively few sales of wooded lake tracts have been confirmed by the Lands staff on the Superior National Forest, owing primarily to a decline in funding available to the Forest under the Land and Water Conservation Fund Act. Consequently, the prices reported in Table 2.5 should be regarded as spot observations that are, perhaps, indicative, but not necessarily truly representative of absolute price levels. The 78 sales observed, however, are sufficient for this purpose of making a first approximation of the influence of lake frontage on the market value of forest land.

Table 2.5: Average Prices for Northern Minnesota Woodlands with Lake Frontage, 1965-1981

		Nominal Price		Real Price*		Average Size
Year	N	Front Foot	Acre	Front Foot	Acre	(Acres)
1965	28	$ 1.80	$ 119	$ 1.80	$119	57
1970	23	10.32	385	8.40	313	51
1975	9	15.18	962	9.00	569	29
1979	5	31.00	1371	14.15	679	26
1980	9	44.00	906	18.40	379	37
1981	4	35.00	943	13.50	363	57

*Real price in 1965 dollars--GNP deflator.

In columns three and five, the prices for wooded lake tracts are expressed in terms of dollars per foot of shoreline, the traditional unit of valuation for lake properties. In 1965 the mean market price was just under $2.00 per front foot; thereafter prices rose dramatically, attaining $44.00 per front foot in 1980 but falling, based on the sample of sales, to $35.00 in 1981. In real terms, as expressed in constant 1965 dollars in column five, front foot prices increased by a factor of 10.2 between 1965 and 1980.

In Figure 2.4 prices for wooded lake tracts are shown on a per acre basis in order to have a common unit of valuation for comparison with woodland tracts without lake frontage. Lake front "forties" are rare since lake tracts in the area typically are described in terms of government lots based on meander line surveys of the shoreline.

Panel a of Figure 2.4, displaying nominal market prices on a conventional vertical scale, gives the impression that lake tracts vastly out-performed wooded forties during the study period. Panel b provides a fairer comparison of relative performance. The price lines in panel b are closer together because the GNP deflator removes some of the absolute difference and the logrithmic price scale portrays proportional changes. Despite the

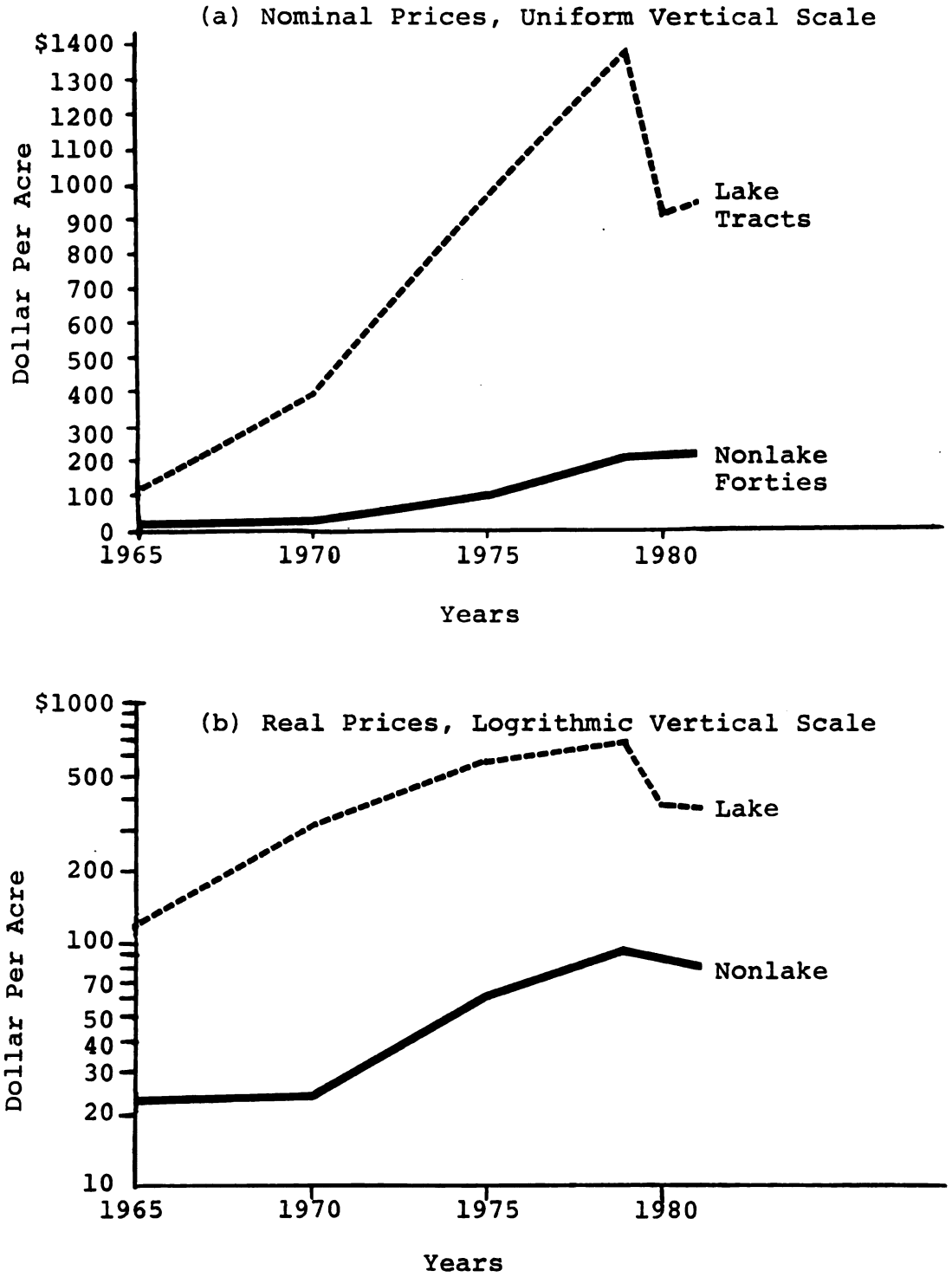

Figure 2.4: Average Prices for Northern Minnesota Woodland Sales With and Without Lakefrontage, 1965-1981

popular notion that lake tracts have been the glamour sector of the market, nominal price increases from 1965 to 1981 reflect an average annual compound rate of 13.8 percent as compared to 15 percent for nonlake wooded forties. Rates of real price increase were 7.2 for lake tracts and 8.3 percent for general wooded forties.

Another item of interest is the ratio between the prices of lake and nonlake tracts. At the various points of observation, lake tracts were priced anywhere from 4.4 (in 1980) to 13.8 (in 1970), and averaged 7.5, times as much as nonlake tracts. Thus, in broad terms, a timber producer could purchase 7.5 acres of general woodland for the price of one acre of lake property and, at the same time, avoid the additional hassle and constraints associated with the management and harvest of timber in lake zones.

Reasons for Purchase

As part of the process of confirming sales, inquiry is made as to the buyer's primary reason for making the purchase. For the purposes of this report, the various reasons given for purchasing forest land in Northern Minnesota were sorted into the following five categories:

Timber production
Recreation
Permanent Homesite
Investment
All Other

As used, herein, "timber production" includes purchases made simply to harvest the timber as well as tracts acquired for long term timber management. The "all other" category includes all uses not otherwise specified and sales for which information on the proposed employment was not obtained.

The reasons given by buyers for their purchases of forest land are not mutually exclusive. A number of buyers gave more than one reason, such as immediate use for personal recreation plus the possibility of living on the property after retirement. Investment potential was commonly cited as an influencing factor, but generally was not the primary reason given by purchasers.

The reasons given for purchasing forest land differed for tracts of varying size. Examination of 70 purchase transactions of non-waterfrontage tracts of less than 40 acres revealed only two with any stated relationship to timber production; both properties--a 14-acre tract purchased in 1975 and a 5-acre tract acquired in 1979--were purchased as sources of firewood. Seasonal and permanent homesites dominated these sales, in combination accounting for 51 (73 percent) of the sales. Investment was stated for 9 sales (13 percent) and other uses (expansion of existing ownerships) was the reason for the three (4 percent) other sales.

Table 2.6 and Figures 2.5 and 2.6 provide further insight as to the relationship between size and the reason for purchase. The data for 1965 sales in the 40 to 80 and 81 to 160 acre classes are not representative, as they were mostly acquired from a variety of private owners by a relatively few buyers for subsequent exchange with the U.S. Forest Service and the State of Minnesota. Otherwise, the sales display distinct differences in the reasons for purchase between property size classes and over time.

As shown in the summary tabulation at the end of Table 2.6 and illustrated in Figure 2.5, only six percent of all woodland sales without waterfrontage in the 40 to 80 acre size class were purchased for timber production. However, timber production was given as the primary reason for acquisition for 17 percent of the sales in the 81 to 160 acre class and fully 50 percent of the sales of 161 acres and larger. It is evident that these gains were made by displacing other uses--recreation fell from its dominant position with 32 percent of sales in the 40 to 80 acre size class to an also-ran 25 percent for 80 to 160 acre tracts and, finally, to nine percent for the largest tracts; permanent homesites turned in a similar performance, declining from 12 percent for the smallest grouping to eight percent for mid-size tracts and disappearing from the sample for tracts larger than 160 acres.

Table 2.6: Reasons Given for Acquiring Northern Minnesota Woodlands (Excluding Water Frontage Tracts) by Tract Size, 1965-1981

Year	Use	40-80 Acres N	40-80 Acres %		81-160 Acres N	81-160 Acres %	161+ Acres N	161+ Acres %	Total N	Total %
1965	Timber Production						2	40	2	7
	Recreation									
	Investment									
	Homesite									
	All Other	21	100		1	100	3	60	25	93
	Total	21	100		1	100	5	100	27	100
1970	Timber Production	3	6		2	22	6	46	11	15
	Recreation	24	47		2	22	2	15	28	39
	Investment	7	14				1	8	8	11
	Homesite	3	6		1	11			4	5
	All Other	14	27		4	45	4	31		30
	Total	51	100		9	100	13	100	73	100
1975	Timber Production	3	7				2	67	5	9
	Recreation	10	22						10	19
	Investment	9	20		3	75			12	23
	Homesite	7	15						7	13
	All Other	17	36		1	25	1	33	19	36
	Total	46	100		4	100	3	100	53	100
1979	Timber Production	1	3		1	50	1	100	3	9
	Recreation	8	28		1	50			9	28
	Investment	4	14						4	13
	Homesite	9	31						9	28
	All Other	7	24						7	22
	Total	29	100		2	100	1	100	32	100
1980	Timber Production	1	8						1	5
	Recreation	6	45		3	50			9	48
	Investment	1	8		3	50			4	21
	Homesite	1	8						1	5
	All Other	4	31						4	21
	Total	13	100		6	100	0	0	19	100
1981	Timber Production	2	15		1	50			3	20
	Recreation	7	54						7	47
	Investment								--	--
	Homesite	1	8		1	50			2	13
	All Other	3	23						3	20
	Total	13	100		2	100	0	0	15	100
	Summary									
1965-1981	Timber Production	10	6	4	17	11	50		25	11
	Recreation	55	32	6	25	2	9		63	29
	Investment	21	12	6	25	1	5		28	13
	Homesite	21	12	2	8				23	11
	All Other	66	38	6	25	8	36		80	36
	TOTAL	173	100	24	100	22	100		219	100

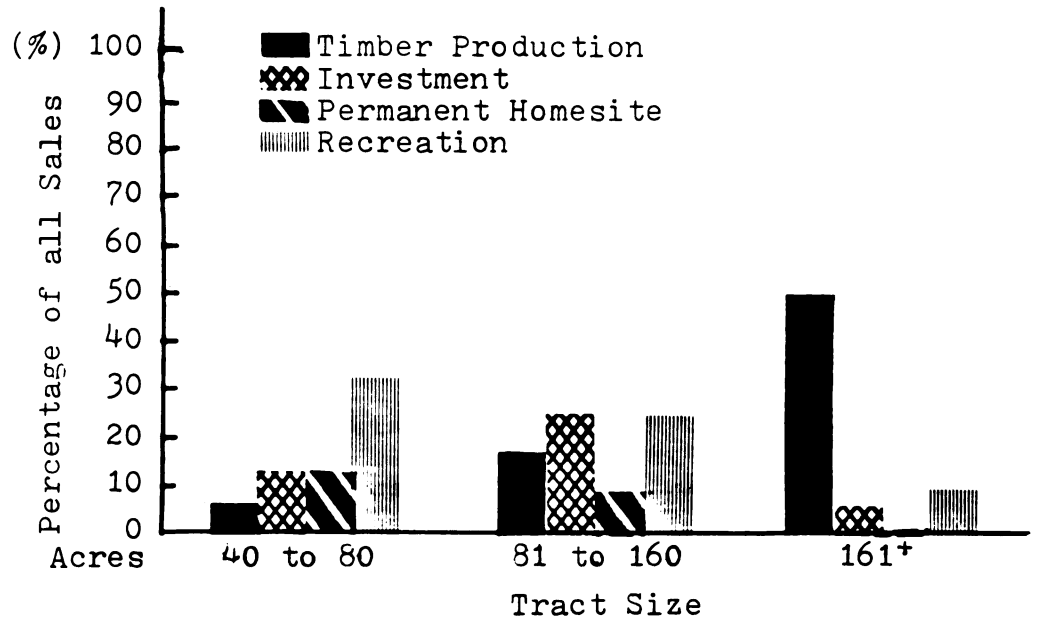

Figure 2.5: Reasons Given for Acquiring Northern Minnesota Woodlands (Excluding Waterfronage Tracts) by Tract Size During 1965-1981

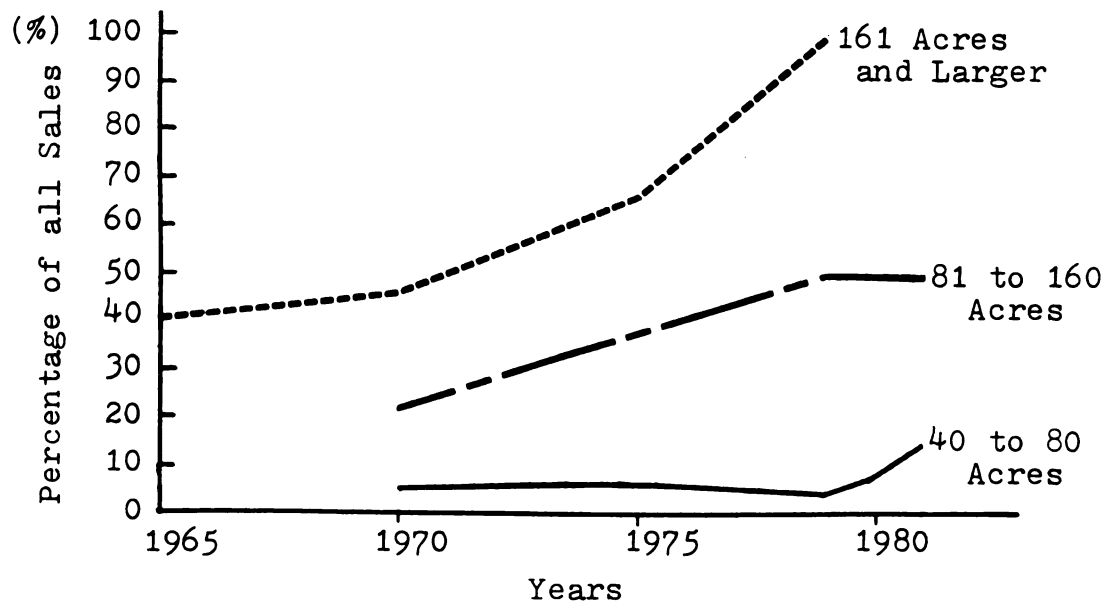

Figure 2.6: Percentage of Northern Minnesota Woodland Tracts (Excluding Waterfrontage) Acquired for Timber Production by Size Class, 1965-1981

Of the cited uses, only investment displayed an erratic pattern, starting at 12 percent of the market for 40 to 80-acre tracts, increasing to 25 percent for the 81 to 160-acre grouping, and closing at five percent of the market for the largest tracts.

Confirming evidence of the importance of timber as a reason for the acquisition of larger tracts is provided by the all-year listing of woodland tracts of 200 acres and larger as previously displayed in Table 2.4. Sixteen (38 percent) of these sales were acquired for timber production. Further stratification by size revealed that timber production was the reason for the acquisition of 50 percent of the tracts of 500 acres and larger and 53 percent of the tracts of 1000 acres and larger.

Figure 2.6, which is based on Table 2.6, displays some unexpected results. Given the increasing competition for forest land and the rather dramatic increases in its price, it was expected that the proportion of tracts acquired for timber production would decline over the 16-year study period. The sales, however, generally reflect just the opposite situation. As indicated in Figure 2.6, timber production steadily increased its market share for medium and large size tracts and, on balance, more than held its own even for tracts in the 40 to 80 acre class. Factors that may have contributed

to the observed trends, especially for large tracts but also affecting scattered, smaller outholdings, were large sales of land between forest product companies. Kimberly-Clark, Tomahawk Timber and Halvorson liquidated or reduced their holdings during the study period. Other large sales were made by national real estate investment companies and by heirs to large estates.

While timber production was found to be an important factor influencing the market for general woodland tracts, in particular for tracts of larger sizes, it was conspicuously absent as a reason for purchasing lake frontage tract sales of all sizes, not one was purchased for timber production. Recreation was the dominant use.

A Closer Look at Tract Size

The relationship between tract size and the prices paid for Northern Minnesota woodland tracts without water frontage is illustrated for three representative years in Figure 2.7. It may be recalled that tract size was previously found to influence both the prices paid and the reasons for which these properties were acquired.

The three curves in Figure 2.7 show striking similarities. In all cases, per acre prices decline very rapidly as tract size increases until a size of about 40 acres is attained. Further declines in price associated with

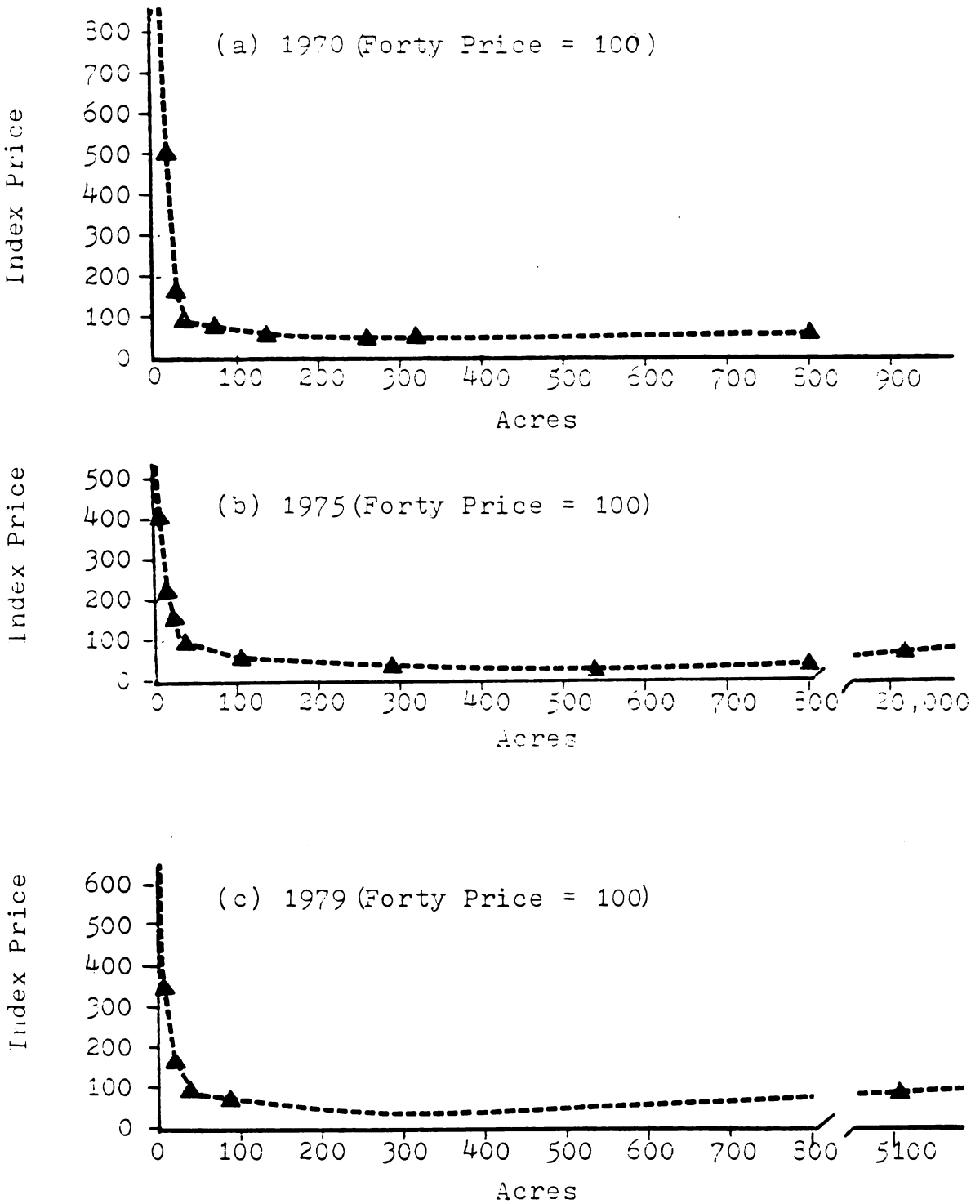

Figure 2.7: Relationship Between Tract Size and Average Market Prices for Northern Minnesota Woodlands (Excluding Waterfrontage Tracts), 1970, 1975 and 1979

increases in tract size are moderate from 40 acres to about 80 or 100 acres; minor from these points to about 200 acres; and almost imperceptible from 200 acres to about 400 or 500 acres. Thereafter, the price trends reverse and start to increase, very slowly to be sure, but sufficiently so that prices paid for tracts of about 800 acres rival those paid for 80 acre tracts. Panels b and c of Figure 2.7 for years 1975 and 1979, respectively, further indicate that per acre prices became competitive with those paid for 40-acre tracts as tract size advanced into the thousands of acres. This relationship was also observed in 1965 (not shown) in which tracts of 800 acres and larger averaged $26 per acre as compared to $22 for forties.

The price-size relationships shown in Figure 2.7 for small to medium size tracts is consistent with expectation as similar results have been widely reported in the literature. Moreover, the response function appears to be largely independent of price levels. For example, in his work in the Sawtooth Valley of Idaho, Dunford found that per acre prices initially fell very rapidly as tract size increased but stabilized at about $2250 for 200 acre

tracts; thereafter, prices fell only slightly as acreage increased.[4] Similarly, de Steiguer, commenting on data reported in USDA Economic Research Service Farm Real Estate Market Development reports, has observed that the average per acre selling prices for forested tracts in the 48 States declined rapidly until tract size increased to about 200 acres, whereupon prices stabilized at about $525 per acre.[5]

Because of the high degree of correlation that is frequently observed between tract size within given ranges and per acre prices, it is tempting to assume that a causal relationship exists between these variables. Higher prices have been justified for smaller tracts for reasons varying from greater competition for smaller tracts (since they are within the financial means of more people) to relatively higher transaction costs. Neither of these reasons is a fully satisfactory explanation and tend to result in more importance being placed on tract size as a factor influencing prices than is warranted.

As a matter of fact, displaying per acre prices for tracts of widely varying size (as in Figure 2.7) is no different than displaying board foot prices for stumpage

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[4]Joseph Wm. Dunford, Market analyses contained in various unpublished appraisal reports, prepared for USDA Forest Service, Sawtooth National Recreation Area, Montpelier, Idaho, 1979.

[5]de Steiguer, p. 216.

and lumber, or the per pound price for steers and steak, in a single graph. To land developers and subdividers, who are necessarily concerned about such things as: return of, and returns on, capital invested in raw land and development; delays and expenses incurred in getting necessary approvals from authorities; product losses arising because not all portions of larger tracts are necessarily suitable for subdivision, to say nothing about possible setback and minimum lot size requirements; sellout periods; promotion and selling expenses; and, perhaps, even returns to management, larger tract prices do represent prices at the wholesale level while prices for smaller parcels represent retail prices.

The effects of tract size (i.e., quantity discounts) should only be evaluated on the basis of sales of identical units in various quantities. This condition was widely violated by the sales examined for this study. As noted in the discussion on the reasons for purchase, tracts of less than 40 acres were predominantly (73 percent) purchased for either seasonal or permanent homesites, and these became essentially the only reasons for purchase as tract size was reduced to five acres or less. A large proportion of these sales had road access, electric power (especially for permanent residence sites), surveyed property boundaries and, of course, one or more building sites. It, perhaps, goes without saying that

none of the tracts of 40 acres or larger offered these same features on each and every acre. What is often construed to be a quantity difference between tracts may, upon reflection, be more a matter of differences in quality attributes.

Quality differences, arising from the fact that larger tracts of land are not simply a collection of smaller, identical units, possibly influences the market price throughout the entire range of tract sizes. However, such differences become proportionally less important as tract size increases. Thus, the curves in Figure 2.6 may give a truer picture of the effects of tract size for medium to large size tracts than they do for tracts of lesser size.

The tendency for prices to rise as tract size increased beyond the 400 to 500 acre level has rarely been observed in emperical data (one reason being that such sales occur infrequently in most areas). Theoretically, such results are acceptable as: the majority of these properties were acquired by timber corporations who must have viewed the opportunity to acquire a large number of acres in one transaction as very attractive; there were a sufficient number of such buyers in the area to generate competition; and the level of knowledge was about equal on both sides since many of these sales were from timber

corporation to timber corporation. Special attention will be given to see if these results are duplicated in other locations considered in this study.

Separation of Effects

The treatment of the Northern Minnesota woodland sales to this point has been largely descriptive and has relied upon overall average selling prices. These prices have served well to illustrate major effects, such as price changes over time, the influence of lake frontage on selling prices, and general tract size--price relationships. But overall averages have been an inherent limitation-they give a greatly oversimplified view of the market. As a case in point, consider Figure 2.8 which displays the selling prices of individual tracts of various sizes.

In Figure 2.8 the points, representing the selling prices of tracts of various sizes, are scattered fairly uniformly but widely along the average price curve. Most points fall within $20 of the price curve, but, since the price curve lies between $14 and $28, it is apparent that the standard error is proportionately very large. It should also be noted that segments of the response function are almost linear and have close to zero slope. Thus, even considerable changes in tract size result in negligible changes in market prices.

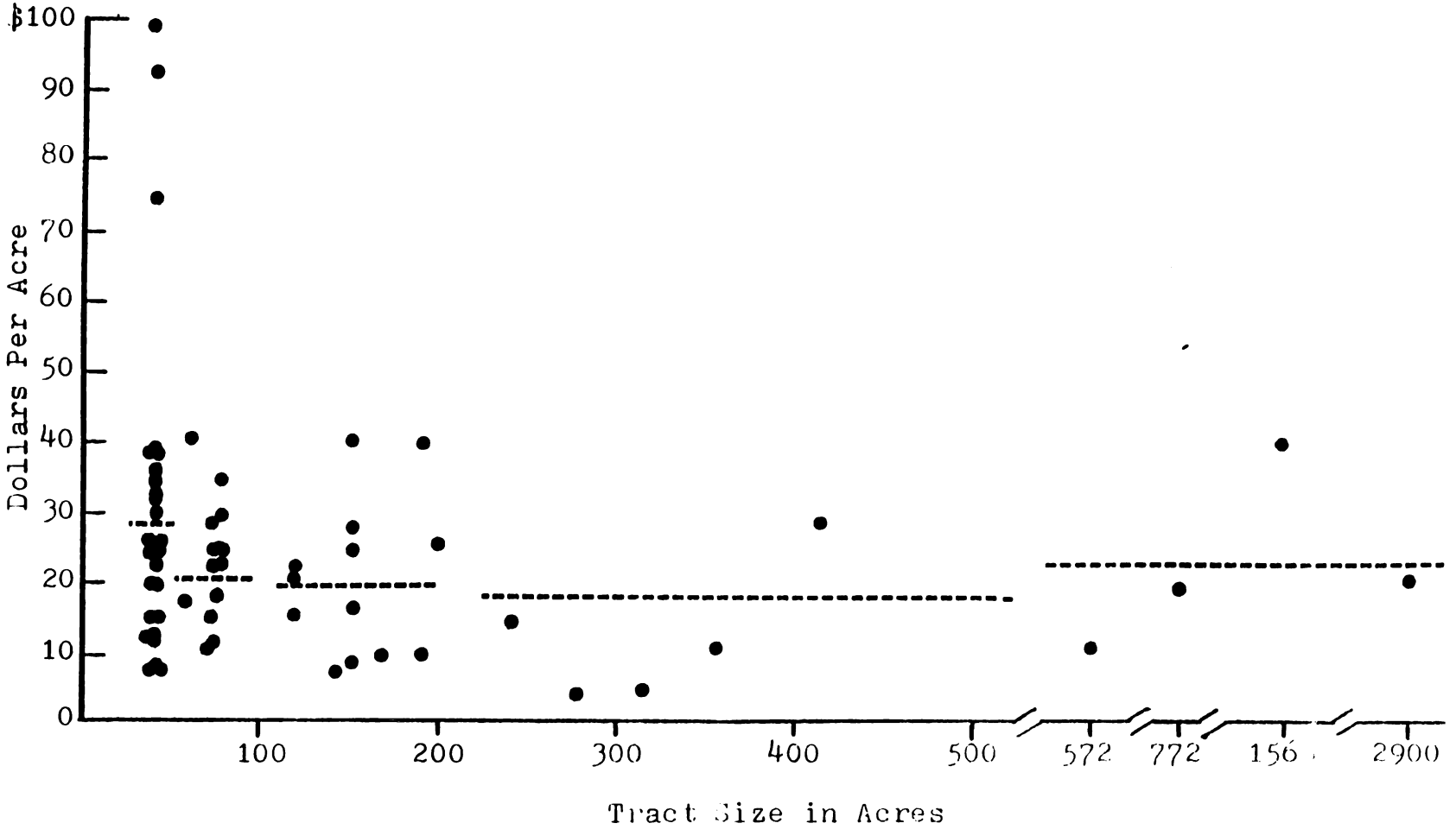


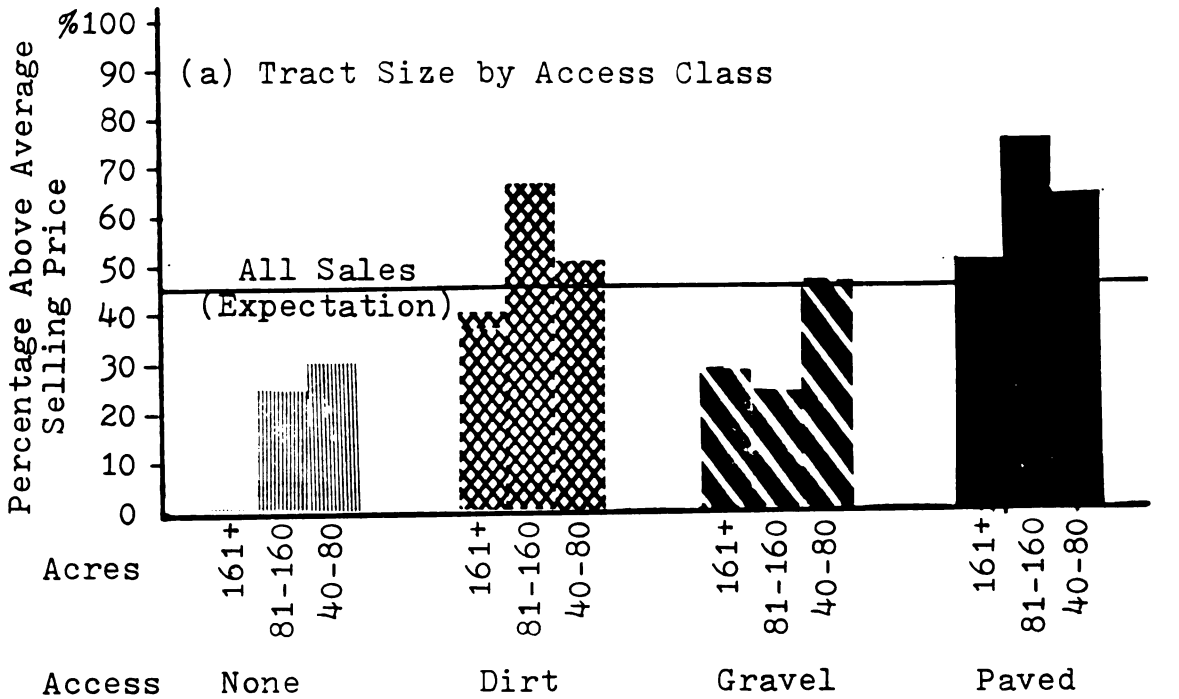
Figure 2.8: Tract Size--Price Relationship for Northern Minnesota Woodland Sales (Excluding Waterfrontage) in 1970

It is evident from Figure 2.8 that factors other than size influence the selling prices of Northern Minnesota woodlands, and the balance of this chapter will explore various factor-price relationships.

Size and Access

Figure 2.9 features a comparison of the price performance of Northern Minnesota woodland tracts in various size and access classes. The display is based on 192 sales of tracts of 40 acres and larger that sold from 1970 to 1981. Sales occurring in 1965 were not used since specific tract information was not available for these sales.

The information displayed in Figure 2.9 was developed by assigning the sales in each study year to one of twelve cells defined by four road access classes and three tract size classes. The selling price of each tract was then compared with the average (grand mean) selling price for all tracts in its year of sale. Of the 192 sales, 86 (45 percent) sold for more than the average price and 106 (55 percent) sold for less. If neither tract size nor condition of road access influenced selling prices, the sales in each tract size-access classification would be expected to have approximately the same ratio of sales selling for more and less than the average price.



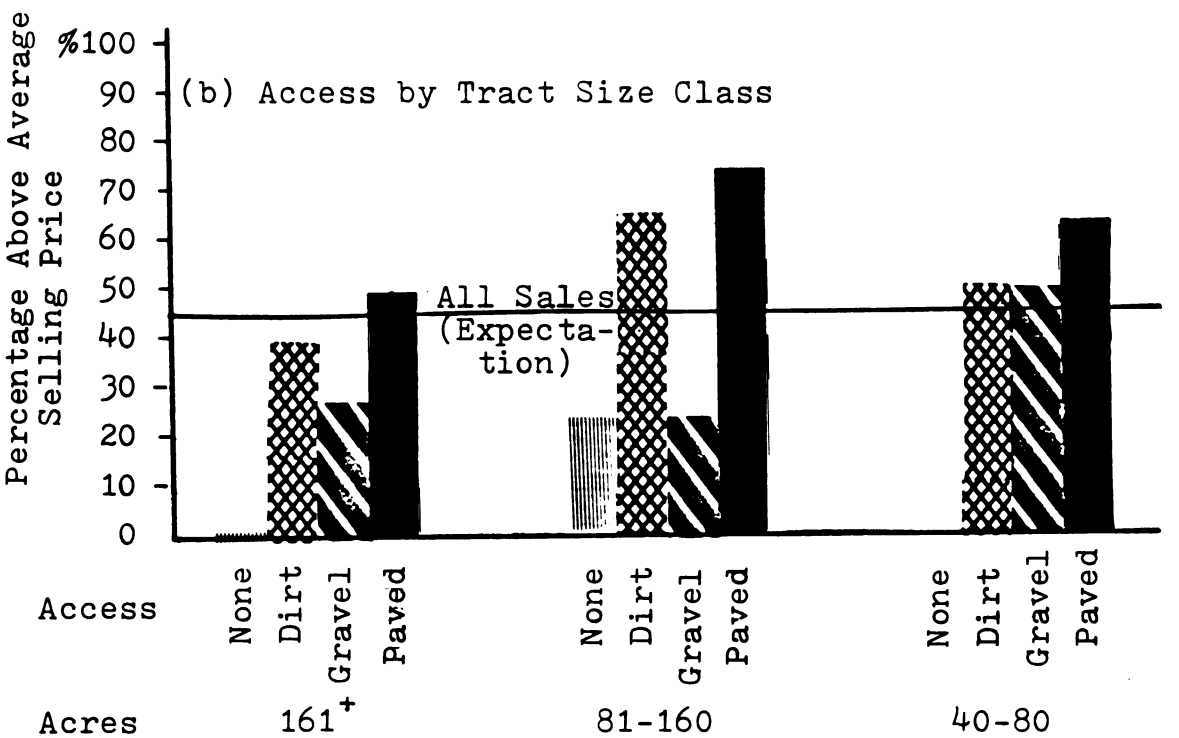


Figure 2.9: Effects of Tract Size and Access on Prices of Northern Minnesota Woodlands, 1970-1981

In the top panel of Figure 2.9, the sales were grouped by access. This permitted the general effects of road access on price to be observed. The top panel also displays the specific effects of tract size on price within each access classification. The same data are displayed in the bottom panel but are rearranged to emphasize the general effects of road access.

The effects of extremes in access conditions on market prices are readily evident in panel a--50 to 75 percent of the tracts with paved access roads sold for more than the average price in their year of sale as compared to zero to 30 percent of the tracts without road access. Tracts with dirt access and those with gravel access are intermediate in price performance. Tracts with dirt access roads show better overall performance than do tract with gravel access, however, this observation is subject to later qualification.

In panel a tracts of 40 to 80 acres show better price performance than tracts of 161+ acres within all access classes (i.e., with access held constant), but there is no consistent difference in price performance for tracts of 40-80 acres versus those in the 81 to 160 acre class.

Panel b reveals a tendency for tract prices to increase as size is reduced--only sales with paved access

extend above the expectation line for tracts of 160+ acres while all tracts of 40 to 80 acres, except those without road access, extend above the expectation line. It is apparent, however, that the effects of tract size are not as strong as those associated with access as the general effects of size in panel b are less well defined than the general effects of road access in panel a. Panel b also shows the very strong effects of access extremes within size classes.

Two major qualifications apply to the data displayed in Figure 2.9. First, as shown in Table 2.7, several of the classifications are based on only a few sales and, thus, are highly subject to the influence of factors controlled in this test. Only the classification involving 40-80 acre tracts are based on a sufficient number of observations to be tested individually for statistical significance. The second qualification is that, due to the nature of the test applied, sales classified in the mid-range of either of the tested variables are most likely to exhibit inconsistent behavior. This occurs because, if a variable has a strong influence on price, sales with a moderate rating for the variable will tend to sell for close to the average price and can easily be pushed over the expectation line by uncontrolled variables.

Table 2.7: Relative Prices of Northern Minnesota Woodlands (Excluding Waterfrontage Tracts) Statified by Access and Size Classes, 1970-1981

	Access and Size Classes (Acres)												
	No Road			Dirt Road			Gravel Road			Paved Road			
	40-80	81-160	161+	40-80	81-160	161+	40-80	81-160	161+	40-80	81-160	161+	Total
	(Number of Sales)												
Lower than Average Price	16	6	3	15	1	3	39	6	5	10	1	1	106
Higher than Average Price	7	2	0	15	2	2	33	2	2	17	3	1	86
Total (N)	23	8	3	30	3	5	72	8	7	27	4	2	192
	(%)												
Percentage with Higher than Average Selling Price	30	25	0	50	67	40	46	25	29	63	75	50	45

The results of Chi-square tests of significance applied to the Northern Minnesota woodland sales are shown in Tables 2.8 and 2.9.

In Table 2.8, which tests the physical relationship between size and access, the observed and expected values are generally very similar. Accordingly, the Chi-square (X^2) values are small. (For reference an average cell value of 1.05 would be required to reject the null hypothesis of independence at the .05 level of significance.) Tracts of 81 to 160 acres with no road access occurred in the sample twice as often as expected, but this is the only exception. As indicated in the test portion of Table 2.8, the null hypothesis of independence between size and access cannot be rejected even at the .25 level of significance. This indicates there is little chance that price responses attributed to either size or access could, in fact, be caused by the other variable.

Table 2.9 features a test of the effects of access and size upon selling prices. Insufficient observations prevented the separate testing of the 81-160 and 161+ acre classes. However, combining these size classes gave expected values of at least two in each cell and allowed an approximate Chi-square test to be made since the remaining requirement of at least two degrees of freedom

Table 2.8: Approximate Chi-Square Test of Physical Relationship Between Tract Size and Access Class for Northern Minnesota Woodland Sales, 1970-1981

Key

Observed Number of sales
(Expected Number)
[Cell Chi-Square Value]

ACCESS CLASS	Tract Size in Acres 40-80	81-60	161+	Total
No Road	23 (26.917) [.570]	8 (4.073) [3.786]	3 (3.010) [0.000]	34
Dirt	30 (30.083) [.000]	3 (4.552) [.529]	5 (3.365) [.794]	38
Gravel	72 (68.875) [.142]	8 (10.422) [.563]	7 (7.703) [.064]	87
Paved	27 (26.125) [.029]	4 (3.953) [.001]	2 (2.922) [.291]	33
Total Observation	152	23	17	192

----------TEST---------- DF = 6 -------

$X^2cal = 6.769$ vs. Table $X^2.95 = 12.60$

$X^2.75 = 7.84$

$X^2.50 = 5.35$

Cannot reject null hypothesis of independence even at .25 level of significance.

Table 2.9: Approximate Chi-Square Test of the Effects of Tract Size and Access on the Relative Selling Prices of Northern Minnesota Woodlands, 1970-1981

Key

Observed Number of Sales
(Expected Number)
[Cell Chi-Square Value]

Access and Size Classes

	No Road		Dirt Road		Gravel Road		Paved Road		
	40-80 Acres	81 Acres & Larger	40-80 Acres	81 Acres & Larger	40-80 Acres	81 Acres & Larger	40-80 Acres	81 Acres & Larger	Total Observations
Lower than Average Price	16 (12.698) [.859]	9 (6.073) [1.411]	15 (16.563) [.147]	4 (4.417) [.039]	39 (39.759) [.014]	11 (8.281) [.893]	10 (14.906) [1.615]	2 (3.313) [.520]	106
Higher than Average Price	7 (10.302) [1.058]	2 (4.927) [1.739]	15 (13.438) [.182]	4 (3.583) [.049]	33 (32.250) [.017]	4 (6.719) [1.100]	17 (12.094) [1.990]	4 (2.688) [.640]	86
Total Observations	23	11	30	8	72	15	27	6	192

TEST DF = 7

X^2cal = 12.273 vs. Table $X^2.95 = 14.1$

$X^2.90 = 12.0$

The null hypothesis of independence can be rejected at the .10 level of significance.

is more than satisfied.[6] The test shows that the null hypothesis of independence between price and the combined effects of size and access cannot be rejected at the .05 level of significance but can be rejected at the .10 level.

In addition to the basic test of significance, the values in Table 2.9 allow inferences to be made as to the relative strength of separate effects. The dominant effect of access is evidenced by the relatively large differences between observed and expected values and, accordingly, in the bracketed Chi-square values for access extremes (no road and paved road). Consequently, the close agreement between observed and expected values, resulted in small cell Chi-square values, for tracts with moderate (dirt and gravel) access conditions. This indicates tracts with excellent access tend to sell for more than the average price, those with poor access tend to sell below average, and those with moderate access sell for about the average price, regardless of tract size. The effects of size, however, are indicated by the better performance of paved 40 to 80 acre tracts, as compared to larger paved tracts, and the poorer performance of large tracts with no road access and gravel road access.

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[6]Helen M. Walker and Joseph Lev, Statistical Inference, (New York, Henry Hoff & Co.), p. 107.

Finally, when the Chi-square test was applied to tracts in the 40-80 size class having no access versus paved access, there were sufficient observations in all cells for an exact test and the null hypothesis of independence between access and selling price could be rejected, not only at the .05 level, but also at the .025 level of significance.

Access and Timber

The transaction cards for Northern Minnesota woodlands tend to describe cover types in very general terms such as "all wooded" or "mixed hardwoods and conifers." Information on species and estimated volumes was not stated in enough cases to be useful. The cards, however, do tend to mention exceptions such as tracts with sawtimber, recent cutting, reserved timber harvest rights, extensive blowdown, or unusually poor site conditions. These exceptions were used to classify the timber into three classes: superior, average, and inferior.

In the way of background, most Northern Minnesota wooded tracts do contain at least some commercial timber volume. Forest Survey reports indicate that net annual growth exceeds annual removals by about 2.5 times with overaged aspen and other hardwoods in particular abundance.

Pulpwood accounts for about 90 percent of the total value of forest products harvested in the state.[7]

As can be seen in Figure 2.10, both access and timber strongly influence relative price performance. In panel a there is a general upward trend as access improves, but there is great variation within each access class depending upon the condition of the timber. The main reason for this is apparent in panel b where the same sales are rearranged by timber condition--none of the sales with inferior timber were able to sell for more than the average price in their year of sale.

One point of particular interest is the differential effect of timber. Inferior timber always is injurious to price but superior timber resulted in better price performance, as compared to average, only in the case of tracts without road access. For all other access classes, superior timber is associated with declines in relative price.

Even though timber was rated in terms of commercial products, it is understandable that tracts, with inferior timber (cutover, wind thrown, etc.) would be poorly regarded by all classes of buyers. Superior timber

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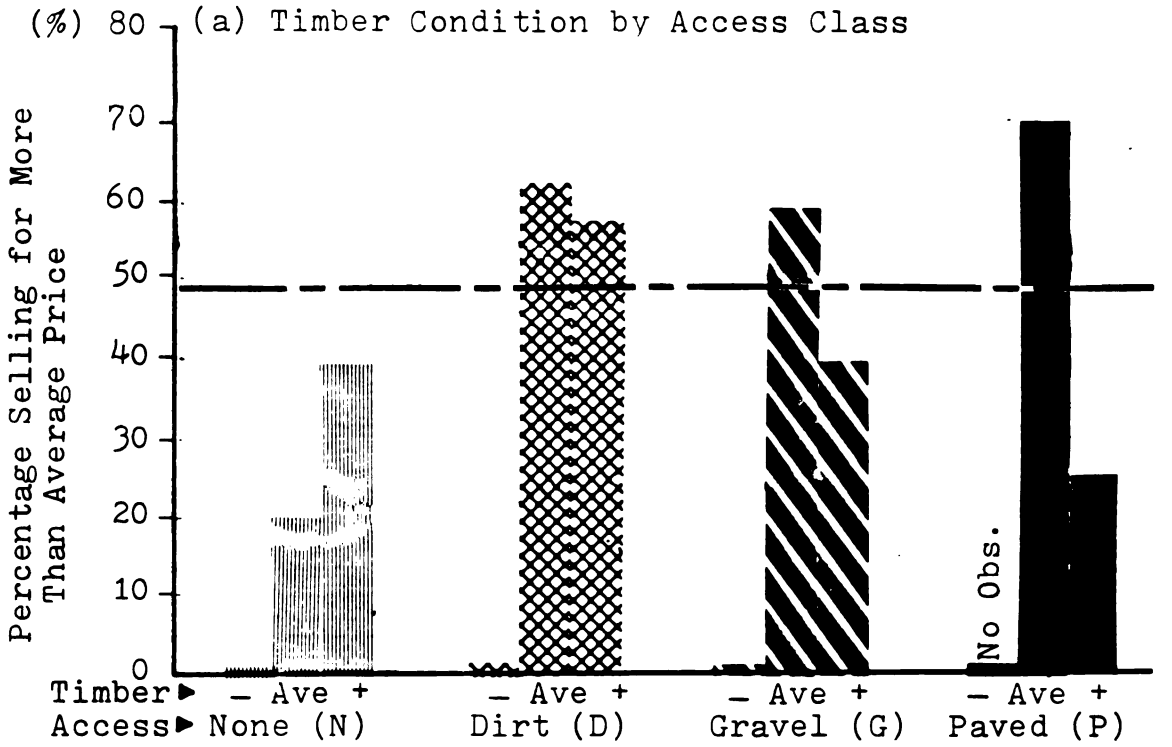
[7]North Central Forest Experiment Station (unpublished data), Minnesota Forest Survey, as cited by Forest Industries Council, Minnesota Forest Productivity Report (Washington, DC: Forest Industries Council, 1979), pp 3-4.



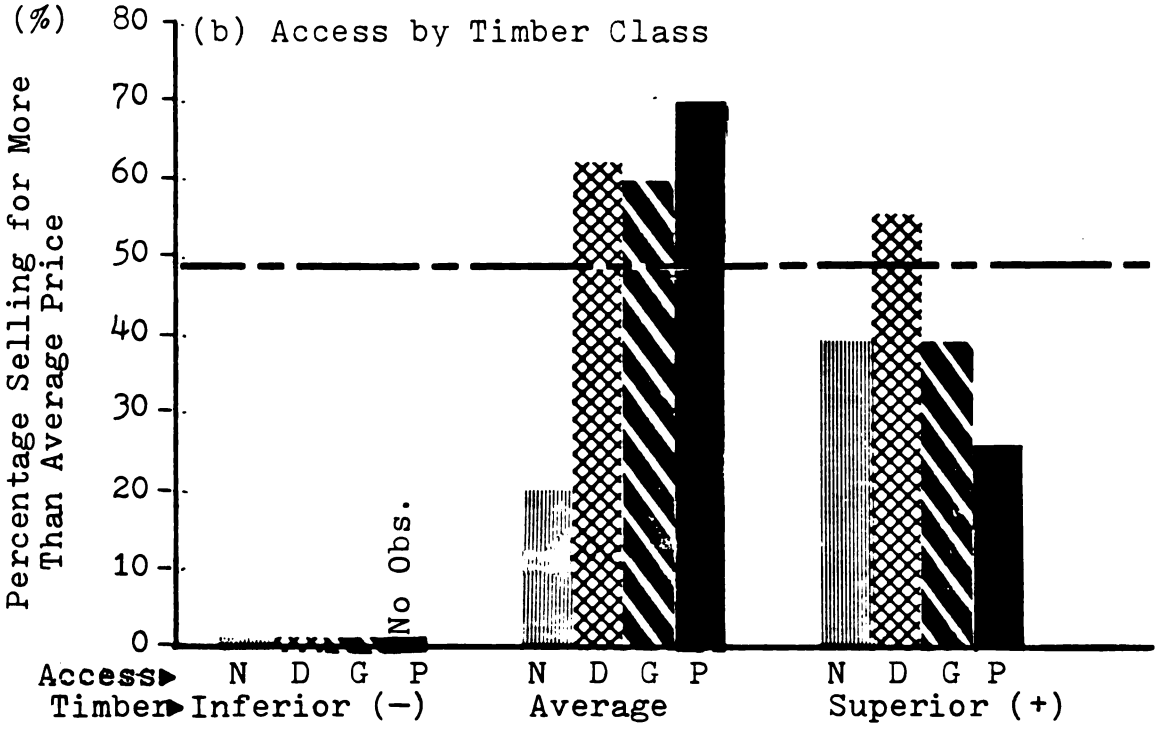


Figure 2.10: Effects of Access and Timber on Prices of Northern Minnesota Woodlands, 1970-1981

likely is beneficial to tracts without access since any given timber value would make a proportionately greater contribution to the total (and per acre) price, given the relatively low base prices for tracts in this classification.

The reason for the adverse effect of superior timber on the prices paid for properties in the other access classes is not apparent based on the information provided in Figure 2.10. However, a check showed that 64 percent of sales of 161 acres and larger were classified as having superior timber as compared to only 31 percent in the 81-160 acre size class and 21 percent in the 40-80 acre group. (In fact, the relationship between timber classification and tract size was significant at the .005 level.) Thus, associated tract size differences may explain, in large measure, the apparent negative response for tracts rated as having superior timber.

Reason for Purchase - Price Relationships

Figure 2.11 features a comparison of real prices paid for Northern Minnesota woodlands by reason for purchase. As before, the actual prices were adjusted using the GNP implicit deflator and are expressed in terms of 1965 dollars.

Throughout the period of observation, permanent homesites sold for the highest average per acre prices. Homesite prices averaged $23 per acre in 1970, climbed to $107 in 1979, then dropped to $81 in 1980-81. At the low end of the market were tracts purchased for timber. Their average per acre price was $21 in 1965, $72 in 1979, $68 in 1980-81, and averaged about 79 percent of the prices paid for homesites.

As can be seen in Figure 2.11, recreation tracts sold for an average of $16 per acre in 1970, the lowest of any classification. Thereafter, prices for recreation tracts climbed to $43 per acre in 1975 and stayed $4 to $5 above that paid for tracts purchased for timber production in 1979 and in 1980-81.

The prices paid for tracts purchased as investments show the greatest variation in average year-to-year prices but generally fall within the boundaries set by homesite and timber tract sales. The greatest price variation was expected in this class because tracts in any of the other classifications may be purchased as investments. The pattern of prices does suggest that the emerging trend of rising prices prompted increasingly aggressive bidding by investors from 1975 to 1979, followed by a retreat as prices started a general decline.

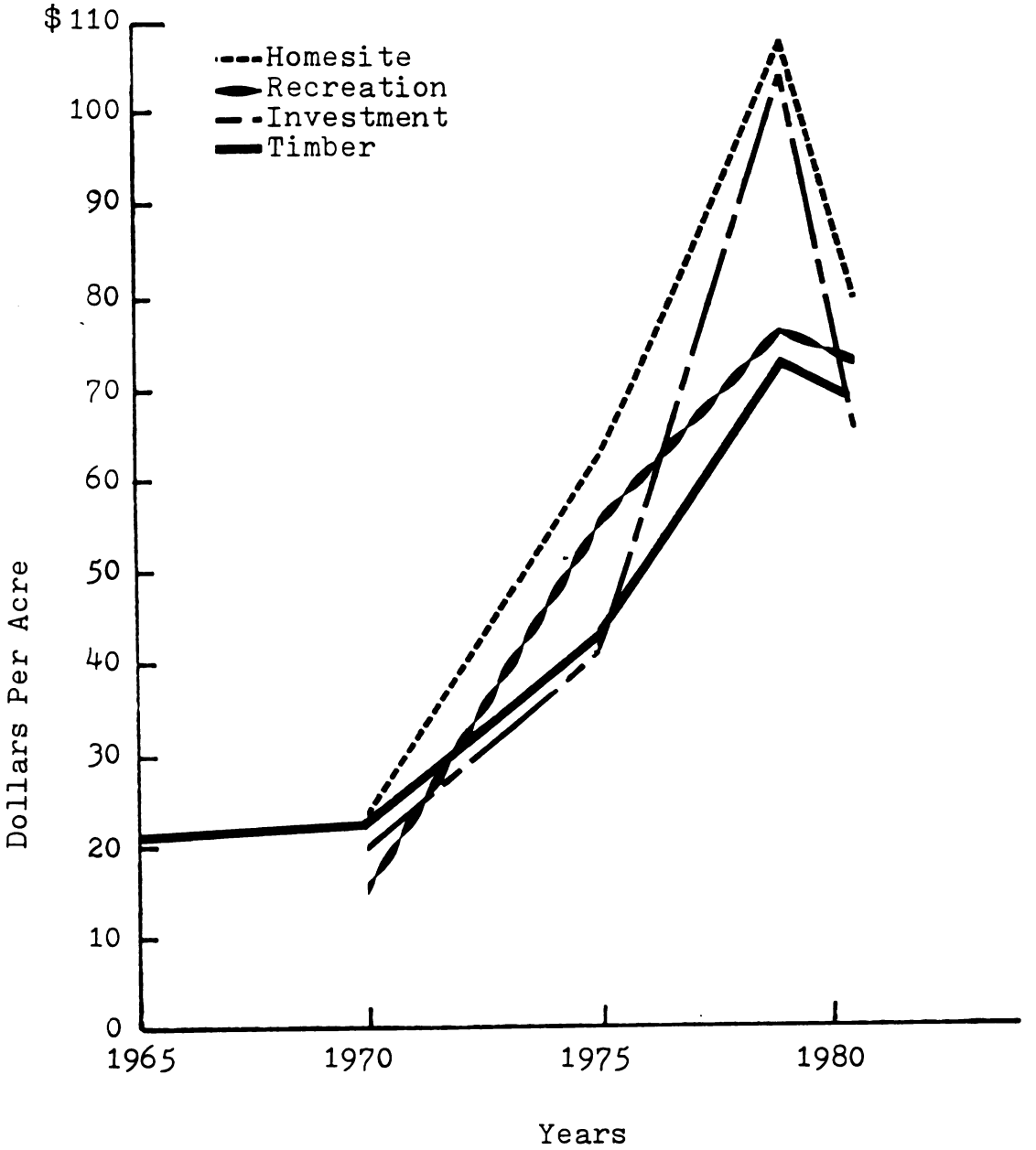


Figure 2.11: Average Real Prices of Northern Minnesota Woodlands (Excluding Waterfrontage) of Forty Acres and Larger by Reason for Purchase, 1965-1981

Table 2.10 lists the price paid for tracts of various uses and also provides information on tract features that help to explain the differences in prices. Permanent homesites, for example, appear to have commanded the highest per acre prices because of their relatively small average size of 40 to 70 acres, in respective years, and superior access--82 percent had either gravel or paved access roads. In contrast, tracts purchased for timber production tend to be much larger--averaging 541 to 4,091 acres in the years best supported by a volume of sales--and, typically, have either dirt or gravel road access. Some 52 percent of the tracts acquired for timber production were classified as having superior timber, a much higher percentage than the other classification of sales. Finally, recreation and investment tracts could be categorized as relatively small in size and intermediate in access.

Table 2.10: Average Real Prices and Selected Tract Features of Northern Minnesota Woodlands of Forty Acres and Larger (Excluding Water Frontage Tracts) by Reason for Purchase, 1965-1981

	Reason for Purchase							
	Permanent Homesite		Recreation		Timber Production		Investment	
Tract Size and Price	Real Price* $/Acre	Tract Size (Acres)	Real Price* $/Acre	Tract Size (Acres)	Real Price* $/Acre	Tract Size (Acres)	Real Price* $/Acre	Tract Size (Acres)
1965	--	--	--	--	$21	--	--	--
1970	$ 23	70	$16	93	22	541	$ 20	95
1975	63	44	56	51	43	4,091	41	73
1979	107	40	76	71	72	1,742	104	49
1980-81	81	54	73	63	68	70	65	120
Access Conditions	% of Sales							
No Road	9%		24%		13%		14%	
Dirt Road	9%		19%		30%		24%	
Gravel Road	48%		46%		48%		48%	
Paved Road	35%		11%		9%		14%	
Timber Conditions	% of Sales							
Inferior	0%		3%		0%		3%	
Average	96%		83%		48%		83%	
Superior	4%		14%		52%		14%	

*Expressed in 1965 dollars - GNP deflator.

CHAPTER III

MISSOURI OZARKS

The treatment of the Missouri Ozark woodland sales generally parallels that used in Northern Minnesota. Consequently, the discussion will move more directly to the findings with lesser emphasis on the explanation of procedures.

Description of Study Area

The study area is comprised of 28 counties in the Ozark Plateau region of South-Central and Southeastern Missouri. The area lies generally south of Interstate Highway 44 and, with the exception of the flatlands in the Bootheel, extends to the Arkansas state line. The area may be further described in terms of bordering population centers. Springfield, Missouri (population 133,116) is on the western fringe, Popular Bluff (17,139) marks the southeast corner while Lebanon (9,507) and Rolla (13,303) establish the northern limit. St. Louis (453,085) is 105 miles northeast of Rolla on Interstate Highway 44. The described area contains about 19,000 square miles and includes the major portion of the Missouri Ozarks.[1]

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[1]Land area and population statistics cited in this section are from U.S. Bureau of Census reports.

Most counties in the Missouri Ozarks experienced population declines during the depression and following World War II until about 1960. Since then, the pattern has reversed, and most counties posted population gains of 10 to 25 percent between 1970 and 1980. Many people, who formerly left to seek employment in outside industrial areas, are now returning in retirement, and the Ozarks are emerging as a major retirement and year-round recreation area. Employment opportunities have improved due to expanded mining activity, particularly in the northeastern counties, and the general expansion of industry in the central and southern states.

The Ozarks, of course, are the major timber producing region in the state and the location of over 75 percent of the sawmills that produce more than one million board feet of lumber per year.[2] Lumber, charcoal and cooperage are the major wood products of the Ozarks. Agriculture has also expanded in the study area. The introduction of varieties of tall fescues solved the earlier problem of winter palatability and nutritional losses associated with the native forage, and the high cattle prices of the 1960s and early 1970s prompted significant conversions of woodlands to pasture. It is estimated that between 1959

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[2]Forest Industries Council, Missouri Forest Productivity Report, (Washington, DC: Forest Industries Council, 1979), p. 3.

and 1972 the area of commercial forestland in Missouri declined by nearly 1.5 million acres (12 percent) and that 62 percent of the total loss was in the Ozark region.[3]

Nonindustrial private landowners control 84 percent of the state's commercial forestland, 11 percent is administered by USDA Forest Service, 2 percent by other public agencies, and the remaining 3 percent is owned by forest industry.[4]

Price Trends

Tables 3.1 and 3.2 document the prices paid for 304 sales of unimproved Ozark wooded tracts of 40 acres and larger between 1965 and 1981. Sales occurring in 1974 were added to supplement the limited number of sales confirmed in the 1975 study year.

As shown in the tables and displayed in Figure 3.1, tracts of all sizes experienced major changes in market price during the study period. In terms of nominal dollars, tracts of over 40 acres in size were selling for

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[3]Forest Industries Council, Missouri Productivity Report, p. 2.

[4]Forest Industries Council, Missouri Productivity Report, p. 2.

Table 3.1: Nominal and Real Prices of Missouri Ozark Woodland Sales, 1965-1981

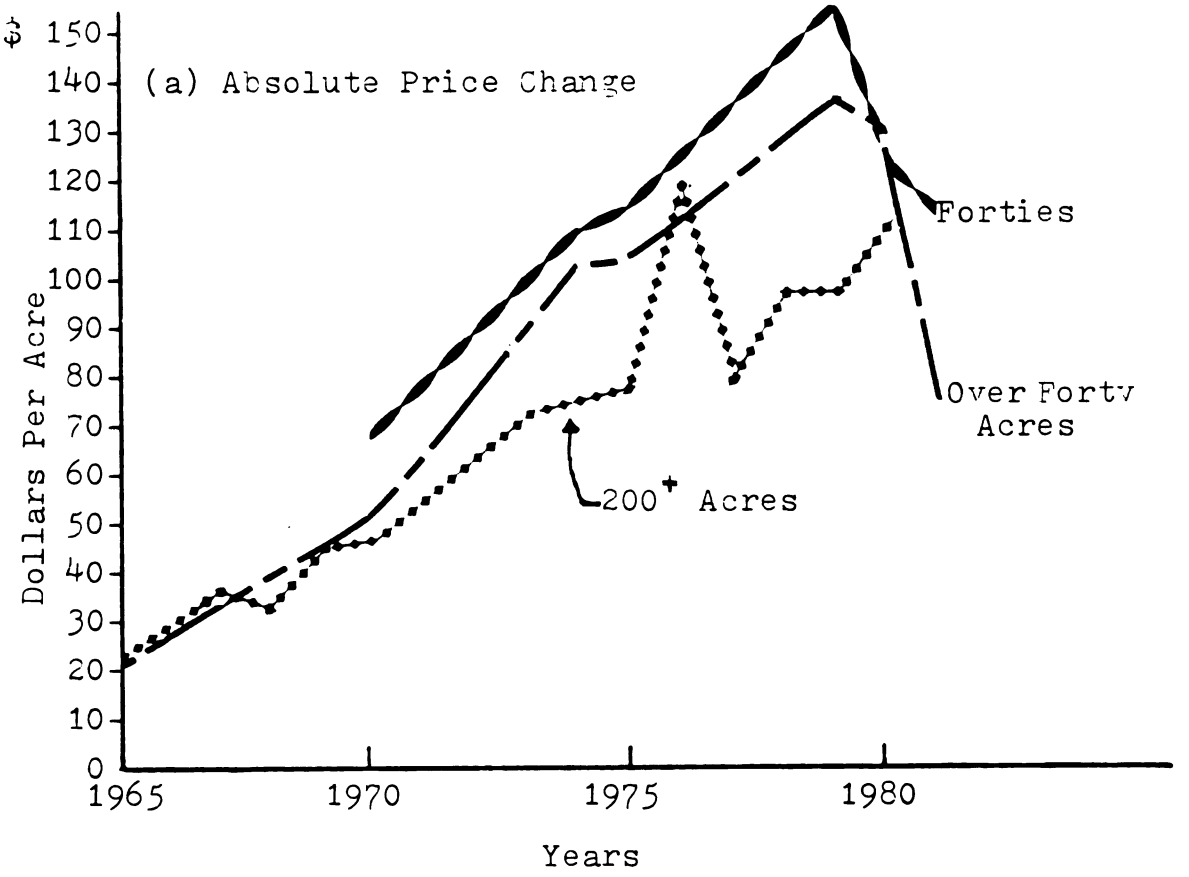
	Forties			Over Forty Acres		
Year	N	Nominal	Real*	N	Nominal	Real*
1965	-	-	-	4	$ 21	$ 21
1970	12	$ 81	$ 66	26	60	49
1974	13	165	106	17	152	98
1975	8	187	111	6	167	99
1979	24	329	150	37	288	132
1980	16	286	120	24	298	125
1981	13	283	109	11	189	73

*Real price in 1965 dollars - GNP deflator

Table 3.2: Nominal and Real Prices for Missouri Ozark Woodland Sales of 200 Acres and Larger, 1965-1981

		Per Acre Price	
Year	N	Nominal	Real*
1965	2	$ 21	$ 21
1966	3	30	29
1967	5	37	35
1968	12	35	32
1969	11	50	43
1970	9	55	45
1971	8	67	52
1972	8	81	60
1973	3	100	70
1974	-	-	-
1975	1	125	74
1976	4	204	115
1977	6	144	77
1978	10	187	93
1979	8	204	93
1980	3	259	108
1981	-	-	-

*Real price in 1965 dollars - GNP deflator.



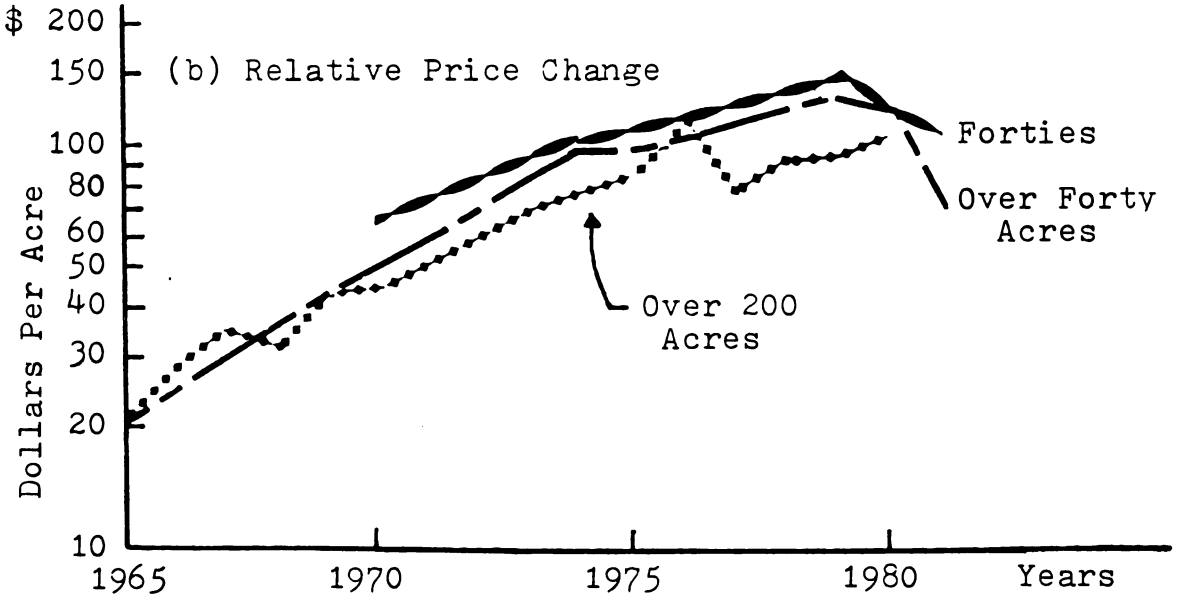


Figure 3.1: Average Real Prices of Missouri Ozark Sales by Tract Size, 1965-1981

an average of $21 per acre in 1965 and for $298 in 1980; forties were selling for $81 per acre in 1970 and for $286 in 1980; tracts of 200 acres and larger sold for $21 per acre in 1965 and $259 in 1980. Inflation contributed to only a portion of these increases as evidenced by five to six fold increases in real prices between 1965 and 1980.

The sales show the expected negative correlation between tract size and per acre prices. The price of tracts larger than forty acres averaged 87 percent of the price for forties while tracts of 200 acres and larger sold for an average of 75 percent of the price of forties. However, the same caution, as suggested for the Northern Minnesota sales in assuming a direct cause-and-effect relationship between these variables, is applicable.

Table 3.3 shows comparative rates of price change for the three tract size classifications. Basically, this table contains the same information as panel b of Figure 3.1 where, because of the logrithmic price scale, the slope of the curves indicate rates of change. It is evident from the data that properties of all sizes experienced substantial and continuing price increases from the beginning of the study period in 1965 until 1979, thereafter, prices tended to decline. There is a slight suggestion of price dampening during the economic slowdown of 1970 (only

the 200+ acre tracts have point observations to show this) as well as lateral movement in 1974-1975.

Generally, tracts in all sizes classes performed similarly over the study period and variations in period to period observations are more likely attributable to sampling errors than to differences in size classes. Only tracts of 40 acres and over contain observations for both 1965 and 1981, but it appears reasonable to assign a compound growth rate of about 15 percent, nominal, and about 8.5, real, to all classes of Ozark woodlands for the total 16-year period of study.

Reasons for Purchase

The reasons given by buyers for the acquisition of Missouri Ozark woodland tracts were categorized as follows:

Timber Production
Recreation
Permanent Homesites
Conversion to Agriculture
Investment
All Others

These reasons are not necessarily exclusive as some buyers cited multiple reasons. In these instances, sales were classified on the basis of reason regarded as most important by the buyers. "Timber production" includes

Table 3.3: Compound Rates of Nominal and Real Price Change for Missouri Ozark Woodlands, 1965-1981

	Compound Rates For:					
	Forties		Over Forty		200+ Acres	
Period	Nominal (%)	Real (%)	Nominal (%)	Real (%)	Nominal (%)	Real (%)
1965-1970	-	-	23.4	18.5	21.2	16.5
1970-1974	19.5	12.6	26.2	18.9	17.8[2]	10.5[2]
1974-1979	14.8	7.2	13.6	6.1	13.0[3]	5.9[3]
1979-1980[1]	-13.1	-20.0	3.5	-5.3	27.0	16.1
1980-1981[1]	-1.0	-9.2	-36.6	-41.6	-	-
OVERALL						
1965-1981	-	-	14.7	8.1	-	-
1965-1980	-	-	19.3	12.6	18.2	11.5
1970-1981	12.0	4.7	11.0	3.7	-	-
1970-1980	13.4	6.2	17.4	9.8	16.8	9.1

[1]Simple rates as compounding computed on annual basis.

[2]No observation for 1974; used 1970-1975.

[3]No observation for 1975; used 1975-1979.

Table 3.4: Reasons Given for Acquiring Missouri Ozark Woodlands of 40 Acres and Larger by Size Class, 1965-1981

Year	Reason	Tract Size: 40-80 Acres N	40-80 Acres %	81-160 Acres N	81-160 Acres %	161+ Acres N	161+ Acres %	Total N	Total %
1965	Timber								
	Recreation	1	100					1	25
	Investment			1	100			1	25
	Homesite								
	Agriculture					1	50	1	25
	All Other					1	50	1	25
	Total	1	100	1	100	2	100	4	100
1970	Timber					1	11	1	3
	Recreation	7	32	4	57	2	22	13	34
	Investment	6	27	1	14	5	56	12	32
	Homesite	3	14	1	14			4	11
	Agriculture	3	14					3	8
	All Other	3	14	1	14	1	11	5	13
	Total	22	101	7	99	9	100	38	101
1974	Timber	1	5	1	13			2	7
	Recreation	3	14					3	10
	Investment	11	50	5	63			16	53
	Homesite	2	9					2	7
	Agriculture	2	9					2	7
	All Other	3	14	2	25			5	17
	Total	22	101	8	101	0	0	30	101
1975	Timber	2	18					2	14
	Recreation	5	45	2	100			7	50
	Investment	2	18			1	100	3	21
	Homesite	1	9					1	7
	Agriculture	1	9					1	7
	All Other								
	Total	11	99	2	100	1	100	14	99

(Table 3.4 Continued)

		Tract Size							
		40-80 Acres		81-160 Acres		161+ Acres		Total	
		N	%	N	%	N	%	N	%
1979	Timber	3	7		3	33		6	10
	Recreation	13	32	1	9	1	11	15	25
	Investment	6	15	4	36	4	44	14	23
	Homesite	12	29	4	36			16	26
	Agriculture	1	2					1	2
	All Other	6	15	2	18	1	11	9	15
	Total	41	100	11	99	9	99	61	101
1980	Timber	3	11	1	10	1	33	5	13
	Recreation	9	33	4	40			13	33
	Investment	5	19	1	10	2	67	8	20
	Homesite	5	19	1	10			6	15
	Agriculture	2	7					2	5
	All Other	3	11	3	30			6	15
	Total	27	100	10	100	3	100	40	101
1981	Timber	1	5					1	4
	Recreation	10	48	2	67			12	50
	Investment	2	10	1	33			3	13
	Homesite	2	10					2	8
	Agriculture							0	0
	All Other	6	29					6	25
	Total	21	102	3	100	0	0	24	100

SUMMARY

1965-	Timber	10	7	2	5	5	21	17	8
1981	Recreation	48	33	13	31	3	13	64	30
	Investment	32	22	13	31	12	50	57	27
	Homesite	25	17	6	14	0	0	31	15
	Agriculture	9	6	0	0	1	4	10	5
	All Other	21	14	8	19	3	13	32	15
	Total	145	99	42		24	101	211	100

all tracts acquired for immediate or future harvests of forest products. Most Missouri Ozark woodlands in private ownership are not actively managed for forest products. Although private nonindustrial lands provide 94 percent of state-wide annual removals, and 1.5 percent of these lands are harvested each year, forest treatments are being applied to less than 0.1 percent of these acres.[5]

As expected, timber production had only a minor influence on buyers' decisions for tracts of less than 40 acres in size. Out of 86 sales of smaller tracts occurring between 1965 and 1981, in only three instances did buyers indicate that timber as a product was a factor. A seven-acre tract was acquired in 1980, and a 15-acre tract in 1981, as sources of firewood, and the buyer of a five-acre parcel in 1979 immediately harvested a stand of oak sawtimber to obtain an early return on his investment. Most tracts of less than 40 acres were acquired by buyers seeking permanent rural homesites (38 percent), recreation (35 percent), and investments (15 percent).

As shown in the summary section of Table 3.4 and in Figure 3.2, timber production was cited as the primary reason for the purchase of only 8 percent of 211 Missouri

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[5]Forest Industries Council, Missouri Productivity Report, p. 3.

Figure 3.2: Percentage of Missouri Ozark Woodland Tracts by Reason for Purchase and Size Class (1965-1981 Sales)

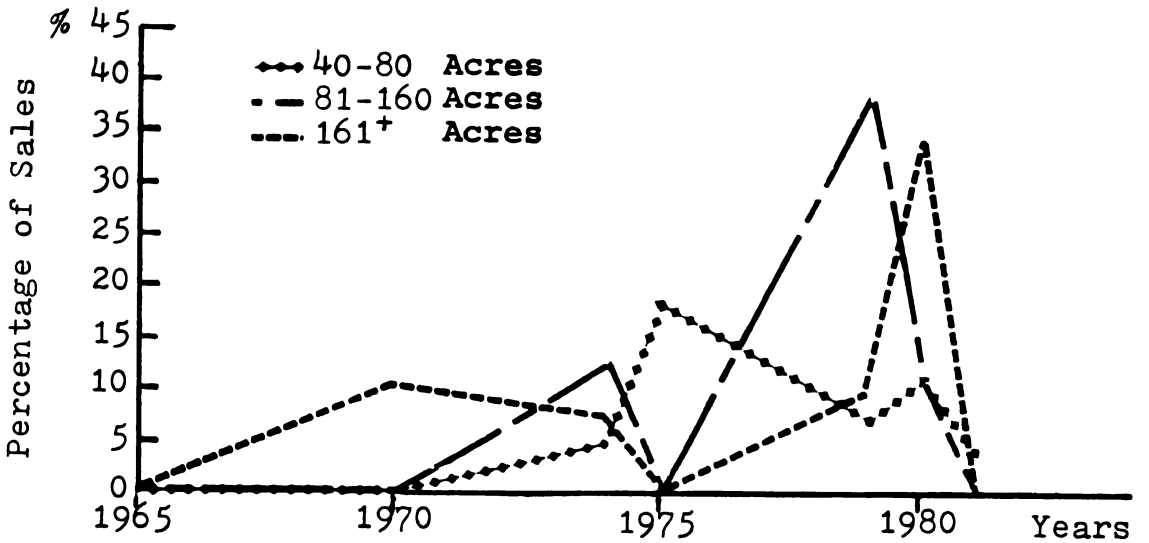


Figure 3.3: Percentage of Missouri Ozark Woodland Sales Acquired for Timber Production, 1965-1981

Ozark sales of 40 acres and larger during the study period. Timber production ranked somewhat higher as tract size increased, accounting for 21 percent of the sales of 161 acres and larger during the major study years, and 15 percent of the 93 sales in the all-year listing of woodland tracts of 200 acres and larger in Table 3.2. This is well below the 38 to over 50 percent of larger sales acquired for timber production in Northern Minnesota, and, no doubt, is due to the minimal presence of larger forest products companies in Missouri.

Timber production's share of the market (see Figure 3.3) is a story of ups and downs but shows an overall upward trend over the years. Timber production accounted for zero to 10 percent of sales in 1965 and 1970, zero to 18 percent of sales in 1975 and zero to 33 percent of sales in the various tract size classes in 1979 to 1981.

Recreation was the leading reason for the acquisition of Missouri Ozark woodland tracts with 30 percent of the total market. Recreation accounted for 25 to 50 percent of all sales in all years except 1974, when it fell to 10 percent, and was especially important for tracts of 40 to 80 acres and 81 to 160 acres. Recreation's overall market share fell to 13 percent of the market for tracts over 161 acres listed in Table 3.4 and was 15

percent of the all-year listing of tracts of 200 acres and larger.

Homesites accounted for 17 percent of sales of 40 to 80 acres, 14 percent of 81 to 160 acres, and disappeared as a reason for purchase of tracts larger than 160 acres. In contrast, investment buyers accounted for 45 percent of sales in the all-year listing of tracts of 200 acres and larger, 50 percent of the 161+ acre sales, 31 percent of 81 to 160 acre sales, and 22 percent of 40 to 80 acre sales. Investors' overall share of the market shows a strong tendency to decrease for observation periods since 1974, and very noticably declined in 1979 to 1981, but made a strong showing for tracts of larger size.

Conversion to agriculture (primarily pasture) was given as the reason for purchases for five percent of the forty-acre and larger sales in Table 3.4 and was generally within the range of 2 to 7 percent for various years. While this figure appears low, it shows a slow erosion of the commercial forest land base. Moreover, fully 15 percent of sales in all-year listing of 200 acres and larger were acquired for conversion to pasture. These figures probably understate the true rate of conversion to agriculture as only entirely wooded tracts were included in this study. Most Ozark farms include substantial

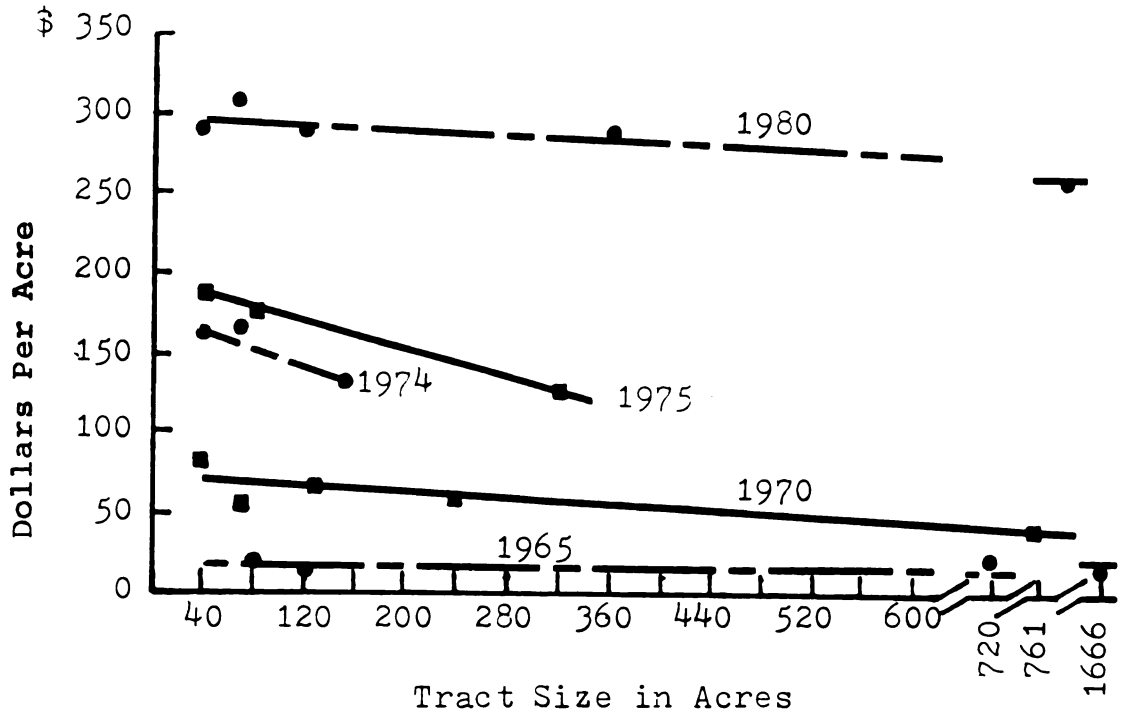
amounts of woodland, and these farm woodlands are especially subject to conversion. Generally, converted woodlands, since they occupy the steeper slopes with shallow, droughty soils, offer supplemental grazing and are best used in conjunction with more productive and dependable bottomland pastures.

Separation of Effects

Tract Size

In five of the seven study years, the relationship between tract size and per acre prices was found to be basically linear for tracts of forty acres and larger. This applies to sales made in 1965, 1970, 1974, 1975, and 1980, as shown in the upper panel of Figure 3.4, where regression lines, based on all sale observations within each year, are shown together with the mean selling prices of tracts in various size groups.

In the upper panel, the response functions for the years 1965, 1970, and 1980 are of particular interest since sales of larger tracts occurred in each of these years. In 1965, when tracts were selling for about $20 per acre, the regression line has a slope of -.002 indicating that each additional acre increase in tract size resulted in a price reduction of only two-tenths of one cent. As prices rose to about $80 per acre in 1970,



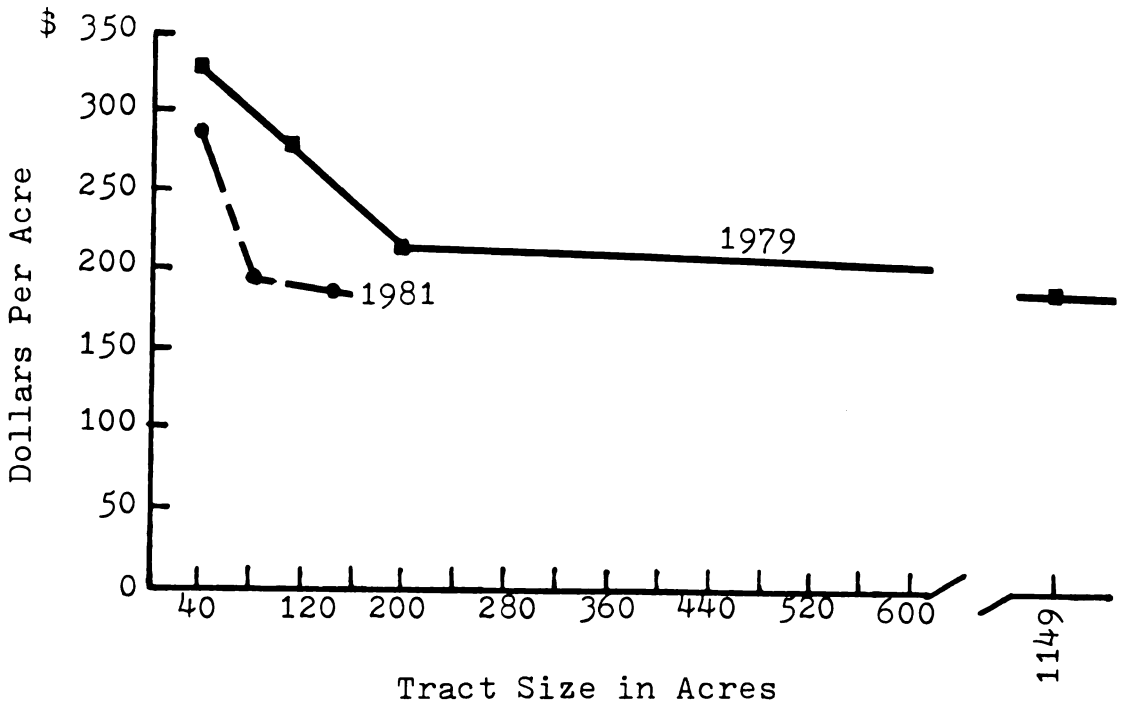


Figure 3.4: Relationship Between Average Per Acre Prices and Tract Size for Missouri Ozark Sales of Forty Acres and Larger, 1965-1981

each additional acre was associated with a price decline of 2.7 cents. And in 1980, when prices averaged about $300 per acre, each additional acre, on average, was associated with a price decline of 3.6 cents. In the case of the Missouri Ozark sales, there was no tendency for selling prices to rebound as tract size became very large.

The regression lines shown for the years 1974 and 1975 have steeper slopes, reflecting a price decline of 27 cents per acre for each additional acre in 1974 and 22 cents per acre in 1975. It seems likely that the response function in these years would have become curvilinear and would flatten, if sales of larger tracts had been observed, much as the curves in the lower panel for years 1979 and 1981 become flatter. Beyond 200 acres the response function for 1979 indicates a decline of 2.5 cents for each additional acre.

Even though the effects of increased tract size are relatively minor, they are persistent and give rise to the differences in price levels for tracts in various size classes as noted in the earlier discussion concerning price trends.

Tract size as an independent variable is useful for the purpose of describing general overall effects but is of almost no value in explaining what prices individual

tracts will bring in the market. Figure 3.5, which displays the selling prices of Ozark wooded tracts in 1980, highlights this point. Very few of the points actually fall on the regression line. Rather they tend to scatter within ± $100 of the average selling price of about $300 per acre, regardless of tract size.

Tract Size and Access

For the purpose of analysis, the Missouri Ozark woodland sales were stratified into three size classes--40 to 80 acres, 81 to 160 acres, and 161 acres and larger--and four road classes--none, dirt, gravel, and paved.

Physical Relationship - The Chi-square test detailed in Table 3.5 suggests that there is not a strong overall relationship between tract size and conditions of access. More specifically, the null hypothesis of independence between these variables cannot be rejected at either the .05 or .10 level of significance, but could be at the .25 level. The reason for this is that the observed and expected values shown in the various cells in Table 3.4 generally show close agreement. The major exception is for tracts of 161 acres and larger. The sampled tracts in this size class had fewer sales with no access roads and dirt access roads and, conversely, more sales with gravel and paved access than expected. Very likely this

Table 3.5: Approximate Chi-Square Test of Physical Relationship Between Tract Size and Access for Missouri Ozark Woodland Sales, 1965-1981

Key

Observed Number of Sales
(Expected Number)
[Cell Chi-Square Value]

ROAD ACCESS	Tract Size in Acres: 40-80	81-160	161+	Total
None	14 (12.370) [.215]	4 (3.583) [.049]	0 (2.047) [2.048]	18
Dirt	57 (57.725) [.009]	21 (16.720) [1.096]	6 (9.555) [1.322]	84
Gravel	51 (51.540) [.006]	12 (14.929) [.575]	12 (8.531) [.1411]	75
Total	145	42	24	211

TEST

X^2cal = 8.376 vs. Table X^2 = 12.60

X^2.90 = 10.6

X^2.75 = 7.84

Cannot reject null hypothesis of independence at either the 5 or .10 level of significance.

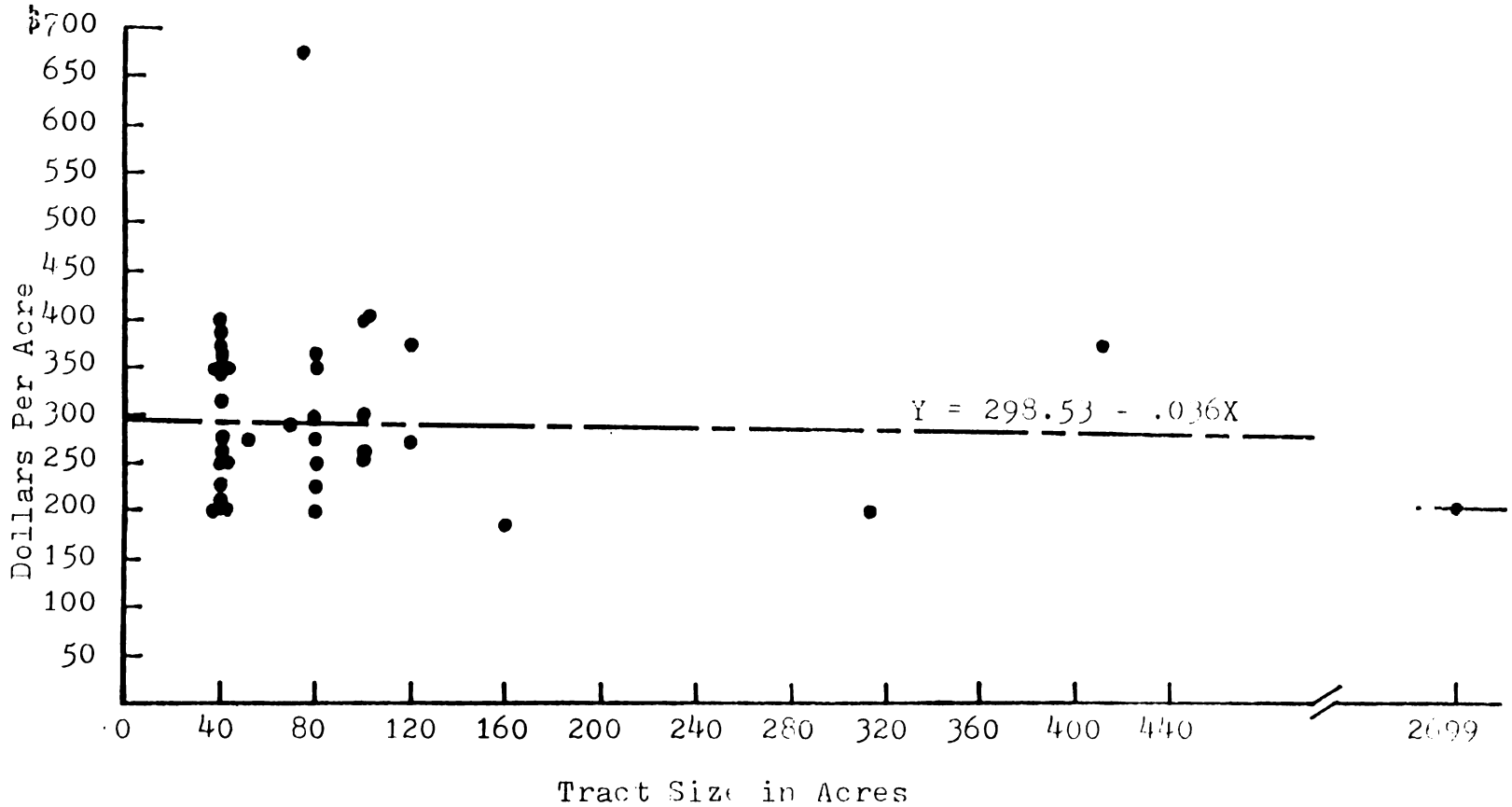


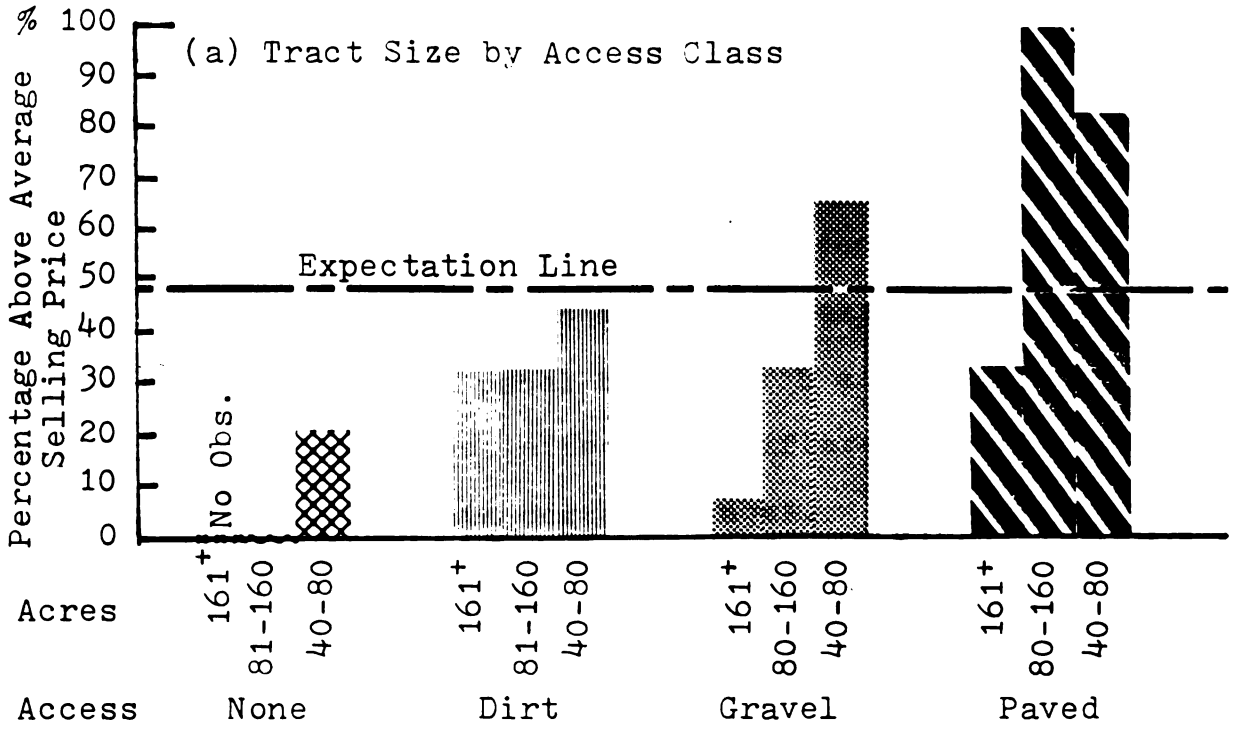
Figure 3.5: Scatter Diagram of Tract Size--Price Relationship for Missouri Ozark Woodlands. (Year 1980)

is the result of a mechanical relationship. Almost every ridge and hollow in the Missouri Ozarks contains a road of some description and larger tracts usually border on, or are crossed, by several roads.

Effect on Price - Figure 3.6 illustrates the separate and combined effects of size and access on relative market prices. Panel a emphasizes the general effects of access and shows an overall improvement in price performance with improved access. Difference in tract size modify price responses but generally could not override the effects of access. All tracts with no road access are below the expectation line and, while 21 percent of in the 40 to 80 acre class sold for more than the average price in their year of sale, as compared to none of the sales of 81 to 160 acres, neither size differences nor other factors not controlled in this test, were of sufficient market importance to bring the prices of tracts without road access above the expectation line.

The stratification of sales by access class in panel a also allows the specific effects of size to emerge, and it is evident that within each access stratum, smaller tracts generally do show the best performance.

Panel b highlights the general effect of size and the specific effects of difference in access. The previous



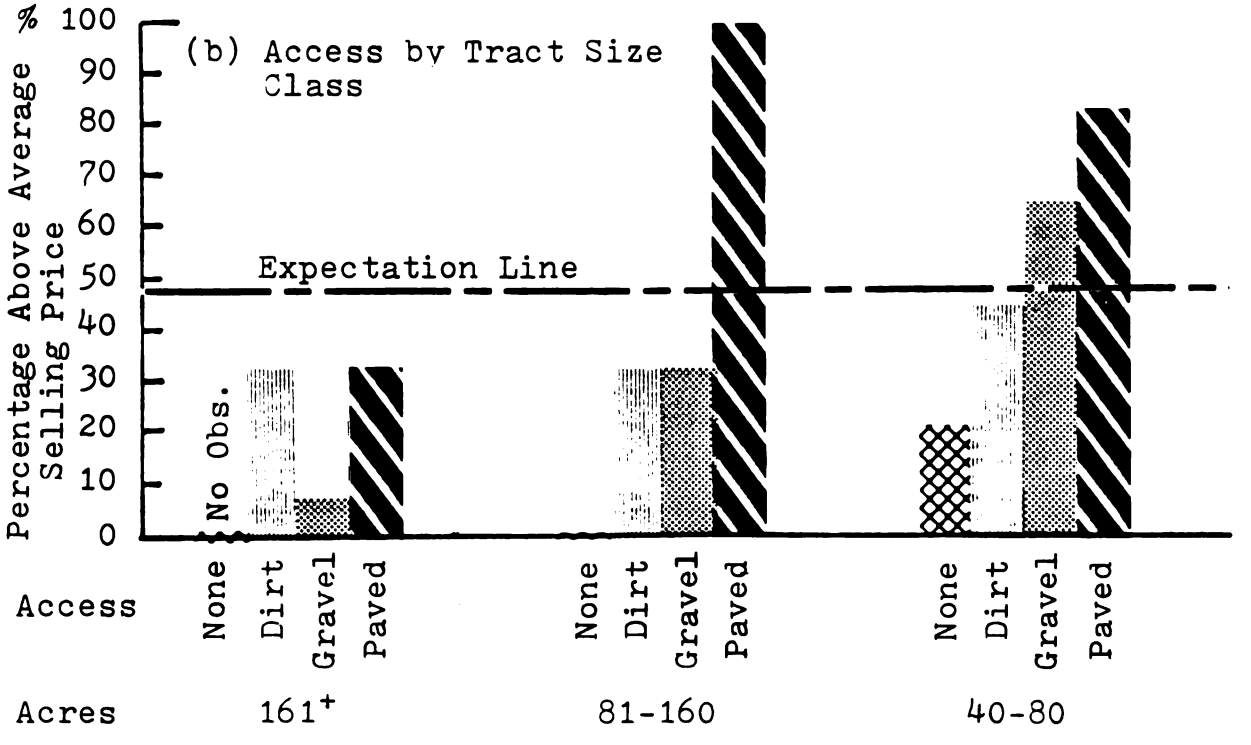


Figure 3.6: Effects of Tract Size and Access upon the Selling Prices of Missouri Ozark Woodlands (Combined 1965-1981 Data)

discussion on tract size--tract price relationships emphasized that the effects of size may be only a matter of pennies per acre, but it is persistent and becomes a matter of dollars when applied to tracts of larger size. Accordingly, it was expected that the effects of size would be greatest for tracts in the largest size class, and this is evident in panel b. Panel b also shows the specific and significant effects of differences in access when size is held within certain ranges.

The Chi-square test shown in Table 3.6 indicated the null hypothesis of independence could be rejected at the .005 level of significance. Large Chi-square cell values result from the strong price performance of tracts with paved access roads in the 40 to 80 (especially) and in the 81-160 acre groups, and by gravel access tracts in the 40 to 80 size class. Large Chi-square cell values are also found in all the cells for tracts with no access and the largest gravel access class tracts. These latter properties all show poor price performance.

Access and Timber

Timber in Missouri is heavily utilized. On a statewide basis, it is estimated that annual removals equal 95 percent of net annual growth, and, in the sawtimber class, nearly 50 percent more volume is being removed than is

Table 3.6: Approximate Chi-Square Test of the Effects of Tract Size and Access on the Relative Selling Prices of Missouri Ozark Woodlands (Combined 1965-1981 Data)

Key

Observed Number of Sales
(Expected Number)
[Cell Chi-Square Value]

Access and Tract Size (Acres)

	No Road		Dirt Road			Gravel Road			Paved Road			Total Observations
	40-80	81-160	40-80	81-160	161+	40-80	81-160	161+	40-80	81-160	161+	
Less than Average Price	11 (7.232) [1.963]	4 (2.066) [1.810]	31 (29.445) [.082]	14 (10.848) [.916]	4 (3.100) [.261]	18 (26.346) [2.644]	8 (6.199) [.523]	11 (6.199) [3.718]	4 (11.882) [5.229]	0 (2.583) [2.583]	4 (3.100) [.261]	109
More than Average Price	3 (6.768) [2.098]	0 (1.934) [1.934]	26 (27.555) [.088]	7 (10.152) [.979]	2 (2.900) [.279]	33 (24.654) [2.825]	4 (5.801) [.559]	1 (5.801) [3.973]	19 (11.118) [5.588]	5 (2.417) [2.760]	2 (2.900) [.279]	102
Total Observations	14	4	57	21	6	51	12	12	23	5	6	211

Test

DF = 10

$X^2cal = 41.352$ vs. Table $X^2.995 = 25.3$

$X^2.95 = 18.3$

The null hypothesis of independence can be rejected at the .005 level of significance.

grown. Removals from nonindustrial private ownerships in recent years have been 79 percent greater than net annual growth. In the Ozark region sawtimber removals have been exceeding sawtimber growth by 30 percent. However, some of this volume has come from the harvest of rough and rotten trees not included in the net annual growth estimates.[6]

As was the case in Minnesota, the transaction evidence cards for the Missouri Ozark sales generally do not include detailed information on species, volumes, and grade. Exceptional timber conditions, however, were cited and on this basis, 16 percent of the 211 sales were classified as having superior timber, another 16 percent as having inferior timber and the remaining 68 percent as having average timber. While the classification of timber is not precise, it does reflect the opinions of foresters and forest technicians based on a study of aerial photographs and a walk-through examination of each property.

Physical Relationship--Access and condition of timber were found to be related characteristics in Missouri Ozark woodland sales. More specifically, the Chi-square test shown in Table 3.7 permitted the null hypothesis of independence between these variables to be rejected at the .05 level of significance.

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[6]Forest Industries Council, Missouri Productivity Report, p. 3.

Table 3.7: Approximate Chi-Square Test of Physical Relationship Between Access and Timber for Missouri Ozark Woodland Sales (Combined 1965-1981 Data)

Key

Observed Value
(Expected Value)
[Cell Chi-Square Value]

Condition of Timber

ROAD ACCESS CLASS	Inferior	Average	Superior	Total
None	5 (2.815) [1.696]	13 (12.284) [.0417]	0 (2.900) [2.900]	18
Dirt	13 (13.137) [.001]	52 (57.327) [.495]	19 (13.536)	84
Gravel	7 (11.730) [1.907]	55 (51.185) [.2843]	13 (12.085) [.069]	75
Paved	8 (5.318) [1.353]	24 (23.204) [.027]	2 (5.479) [2.209]	34
Total	33	144	34	211

----------TEST----------

DF = 6

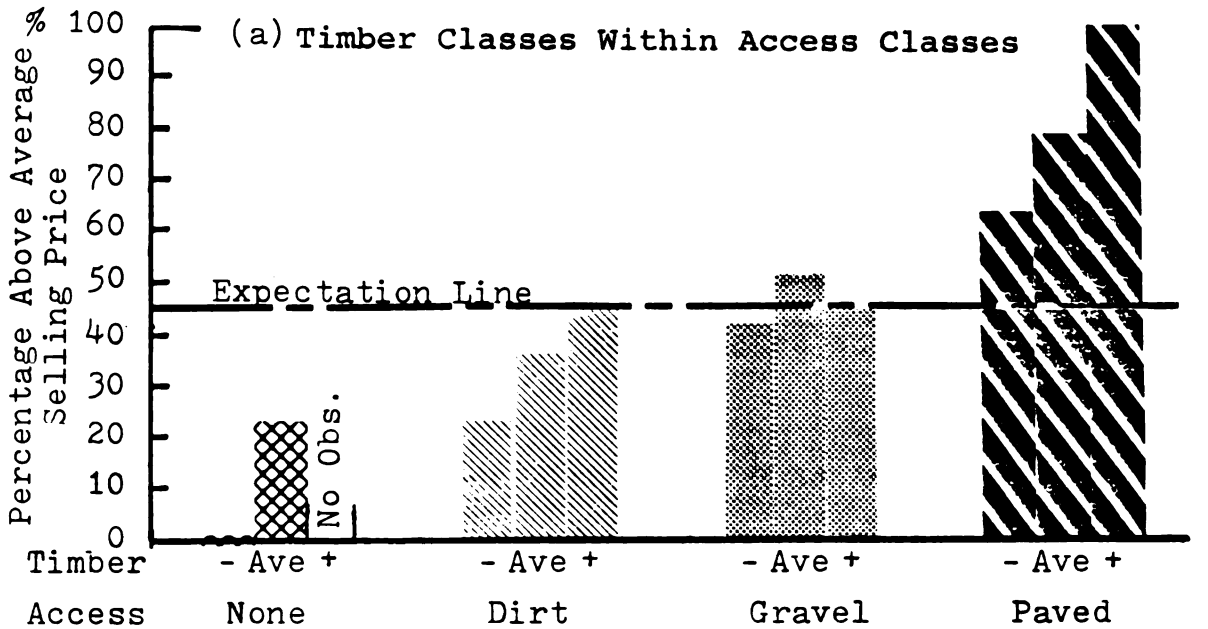
$X^2cal = 13.189$ vs. $X^2.95 = 12.6$

Can reject null hypothesis of independence at .05 level of significance.

Inferior timber and no road access show a strong association as do paved access and inferior timber. Conversely, tracts with no road access and/or paved access rarely had superior timber. It can also be seen that dirt road tracts often had superior timber and that gravel roads and inferior timber occur less frequently than expected.

Effect on Price--Panel a of Figure 3.7 shows the now familar improvement in price performance as access improves. Timber effects are not strong enough to override access effects. However, the specific effects of timber condition are readily apparent in all access classes. Even though only eight percent of the buyers cited timber as their primary reason for purchase, the condition of timber, be it for timber in terms of commercial products, esthetics or other reasons, quite definitely influenced price performance with a positive correlation between timber condition and price.

Panel b indicates that the general effects of timber can be overridden by access--paved tracts sold for more than average prices even with inferior timber. However, it is evident that better timber quality does enhance price performance.



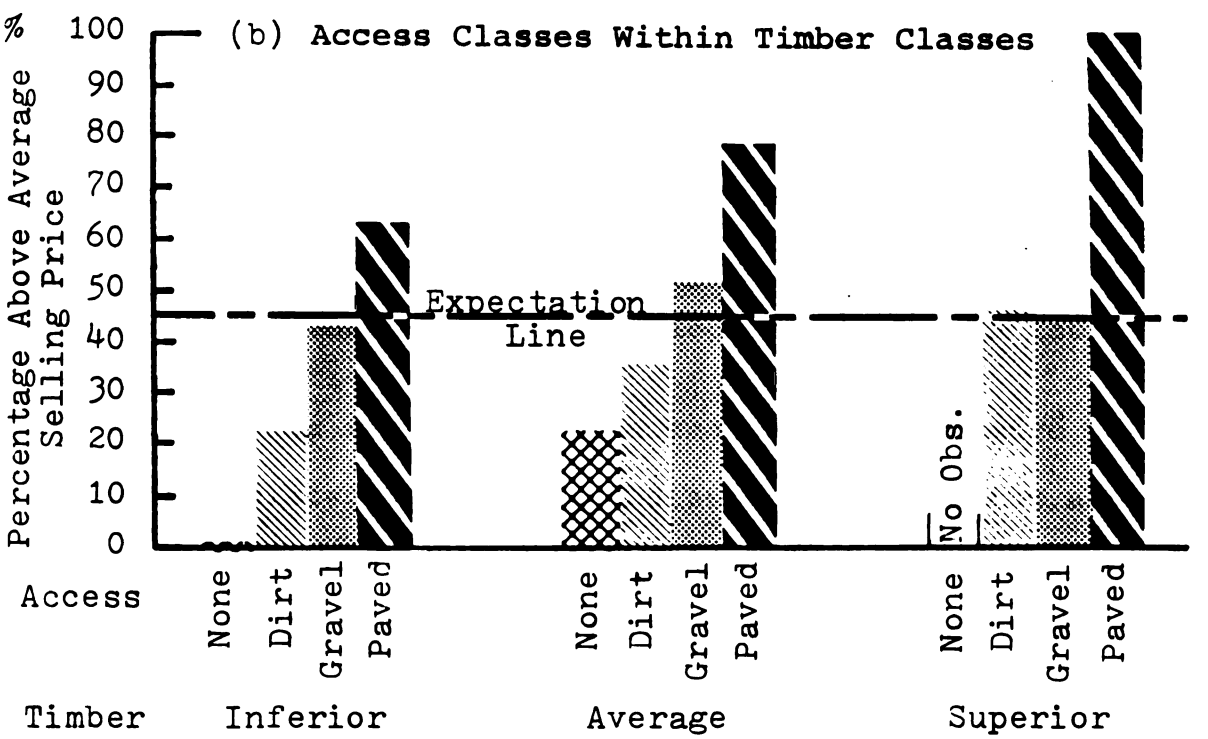


Figure 3.7: Effects of Access and Timber Upon the Selling Prices of Missouri Ozark Woodlands (Combined 1965-1981 Data).

The combined effects of access and timber condition on selling price are sufficiently strong to allow the null hypothesis of independence to be rejected at the .005 level. This high degree of significance arises in large part because of excellent price performance by paved tracts with average and superior timber, and the poor price performance of tracts with no road access and inferior timber.

Price Effects of Timber With Fixed Road Access and Tract Size

Table 3.8 features a final test of the probable effects of timber upon the market prices of Missouri Ozark woodland tracts. In this test, all sales in each year were arrayed into 12 cells based on the four access classes and three size classes previously described. A count was then made of the number of sales with inferior and superior timber which sold for more than the average cell price and the number which sold for less than the average cell price. These numbers were totaled and appear in Table 3.8

It may be recalled that access and timber were found to be associated variables, and subsequent testing also showed an association between tract size and timber condition, i.e., in particular, large tract size and inferior timber, and medium size tracts and superior timber, were closely associated. Thus, these lurking variables could lead to erroneous conclusions as to the effects of timber

Table 3.8: Effects of Timber on the Selling Prices of Missouri Ozark Woodlands With Tract Size and Access Held Within Fixed Ranges (Combined 1965-1981 Sales)

Key

Observed Value
(Expected Value)
[Cell Chi-Square Value]

Condition of Timber

	Inferior	Superior	Total
Less than Average Price	19 (15.190) [.956]	14 (17.810) [.815]	33
More than Average Price	10 (13.810) [1.051]	20 (16.190) [.897]	30
Total	29	34	63

TEST

DF = 1

$X^2cal = 3.719$ vs. Table $X^2.95 = 3.84$

*$X^2.90 = 2.71$

*Cannot reject null hypothesis at .05 level, but can at .10.

on price. As shown in Table 3.8, however, price continues to be affected by the condition of the timber even with tract size and access held constant. The null hypothesis can almost be rejected at the .05 level of significance and clearly can be at the .10 level.

Reasons for Purchase - Price Relationships

Figure 3.8 features a comparison of average real per acre prices paid for Missouri Ozark woodland tracts of forty acres and larger stratified by reason for purchase during the 16 year study period. As can be seen in the figure, the lowest average prices were paid for woodland tracts acquired for conversion to agriculture while homesite buyers rather consistently paid the highest prices. Recreation buyers generally paid more than timber-oriented buyers. Prices paid by investors tend to fall within the limits set by timber and recreation buyers.

Table 3.9 lists the average real prices paid by the various classes of buyers and highlights selected features of the sales. Permanent homesite buyers tended to select tracts of 90 acres or less with superior access--75 percent had gravel or paved access and none were without access by road. In contrast, tracts purchased for agriculture, which are on the opposite end of the price scale, averaged over 700 acres in size in two of the study years, and 73 percent had either no road access or dirt road

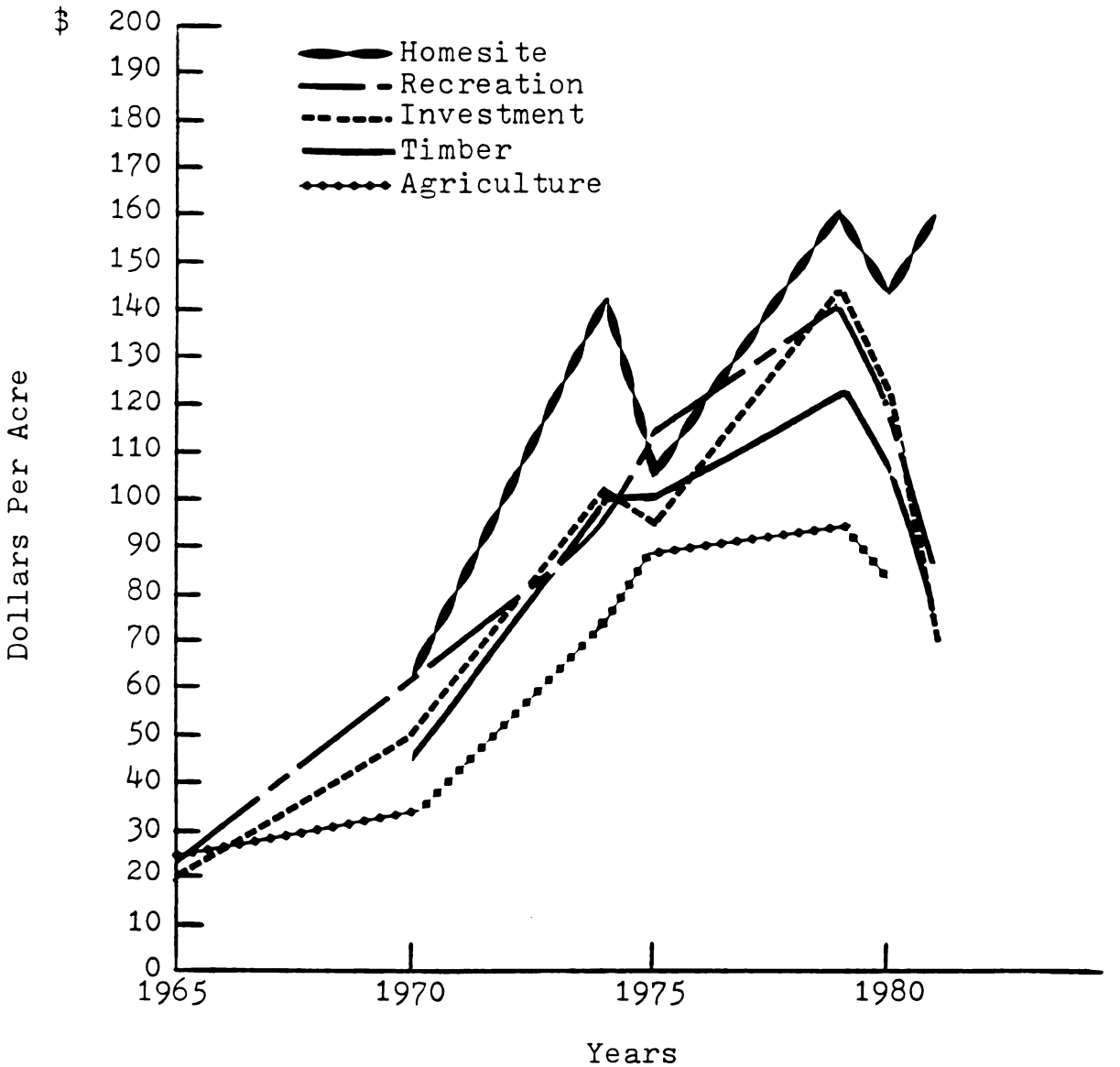


Figure 3.8: Average Real Prices for Missouri Ozark Woodlands of Forty Acres and Larger by Reason for Purchase, 1965-1981

Table 3.9: Average Real Prices and Selected Features of Missouri Ozark Woodlanc Reason for Purchase, 1965-1981

Tract Size and Price*	TIMBER		RECREATION		INVESTMENT	
	Real Price $/Acre	Tract Size (Acres)	Real Price $/Acre	Tract Size (Acres)	Real Price $/Acre	Tract Size (Acres)
1965	-	-	$ 23	80	$ 20	120
1970	$ 45	606	63	200	50	174
1974	100	108	94	53	103	86
1975	100	60	114	57	94	147
1979	122	274	142	68	144	171
1980	110	115	119	82	122	436
1981	77	80	82	58	73	99
Access Conditions					% of Sales	
No Road	6%		5%		16%	
Dirt Road	24%		53%		25%	
Gravel Road	53%		31%		40%	
Paved Road	18%		11%		19%	
Timber Conditions					% of Sales	
Inferior	24%		14%		18%	
Average	52%		58%		73%	
Superior	24%		28%		9%	

*Expressed in 1965 dollars - GNP deflator.

access. Tracts acquired for agriculture were much more apt to have inferior timber (45 percent as compared to 6 to 24 percent for other sales) due, in most cases, to a history of cutting, burning, the application of herbicides and other practices intended to increase forage production for livestock. Wooded tracts acquired for agriculture were also the most likely to involve local buyers and sellers. Such sales tend to get less market exposure and may reflect a preference on the part of sellers for lands to remain in local control.

The physical differences between tracts purchased for timber production, recreation, and investment are less well defined than in the case of tracts purchased for permanent homesites and agriculture. Accordingly, the price spread is less and the competition between those buyers, more intense. Tracts acquired for timber were larger than those acquired for recreation but generally no larger than those acquired as investments. Recreation buyers were more inclined to purchase tracts with dirt access (53 percent as compared to 24 percent for timber buyers and 25 percent for investors) and less inclined to purchase tracts with paved access (11 percent versus 18 and 19 percent for timber and investment buyers).

Perhaps, the most interesting finding is that recreationists were the most selective about timber. Only 14

percent of tracts purchased for recreation had inferior timber as contrasted with 24 percent for timber oriented buyers and 18 percent for investors. And 28 percent of recreation tracts had superior timber as compared to 24 percent of the tracts acquired by timber buyers and 9 percent by investors. Evidently, commercial timber value, the criteria used to rate timber quality, and esthetics are linked characteristics.

CHAPTER IV

MISSISSIPPI

Description of Study Area

The National Forests of Mississippi are fairly well distributed throughout the state. There are the Holy Springs and Tombigbee in the northern area, the Delta and Bienville National Forests in the central part, and the Homochitto and DeSoto in the south. Transaction evidence was available for sales of privately owned woodland tracts in 39 of the state's 82 counties, and these counties constitute the major portion of the state's commercial forest lands.

Excluded from the study area are the primarily agricultural counties of the Delta region (principally in the northwest part of the state but generally extending along the Mississippi River on the west), and portions of the northeast and central portions of the state. Also excluded were the major portions of a tier of three counties in the Coastal Flatwoods adjacent to the Gulf. The counties included in the study area have a combined area of about 22,670 square miles.[1]

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[1]Land area and population statistics cited in this section are from U.S. Bureau of Census reports.

Mississippi has a predominantly rural population with only 36 percent of all people living in communities of 5,000 or more people. The state capital of Jackson, located in the central portion of the state, had a population of 202,895 in 1980, up almost 32 percent from the 1970 count, and the state population increased by 13.7 percent during this period. However, 7 of Mississippi's 27 cities over 10,000 in population and many rural areas experienced small to moderate population declines between recent census periods.

The trend in the area of commercial forest land in Mississippi has generally paralleled that of the Nation as a whole. After attaining a modern day high of 17,976 million acres in 1962, the area of commercial forest land in the state decreased by eight percent to stand at 16,504 million acres in 1977. There have also been some shifts in ownership: forest industry owned 18 percent in 1977 as compared to 15 percent in 1962; private nonindustrial owners held 72 percent in 1977 versus 76 percent in 1962, and the national forests increased from 6 to 7 percent over the same period. Other public ownerships of commercial forest land has remained constant at three percent.[2]

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[2]Brian Wall, Trends in Commercial Timberland Area in the United States by State and Ownership, 1952-77, with Projections to 2030, (U.S. Department of Agriculture, Forest Service, General Technical Report WO-31, 1981) p. 17.

Mississippi, of course, is a leading producer of timber. In the South it is only surpassed by Georgia and Alabama.[3]

Price Trends

Tables 4.1 and 4.2 and Figure 4.1 are based on the sale of 224 private woodland tracts occurring from 1965 through 1981 in the study area. Sales made in 1966, 1969, and 1972 were included to compensate for the limited number of sales confirmed in 1965 and the lack of observations in 1970.

In terms of nominal prices, Mississippi woodland tracts were selling on average for about $100 per acre in 1965 and generally showed increases between observation periods until prices ranged from about $600 to $800 per acre in 1980, and closed at about $750 per acre in 1981. Conversion to real prices using the Gross National Product (GNP) implicit price deflator revealed essentially constant real prices from 1965 until the early to mid 1970s. Thereafter, real prices expressed in 1965 dollars rose sharply to $250 to $350 per acre in 1979 to 1980, then dropped to about $285 in 1981.

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[3]USDA Forest Service, Forest Statistics of the U.S., 1977 (Washington, D.C.: U.S. Government Printing Office, 1978), p. 97.

Table 4.1: Nominal and Real Prices of Mississippi Woodland Sales, 1965-1981

	Forties			Over Forty Acres		
	N	Nominal	Real*	N	Nominal	Real*
1965	-	-	-	8	$114	$114
1966	3	$100	$ 97	8	122	118
1969	1	150	128	-	-	-
1972	2	175	131	8	113	84
1975	3	217	128	34	278	164
1979	8	669	305	26	698	319
1980	11	818	342	24	614	257
1981	14	740	285	16	730	281

*Real price in 1965 dollars - GNP deflator.

Table 4.2: Nominal and Real Prices of Mississippi Woodland Sales of 200 Acres and Larger, 1965-1981

		Per Acre Price	
Year	N	Nominal	Real*
1965	5	$118	$118
1972	1	150	112
1973	10	185	130
1974	10	326	210
1975	13	297	176
1979	4	465	212
1980	11	587	246
1981	4	750	288

*Real price in 1965 dollars - GNP deflator.

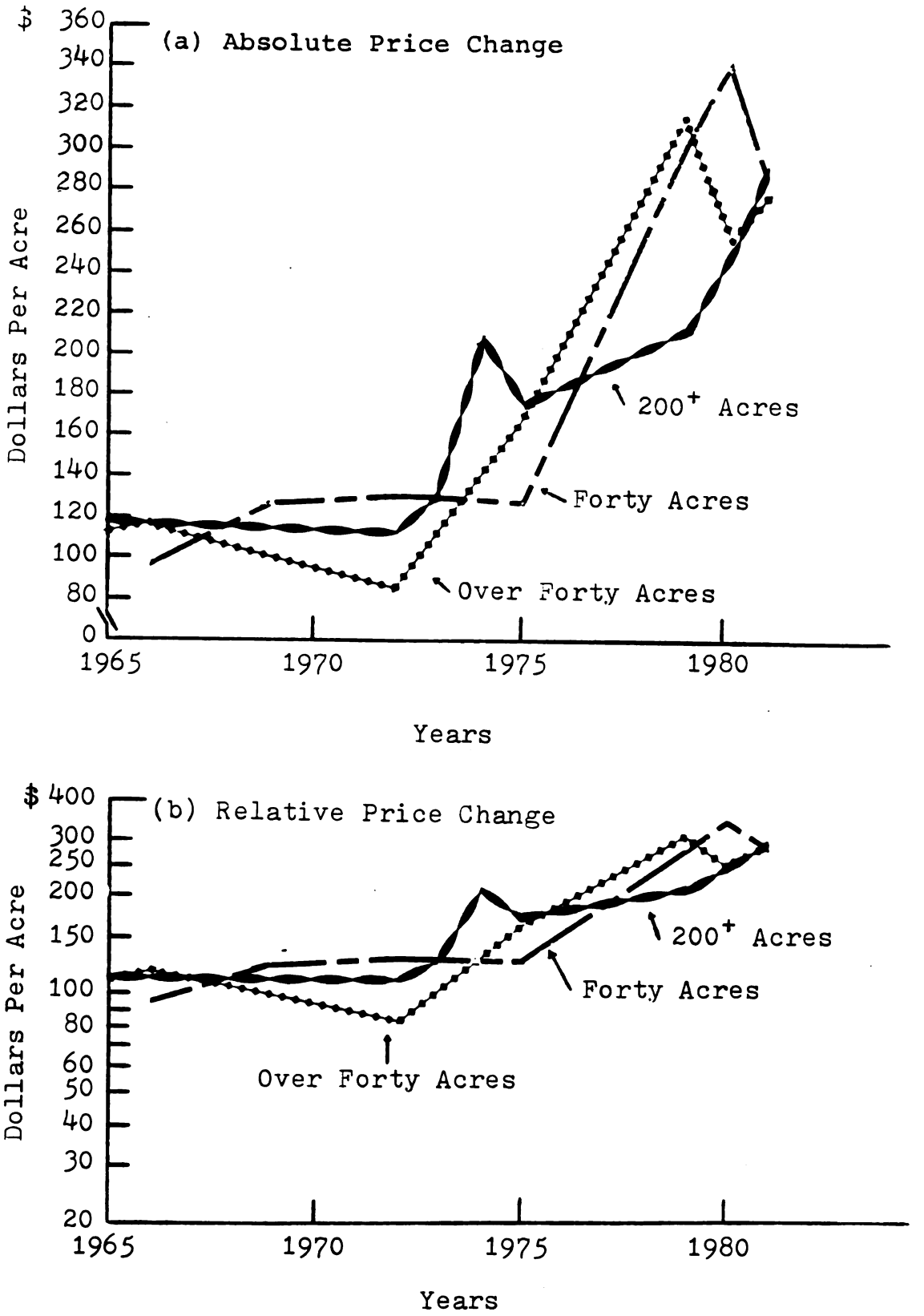

Figure 4.1: Average Real Prices for Mississippi Woodland Sales, 1965-1981

In contrast to the rather distinct differences in price levels for tracts in various size classes observed in Northern Minnesota and the Missouri Ozarks, this relationship is not apparent in the Mississippi data. In panel a of Figure 4.1, the lines cross and re-cross indicating that size is not important or, at least relatively unimportant, as compared to other factors influencing market prices.

Panel b of Figure 4.1 and Table 4.3 feature proportional changes in prices. Point-to-point price performance fluctuated greatly (from -19.4 to 35 percent per year)

Table 4.3: Compound Rates of Nominal and Real Price Change for Mississippi Woodlands, 1965-1981

	Compound Rates For:					
	Forties		Over Forty		200+ Acres	
Period	Nominal	Real[1]	Nominal	Real[1]	Nominal	Real[1]
1966-1972	9.8	5.1	- 1.3	- 5.5	3.5	- .7[2]
1972-1975	7.4	- .8	35.0	25.0	25.6	16.3
1979-1980[3]	22.3	12.1	-12.0	-19.4	26.2	16.0
1980-1981[3]	- 9.5	-16.7	18.9	9.3	27.8	17.1
			OVERALL			
1966-1981	14.3	7.4	12.7	6.0	12.3	5.7[2]
1972-1981	17.4	9.0	23.0	14.4	19.6	11.06

[1]In 1965 dollars - GNP deflator.

[2]No observation for 1966; used 1965-1972.

[3]Simple rates as compounding computed on annual basis.

but, for the period as a whole, nominal prices increased at the rate of about 15 percent per year and real price increases were about 8 percent per year.

Reasons for Purchase

Timber was clearly the most important reason for the acquisition of Mississippi woodlands. The effects of timber were pervasive and influenced tracts as small as ten acres in size.

As shown in Table 4.4, timber was given as the primary reason for purchase of 51 percent of Mississippi woodland sales smaller than 40 acres in size. This is in marked contrast with the findings for small tracts in Northern Minnesota and the Missouri Ozarks. Each of these study areas had but two sales for firewood and a single sale in the Ozarks in which sawtimber was a factor. Furthermore, when observation of the Mississippi sales is confined to parcels of 10 to 40 acres, fully 70 percent were acquired for timber.

Timber was also cited as the primary reason for the acquisition of 76 percent of Mississippi woodland sales of 40 acres and larger. Trailing behind timber at a good distance were conversion to agriculture with 11 percent of sales, investment with 7 percent, and homesites with

Table 4.4: Reasons Given for Acquiring Mississippi Wetlands by Size Class, 1965-1981

Year	Timber	Agriculture	Homesite	Recreation	Invest-ment	All Other	Total
		Reason for Acquisition					
Parcels (Less Than 40 Acres)							
1965		1					1
1966		1					1
1972	3						3
1975	5		7				12
1979	4		4				8
1980	4		1			1	6
1981	3			1		2	6
Total	19	2	12	1	0	3	37
% of Total	51%	5%	32%	3%	0%	8%	99%
Tracts of Forty Acres and Larger							
1965		8					8
1966		11					11
1969	1						1
1972	8		1			1	10
1975	36		1				37
1979	27		1		2	4	34
1980	29		1		5		35
1981	24				5	1	30
Total	125	19	4	0	12	6	166
% of Total	76%	11%	2%	0%	7%	4%	100%
Tracts of 200 Acres and Larger							
1965		5					5
1972	1						1
1973	8	1					9
1974	8	1		1		1	11
1975	12		1				13
1979	2					2	4
1980	6				5		11
1981	4						4
Total	41	7	1	1	5	3	58
% of Total	71%	12%	2%	2%	9%	5%	101%

2 percent. The reason for purchase either was not obtained or was miscellaneous for the remaining four percent of sales. Among investment buyers, two-thirds cited investment in timber as their primary reason for purchase. When these investments in timber are grouped with tracts acquired for timber production, they jointly account for 80 percent of the sales of forty acres and larger.

Finally, in the all year listing of woodland sales of 200 acres and larger, 71 percent were acquired for timber production. This was followed by conversion to agriculture (12 percent), investment (9 percent) and homesites and recreation, each with two percent. Sixty percent of investment buyers cited investment in timber as their primary reason for purchase. Thus, timber was the primary reason for the acquisition of 78 percent of these large tracts.

Separation of Effects

The Mississippi woodland sales provide the opportunity for analyses different than used in Northern Minnesota and the Missouri Ozarks. Not only were the Mississippi sales acquired primarily for their timber, but estimated volumes of timber in thousand board feet (MBF) and cords were available for virtually all sales.

Table 4.5 summarizes the results of multiple linear regression tests of the sales for 1972, 1975, 1979, 1980 and 1981, years with a sufficient number of observations to allow meaningful testing. In each year, the market price of woodland tracts is the dependent variable and was tested against four independent variables--MBF/acre, cords per acre, condition of road access, and tract size in acres.

Since condition of access is not a continuous variable, it was coded in terms of indicator (dummy) variables. Dirt roads, the lowest access classification found for the Mississippi sales, was assigned as the reference category. Consequently, the constant term in the regression equation represents the value of tracts with dirt access while the coefficients in the columns labeled gravel road and paved road represent dollar changes in market prices associated with these access conditions. All other coefficients listed in the table indicate dollar changes in the selling price of tracts per unit change in any one of the variables with all other variables held constant. For example, in 1981 each change of one MBF/acre would change the predicted selling price by about $129 per acre.

Table 4.5: Summary of Multiple Regression Testing of Mississippi Woodland Tracts of 20 Acres and Larger in Various Years, 1972-1981

Year	Ave. Price $/Acre	N	Constant (Dirt Road) Coeff	Constant (Dirt Road) Std Err	MBF/Acre (Pine Sawtimber) Coeff	MBF/Acre (Pine Sawtimber) Std Err	Cords/Acre (Pine Pulpwood) Coeff	Cords/Acre (Pine Pulpwood) Std Err	Gravel Road Coeff	Gravel Road Std Err	Paved Road Coeff	Paved Road Std Err	Tract Size (Acres) Coeff	Tract Size (Acres) Std Err	SER	R^2
1972	$125	10	92.57	14.19	17.14	3.59	-4.41	4.02	--	--	30.81	15.20	0.00	.09	21.55	.85
1975	$270	41	181.97	22.79	65.53	6.33	.99	3.21	.66	5.49	-10.23	27.55	.07	.07	76.58	.76
1979	$718	34	383.51	71.10	175.29	17.08	1.44	11.48	117.60	67.13	90.28	83.27	-.20	.40	166.22	.85
1980	$741	38	446.52	44.78	236.68	38.27	-20.47	12.09	-5.25	50.88	146.31	59.24	-.15	.07	121.06	.80
1981	$720	29	507.68	66.36	128.87	29.08	35.90	16.34	-68.31	74.01	114.36	76.16	-.31	.33	136.42	.70

It is to be appreciated that the regression equation represents the simultaneous influence of the set of independent variables upon the selling price (dependent variable) of woodlands. Thus, the individual coefficients do not necessarily indicate the effects of the independent variables on the selling prices of woodlands in an absolute sense. Interpretation of the meaning of the coefficiencies is further confounded by the fact that some of the independent variables may be highly correlated with variables not included in the model. This can affect both the magnitude and sign of the included variables. These same effects can occur if two or more of the included variables are highly correlated.

While these difficulties do not carry over and affect the validity of inferences made with respect to the dependent variable, they are important in this study since the regression model is being used as a descriptive tool and the influence of each independent variable is of particular interest. Fortunately, examination of the residuals disclosed no important violation of the assumptions governing the model and no important correlation between the included independent variables.

Several general observations can be made concerning the data displayed in Table 4.5. First, F tests showed a strong overall statistical relationship between per acre

selling prices and the cited independent variables. In the case of the 1972 sales, the relationship was significant at the .05 level, and for the other four years the computed F values were substantially higher than required to reject the null hypothesis at the .01 level. SER values ranged from a low of $21.55 in 1972, when the average selling price of woodlands was $125 per acre, to a high of $166.22 in 1979, when the average price was $718 per acre.

Further use of the multiple regression results will be made in the following subsections which address the various independent variables.

Tract Size

Preliminary analysis of the Mississippi woodland sales using tract size--per acre price scatter diagrams revealed that the relationship was basically linear. Unit prices showed no increase for tracts of very large size, as was the case in Minnesota. However, there were a total of only three sales larger than 1000 acres in the sample so there was little opportunity for this response to be expressed. An interesting characteristic of the Mississippi sales was that per acre prices generally showed little tendency to increase as tract size decreased

until tract size became less than 20 acres and, in several cases, until tract size fell below 15 or even 10 acres. Because size had such a minor effect, all woodland tracts of 20 acres and larger are included in the analysis of the Mississippi sales.

As shown by the applicable coefficients in Table 4.5, tract size had no effect on per acre prices in 1972, added seven cents for each additional acre in 1975, and reduced prices by between 15 and 31 cents for each additional acre in 1979 through 1981. These are very minor amounts compared to average selling prices of $270 per acre in 1975 and $718 to $741 per acre in 1979-81, and explain the lack of clear separation in the price trends for tracts by size class in Figure 4.1. As expected, tests of the coefficients for tract size using the t statistic at the .05 and .10 level of significance indicated that size could be dropped from the model without impairing its usefulness. The single exception were the sales for 1980 where, due to the small standard error as compared to the magnitude of the coefficient, inclusion of tract size did improve the model.

Timber

Aside from the land component (as represented by the constant term), pine sawtimber was clearly the most

important variable influencing the selling prices of Mississippi woodlands. Tests based on the t statistic resulted in t values well above those required to indicate a statistical relationship at the .05 level of significance between MBF/acre and per acre selling prices in all years.

Table 4.6 provides a measure of the relative importance of land and pine sawtimber as determinants of selling prices of these woodland tracts.

Table 4.6 and Figure 4.2 are based on the fact that the regression plane passes through the mean of each variable. As can be seen in the table, the land component of the average woodland tract contributed between 53 and 74 percent of the tract price in the various years and pine sawtimber between 21 percent and 39 percent. In combination, land and timber accounted for 92 to 95 percent of the selling price of the average tract in all years. Pine sawtimber, of course, made a greater proportional contribution to the selling prices of tracts with higher than average pine timber volumes and, a lesser contribution to tracts with lower timber volumes.

It is of interest that the coefficients for pine sawtimber show considerable correspondence with actual pine stumpage during the study years. For example, the Mississippi Forestry Commission reports that between 1969

Table 4.6: Modeled Contribution of Land and Pine Sawtimber to Selling Prices of the Average Mississippi Woodland Tract of 20 Acres and Larger in Various Years, 1972-1981

		Contribution of					
		Land		Pine Sawtimber			Land & Timber as % of Total Tract Price
Year	Price of Ave. Tract	$/Acre	% Tract Price	Ave. MBF/A	$/Acre	% Tract Price	
1972	$125	$ 93	74%	1.5	$ 26	21%	95%
1975	$270	$182	67%	1.1	$ 72	27%	94%
1979	$718	$384	53%	1.6	$280	39%	92%
1980	$741	$447	60%	1.0	$237	32%	92%
1981	$720	$508	71%	1.3	$168	23%	94%

and 1980 pine sawlog stumpage prices rose from $50 to $225 per MBF.[4] Similarily, the Mississippi Cooperative Extension Service, using different market reporting areas and reporting pine sawlogs separately from pine peelers and poles, reported that average pine sawtimber stumpage was $30/MBF in 1965, increased to $204 in 1979, dropped to $183 in 1980, and was $203/MBF in 1981. During the economic slowdown of recent years, the number of sales has dropped substantially, but prices (in nominal but not real terms) were holding fairly well.[5]

There are several reasons why the coefficients, representing the contribution of pine sawtimber to the selling price of woodland tracts, should not be identical to stumpage prices. Timber sales are made on tracts with harvestable volumes--generally, two to three MBF/acre as a minimum. In contrast, the coefficients express the contribution of pine sawtimber to woodland tract prices over a wide range of both operable and non-operable volumes.

Actual pine stumpage prices may differ from the contributory value of timber to total tract prices for other

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[4]Mississippi Forestry Commission, Five Year Operational Plan, 1983-1987 (Jackson, Mississippi), p. 2.

[5]Personal Communication with Tom Monaghan, Leader, Extension Forestry, Cooperative Extension Service at Mississippi State University, Mississippi. Prices from Forest Resource Market Notes published annually by the Extension Service and Mississippi State University. January 27, 1983.

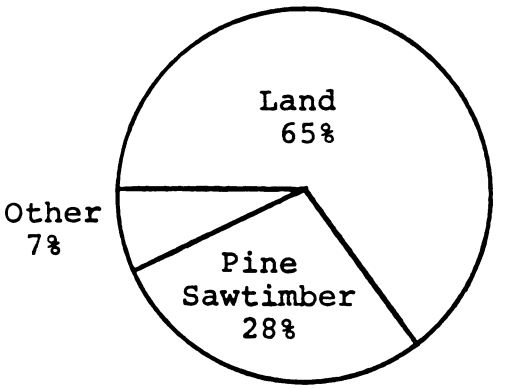


Figure 4.2: Average Contribution of Land and Pine Sawtimber to Selling Price of Typical Mississippi Woodland Tract of 20 Acres and Larger, 1972-1981

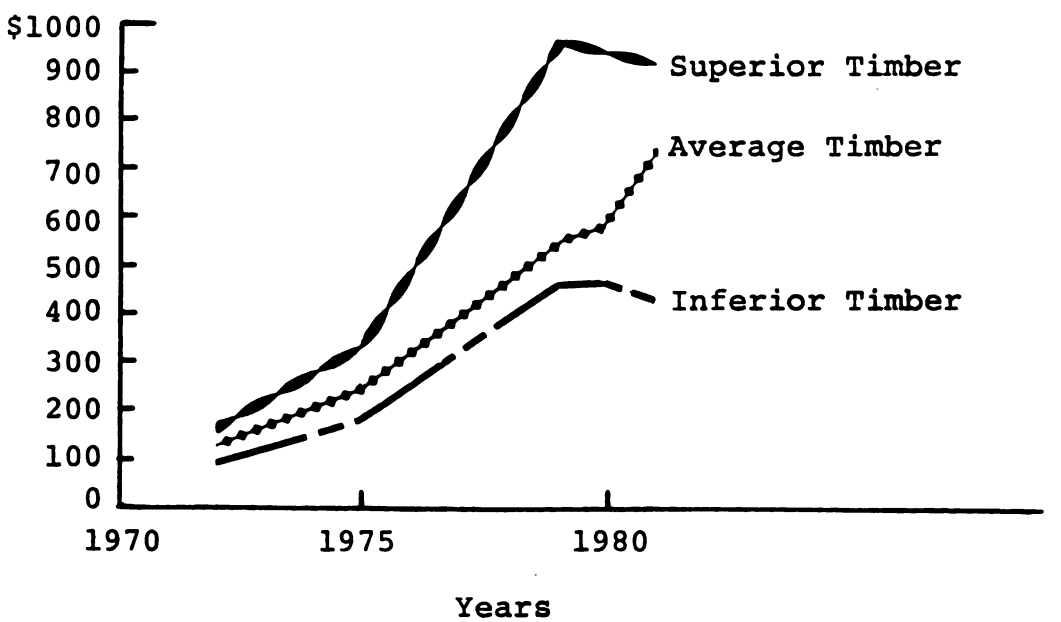


Figure 4.3: Average Price Paid for Mississippi Woodland Tracts of 20 Acres and Larger by Condition of Pine Timber, 1972-1981

reasons: stumpage prices are quite subject to short-term fluctuations; buyers of land and timber may give more emphasis to longer term trends in timber prices; timber prices tend to be discounted in real estate transactions to allow for a return of and on the investment and to management during the period of time between the acquisition of the property and the realization of timber receipts.

Table 4.7 and Figure 4.3 feature the selling prices of Mississippi woodland tracts by timber condition class during the study years. The table was developed directly from the sales data and is independent of the multiple regression model.

Table 4.7: Average Nominal Selling Prices of Mississippi Woodlands of 20 Acres and Larger by Timber Condition Class, 1972-1981.

	Condition of Timber		
Year	Inferior ($/Acre)	Average ($/Acre)	Superior ($/Acre)
1972	$ 98	$125	$157
1975	$195	$254	$329
1979	$461	$555	$982
1980	$465	$591	$942
1981	$440	$743	$918

The following decision rule was used to classify the pine timber:

Class	MBF(E) Per Acre
Inferior	0 - .5
Average	.6 - 2.0
Superior	2.1+

Where $MBF(E) = MBF\ sawtimber + \frac{Cords\ (Pulpwood)}{4}$

and MBF(E) stands for thousand board foot equivalent.

The conversion of cords to pulpwood was made on the basis of the slope of iso-price lines connecting tracts that sold for the same prices plotted on graphs with MBF/acre on one axis and cords/acre on the other.

The physical conversion rate is only two cords per MBF, while sawtimber generally sold for 5 to 15 times the cord price. Neither the physical nor the stumpage price ratios, however, are adequate for the purposes of conversion. With the exception of some industrial forest land owners who produce pulpwood on short rotations, most pulpwood is harvested in intermediate cuts and as an associated product in final sawtimber harvests. Hence, buyers tend to view smaller trees as sawtimber in waiting.

Access and Timber

Table 4.8 shows the distribution of the Mississippi woodland sales by access and timber classes. Because of

Table 4.8: Chi-Square Test of Physical Relationship Between Access and Condition of Timber for Mississippi Woodland Sales of 20 Acres and Larger. (Combined Data 1972-1981)

Key

Observed Value
(Expected Value)
[Cell Chi-Square Value]

ROAD ACCESS	Condition of Timber: Inferior	Average	Superior	Total
Dirt	14 (11.529) [.530]	17 (17.294) [.005]	18 (20.176) [.235]	49
Gravel	12 (14.118) [.318]	22 (21.176) [.032]	26 (24.706) [.068]	60
Paved	10 (10.353) [.012]	15 (15.529) [.018]	19 (18.118) [.043]	44
Total	36	54	63	153*

*Includes one sale described as having "good timber" not used in the regression analysis.

----------TEST----------

DF = 4

$X^2_{Cal} = 1.261$ vs. Table $X^2_{.95} = 9.49$

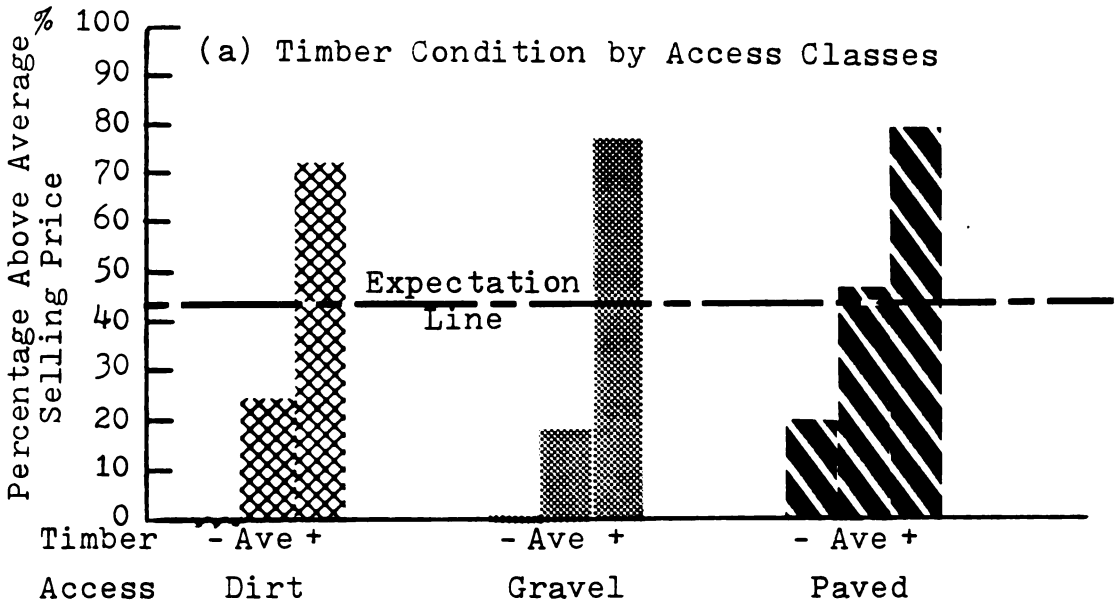
Cannot reject null hypothesis of independence at .05 level of significance.

the close agreement between observed and expected values in each cell, the null hypothesis of independence between these variables could not be rejected at the .05 level of significance.

Figure 4.4 provides a comparison of relative price performance for tracts in various road access-timber condition classes. In panel a the sales were first classified by access in order to isolate the specific effects of timber. Clearly, condition of timber and price performance are highly correlated. The effects are much the same within each access class.

In panel b the general effects of timber are readily evident. At one extreme are sales with superior timber--72 to 79 percent of these sales sold for more than the average price in their year of sale regardless of access. At the other extreme, none of the sales with inferior timber and dirt and gravel roads were able to command the average price, and only 20 percent of the sales with inferior timber and paved access exceeded the average price.

Without question, pine timber is a much more important determinant of the selling price of Mississippi woodland tracts than is access. However, within each timber classification, tracts with paved access do show consistently



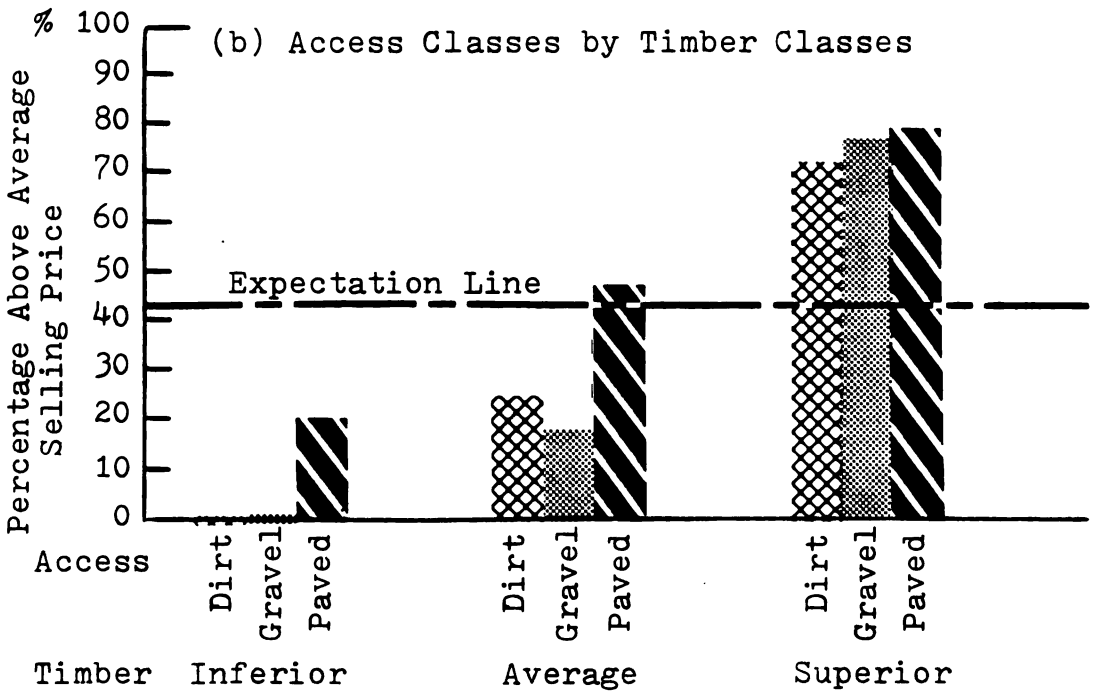


Figure 4.4: Effects of Access and Timber Upon the Selling Price of Mississippi Woodland Tracts of 20 Acres and Larger, 1972-1981

better prices than tracts with either dirt or gravel access. On the other hand, the sales do not indicate that tracts with gravel access will bring consistently better prices than tracts with dirt road access.

The Chi-square test in Table 4.9 indicates a very high degree of statistical correlation between the selling price of Mississippi woodland tracts and the combined features of timber and access.

Reason for Purchase - Price Relationships

Buyers seeking permanent homesites and tracts for homesite development rather consistently paid higher prices for Mississippi woodland tracts of 20 acres and larger than did other buyers. The second highest prices were paid by buyers whose primary interest was timber production. On the low end of the price scale were tracts purchased for conversion to agriculture and tracts acquired as investments. These price relationships are shown in Figure 4.5.

In contrast with the findings in Northern Minnesota and the Missouri Ozarks, where recreation is an important factor in the market, only one observation of a woodland tract acquired primarily for recreation was made in Mississippi. This tract was purchased at the prevailing price for tracts acquired for their timber.

Table 4.9: Chi-Square Test of the Effects of Timber and Road Access Conditions on the Relative Prices Paid for Mississippi Woodland Tracts of 20 Acres and Larger, 1972-1981 Sales

Key

Observed Value
(Expected Value)
[Cell Chi-Square Value]

	ACCESS AND TIMBER									
	Dirt Road			Gravel Road			Paved Road			
Timber	Inferior	Average	Superior	Inferior	Average	Superior	Inferior	Average	Superior	Total
Less than Average Price	14 (8.052) [4.394]	13 (9.778) [1.062]	5 (10.353) [2.768]	12 (6.902) [3.766]	18 (12.654) [2.259]	6 (14.954) [5.361]	8 (5.752) [.8786]	8 (8.627) [.0456]	4 (10.928) [4.392]	88
More than Average Price	0 (5.948) [5.948]	4 (7.222) [1.437]	13 (7.647) [3.747]	0 (5.098) [5.098]	4 (9.346) [3.058]	20 (11.046) [7.258]	2 (4.248) [1.190]	7 (6.373) [.0617]	15 (8.072) [5.946]	65
Total	14	17	18	12	22	26	10	15	19	153

TEST

$X^2_{cal} = 58.67$ vs. Table $X^2_{.95} = 15.5$ DF = 8

$X^2_{.995} = 22.0$

Can reject null hypothesis of independence at .005 level of significance.

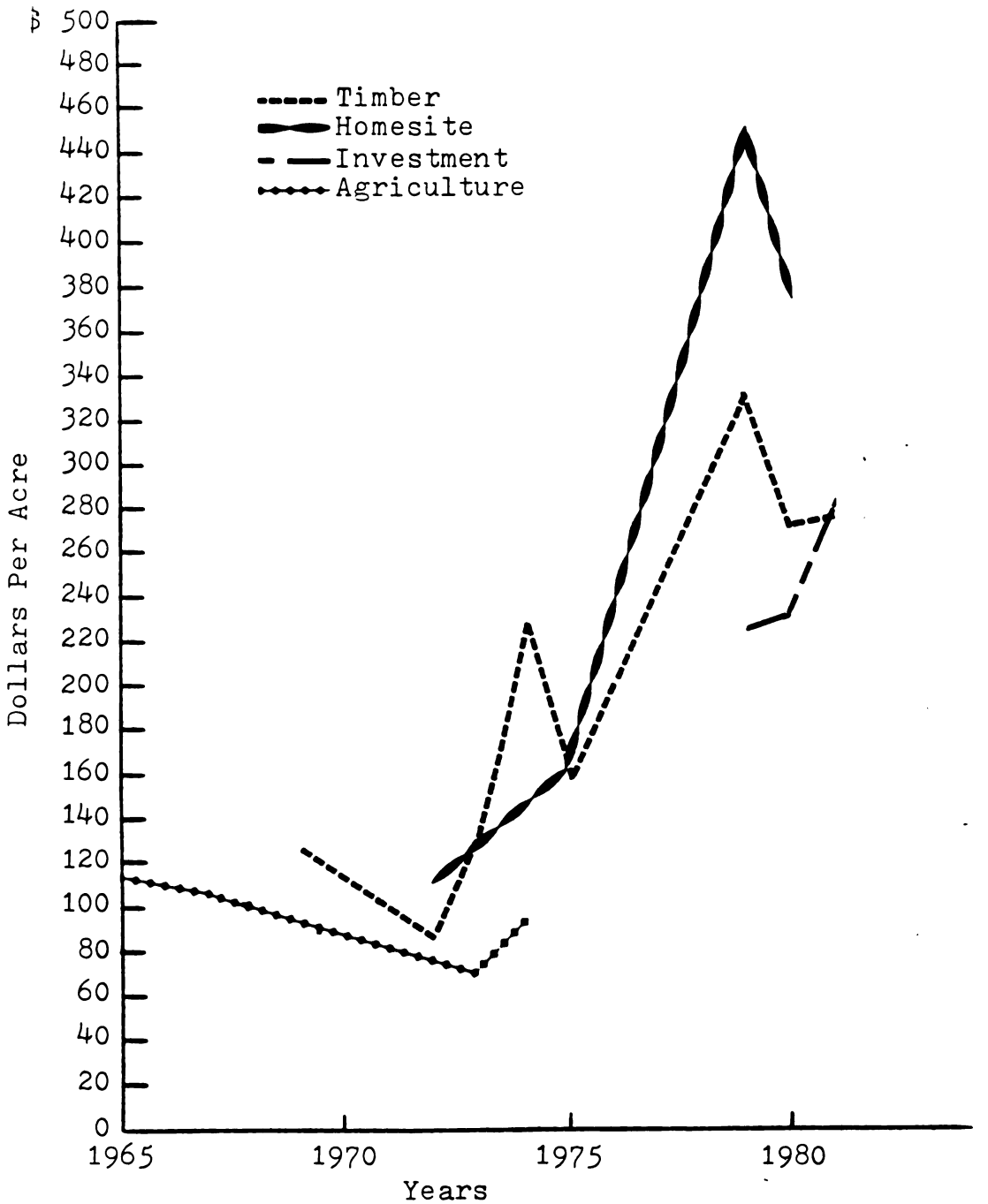


Figure 4.5: Average Real Prices of Mississippi Woodland Tracts of 20 Acres and Larger by Reason for Purchase, 1965-1981

As shown in Table 4.10, homesite buyers tended to purchase smaller and more accessible tracts than did other buyers. Given the relatively minor influence of tract size on per acre prices, the premium paid by homesite buyers can reasonably be attributed to improved access and associated locational features.

Not surprisingly, tracts purchased for timber had the best timber--45 percent had superior timber as compared to 22 percent or less for tracts acquired for other reasons. Tracts acquired for timber also tended to have a large average size but not necessarily larger than those acquired for conversion to agriculture.

Woodland tracts acquired for agriculture (generally for row crop production) can be characterized not only by their large size but, more importantly with respect to prices paid, by inferior access and inferior timber. Fully 77 percent of these tracts had dirt road access and only 9 percent were on paved roads. In contrast, only 6 to 33 percent of tracts acquired for other reasons had dirt road access and 28 to 50 percent were on paved roads. All tracts acquired for agriculture had inferior timber (cutover or inferior hardwoods) while only 27 to 39 percent of tracts acquired for other reasons had inferior timber.

Table 4.10: Average Real Prices and Selected Features of Mississippi Woodland Sales of 20 Acres and Larger by Reason for Purchase, 1965-1981

	Timber		Homesite		Investment		Agriculture		Recreation	
Tract Size and Price*	Real Price $/Acre	Tract Size (Acres)	Real Price $/Acre	Tract Size (Acres)	Real Price $/Acre	Tract Size (Acres)	Real Price $/Acre	Tract Size (Acres)	Real Price $/Acre	Tract Size (Acres)
1965							$115	181		
1966							$113	164		
1969	$128	108								
1972	$ 84	112	$112	66						
1973	$137	229					$ 70	240#	$141	650#
1974	$229	408					$ 97	1646#		
1975	$160	169	$160	240						
1979	$333	90	$457	40	$226	40				
1980	$276	183	$376	33	$237	329				
1981	$278	116	--	--	$288	63				
% of Sales										
Access Condition										
Dirt Road	30%		33%		6%		77%		Tract features not documented	
Gravel Road	38%		17%		66%		14%			
Paved Road	32%		50%		28%		9%			
	100%		100%		100%		100%			
% of Sales										
Timber Condition										
Inferior	27%		33%		39%		100%		Tract features not documented	
Average	28%		50%		39%		0%			
Superior	45%		17%		22%		0%			

Single observation.

* In 1965 dollars - GNP deflator.

As in the other study areas, it is difficult to characterize tracts acquired for investments since investment is not a physical use and all manner of real estate is commonly acquired for investment purposes. It appears that investors tended, on average, to select smaller tracts than did either timber or agricultural buyers but generally larger tracts than did homesite buyers. Investors also preferred tracts with better access conditions (94 percent have gravel or paved roads). Even though many investors cited timber as their primary motivation, 78 percent of the tracts had inferior or average timber. Apparently, investors did not often compete with timber buyers for tracts with operable volumes preferring, perhaps, to acquire tracts that could later be resold as the timber matured.

It is also surprising, considering the large increases in prices for Mississippi woodland tracts starting about 1972, that investment buyers were not apparent in the sampled sales until 1979--the year when prices began to decline in real terms.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary of Findings

Major changes in the market prices of forest lands were observed in all three locations during the 1965-1981 study period. In each location, market prices advanced at an overall average annual compound rate of close to 15 percent during the study period, almost 8.5 percent faster than general inflation as measured by the Gross National Product implicit deflator.

The pattern of price change for the Missouri Ozark sales differs from the two other areas in that real price increases were observed between 1965 and 1970 while real price increases were not apparent in Northern Minnesota and Mississippi until 1970-1972. The overall patterns of real price change, however, are remarkably similar--in all study areas prices peaked in 1979 and then declined through 1981. Moreover, sales in all areas reflected either modest downturns or a dampening of price increases during the lesser recessionary periods of 1970-71 and 1974-75.

While overall price trends were very similar in all areas, considerable differences were observed in actual prices. In Mississippi woodland tracts were generally selling for about $100 per acre in 1965 and averaged $750 per acre in 1981. In contrast, woodland tracts in the Missouri Ozarks and in Northern Minnesota sold for average prices of about $20 per acre in 1965 and for $280 and $205, respectively, in 1981.[1]

In Northern Minnesota comparison was also made of the prices paid for woodland tracts with and without lake frontage. Tracts with lake frontage generally sold for 7.5 times as much as nonlake tracts and showed earlier price increases (i.e., in 1965-1970) but declined more sharply after 1979. Consequently, the observed overall rate of price increase for these tracts was 13.8 percent (compound) as compared to 15 percent for tracts without lake frontage.

Buyers seeking sites for permanent homesites or tracts for homesite development paid the highest average per acre prices in all study areas. These buyers were much more likely to purchase tracts with good access (paved or gravel roads) and tracts of smaller sizes than were other buyers.

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[1]Average prices for tracts 40 acres in size.

The acquisition of forest land for conversion to cropland or pasture was a factor only in the Missouri Ozarks and in Mississippi. In both areas, these properties sold for the lowest average prices. These tracts tended to be relatively large in size and have the poorest access and poorest timber.

Recreation was the most common reason for the acquisition of tracts of 40 acres and larger in Northern Minnesota and in the Missouri Ozarks but was rarely cited as the primary reason for acquiring forest lands in Mississippi. The proportion of tracts acquired for recreation decreased rapidly as tract size increased and few tracts larger than 160 acres were purchased for recreation. Recreational buyers generally paid higher prices for tracts than did timber buyers but less than homesite buyers.

Timber as a commercial product was simply not a factor influencing the sale of Northern Minnesota woodland tracts with lake frontage. Nor was timber as a product important to buyers for tracts without lake frontage of less than 40 acres in size in Northern Minnesota and the Missouri Ozarks. However, two tracts in each of these areas were acquired as sources of firewood, and the buyer of a third small tract in the Ozarks selected the property because of its sawtimber.

In Northern Minnesota, timber production was cited as the primary reason for purchase for only 11 percent of woodland tract (excluding lake frontage sales) of 40 acres and larger. However, the percentage increased rapidly with increased tract size. Six percent of tracts in the 40-80 acre size class, 17 percent in the 81-160 size class, and 50 percent of tracts of 160 acres and larger were acquired for their timber. After 1970, the proportion of tracts acquired for timber production also increased in all size classes.

In the Missouri Ozarks, only 8 percent of tracts of 40 acres and larger were acquired for their timber. However, 21 percent of tracts larger than 160 acres were acquired for this reason. Timber's share of the market showed considerable year-to-year variation but generally has been increasing in recent years.

In Mississippi, timber was cited as the primary reason for the acquisition of 70 percent of all tracts in the 10 to 40 acre size class and 76 percent of tracts of 40 acres and larger. When investors who stated that they were primarily making investments in timber are included, timber accounted for 8 out of 10 Mississippi woodland purchases.

In all areas buyers with a stated interest in timber showed a strong preference for tracts with superior

timber--in Northern Minnesota and Mississippi such buyers were three to four times as apt to select tracts with superior timber as were other buyers. In Missouri, however, recreation buyers were even more prone to buy tracts with superior timber than were timber buyers. And recreationists generally outbid timber buyers in Missouri.

In Mississippi timber, more specifically pine sawtimber, had a very definite influence on woodland selling prices. In this study area, the land and pine sawtimber components jointly accounted for 92 to 95 percent of the selling price of the average tract in each of the study years. The Missouri Ozark sales also showed progressively higher prices for tracts with better timber.

The Northern Minnesota sales showed a somewhat different pattern. Tracts with inferior timber consistently sold for lower prices than did other woodland tracts, but tracts with superior timber did not necessarily sell for higher prices than tracts with only average timber. This was found to be the result of a strong, positive correlation between tract size and condition of timber. That is, lower per acre prices associated with increasing tract size (within the size range of most of the sales) overrode the price enhancing effects of superior timber.

In Northern Minnesota, the per acre selling prices of tracts declined very rapidly until a tract size of about 40 acres was reached. Thereafter, prices declined by only a few pennies per acre until a tract size of 400 to 500 acres was reached. Per acre prices then began to rise at a slow, constant rate until, at about 800 acres, prices were similar to those paid for 80 acre tracts. And tracts above 1500 acres sold for the same prices as forty acre tracts.

Sales of woodland tracts of large size are uncommon in Missouri and Mississippi so the universality of increasing per acre price for very large tracts could not be adequately tested. The few available observations of large tract sales in these other areas did not exhibit price enhancement. The observed price behavior in Northern Minnesota likely is related to the market setting. Many of these sales were between timber corporations with relatively equal bargaining positions and a common concept of land and timber value.

In the Missouri Ozarks and Northern Minnesota, changes in per acre prices associated with changes in tract size for tracts of 40 acres and larger were minor in amount (i.e., pennies per acre) but persistent, and sufficiently large, relative to per acre selling prices, to result in

a clear separation of average prices of tracts of 40 acres, tracts of over forty acres, and tracts of 200 acres and larger. This was not the case in Mississippi where size induced price changes were insignificant for tracts of 20 acres and larger, and even for tracts as small as 10 to 15 acres in some years.

It was concluded from this study that tract size tends to be assigned more importance in appraisal practice and in economic literature as a determinant of value than is warranted. As discussed in some detail in Chapter II, the major difference in per acre prices for small parcels versus acreage tracts is more properly attributed to associated quality differences than to a cause-and-effect relationship. In all areas, knowledge of tract size was of little value in predicting the selling prices of individual properties.

Condition of access, in particular, access extremes, was an important variable influencing woodland selling prices. Tracts with paved access roads sold for the highest prices while tracts without road access tended to bring the lowest prices. The market, however, did not make a consistent distinction with respect to the prices paid for tracts with dirt versus gravel access.

Conclusions and Implications

A number of conclusions can be drawn from the study findings. Foremost, perhaps, is the apparent linkage of the market for forest lands to the national economy. The remarkable similarities in overall price performance in all areas, to include declines in real prices for tracts of all sizes and for essentially all uses after 1979, suggests this association.

On the other hand, the differences in price levels and in the timing of the original, major increases in prices in the respective areas undoubtedly reflect differences in local supply and demand conditions. It is of interest that the comparatively early (1965-70) rise in the prices of wooded tracts with lake frontage in Minnesota, attributable to recreation buyers but including some homesite buyers, corresponds with strong price increases during this same period for Missouri woodlands where demand is also primarily from recreation and homesite buyers. In contrast, increases in demand from timber-oriented buyers did not emerge until 1970-72. This accounts almost entirely for the basically lateral movement in prices prior to this time in Mississippi and to an appreciable degree for Minnesota woodlands without lake frontage.

During the 1965-81 study period, the supply of commercial forest land in each of the study areas declined by

approximately ten percent or at about twice the rate for the Nation. These declines in supply contributed to the upward pressure on prices. Outward shifts in demand, however, were almost certainly more important in driving prices upward.

Increasing competition for forest land was observed, not only among traditional buyers such as farmers and timber producers, whom regard land as a factor of production, but by buyers acquiring land as a consumer good. By 1970, permanent homesite buyers were paying the highest prices for forest land in all three areas, and recreation buyers dominated the markets in both Minnesota and Missouri.

The emergence of nontraditional buyers in the market for forest lands has several implications. The basic function of the market is to allocate resources efficiently. This works well when the resources in question are regarded as factors of production. It would be difficult, current crop surpluses not withstanding, to build a strong economic argument that the economy would be better off if the fertile croplands of Illinois or the Mississippi Delta were in long term timber production rather than in corn, cotton, and soybeans. The efficiency of market mechanisms, however, is open to question when it results in land being allocated, not to alternate productive uses, but to recreation, large homesites, and other nonproduction uses.

The direct, observable effects of nontraditional buyers into the forest land market are higher property prices and smaller tract sizes, neither of which promotes forest products production. And, even though timber was found to influence forest land prices in all areas, a case for timber contributing value as a commercial product could only be made in Mississippi.

Given 1981 prices in the $200 to $280 per acre range in Minnesota and Missouri and $750 per acre in Mississippi for tracts with only average timber, there is no way that an individual could purchase land for long term timber production and hope to receive an adequate rate of return. Stated alternatively, anyone who based their top offer for land on the capitalized value of anticipated net returns from timber production using any reasonable capitalization rate would not buy much land in today's market. Some buyers may still enter hoping to capture their return on increases in the value of the land itself. In doing so, such buyers express belief that the high appreciation rates of the recent past will resume and not fall as the result of land prices being pushed well beyond what their productive capacity will support.

Despite rapidly escalating land prices, forest industry firms continued to acquire forest lands, especially in Mississippi and Minnesota where they are an important part

of the market. Indications are that the price of forest land has become an important factor determining entry, expansion, location, and who the principal players will be in forest industry in future years.

Because the market for forest lands is important in determining the allocation of forest resources and their employment, it almost certainly will become a topic of increasing interest to public policy makers, industry, and others in the years to come.

Suggestions for Further Research

A logical area for further research would be to extend this study to other forest land areas in other states. It would be especially interesting to evaluate the forest land market in the Pacific Northwest and Pacific Southwest states where timber supplies are becoming critical (as compared to forest industry capacity), to Northeastern states, and to other southern states such as Georgia where leasing of lands for timber production is increasingly being employed as an alternative to outright land ownership.

The literature is essentially void of studies that document the specific influence of the real estate market in governing the transition of rural land uses. This study was limited to forested tracts; it would be interesting to investigate the market for agricultural tracts and mixed

agricultural-wooded tracts acquired for various reasons. The focus of such studies would be on how market forces shape land use patterns and how alternate concepts of value (land as a factor of production; land as a consumer good; land as an investment medium) change and interact.

Much work remains to be done regarding the influence of institutional factors such as taxes and zoning on rural land markets. Rural conditions are rapidly changing in many areas due to the heavy influx of nontraditional buyers of land.

Finally, it is suggested that research be undertaken on the effects of forest land values on future timber availability and prices. How important are forest land prices and changes in prices as compared to product prices and their changes, the costs of stumpage, labor, plant and equipment? What is the level of industry investment in forest land as compared to plant and equipment? Will regional differences in forest land prices influence regional production locations? And will land holdings offer strategic advantages to forest industry firms over the long term?

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