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Minnesota Farm Business Notes

Farm Real Estate Values In Minnesota

Anne E. Hammill

Are farm real estate values in Minnesota influenced by distance from major cities, by local development, and by land quality? If they are, knowledge about these factors could help a prospective buyer judge the price to pay for a farm, aid a seller in setting the price for his farm, and assist officials in appraising farms for tax purposes.

If farm real estate values are influenced by location relative to major cities, we would expect high values near the Twin Cities Metropolitan Area and other cities and progressively lower values as we move away from the urban areas. If local development and land quality have an influence on farm real estate values, we would expect high values to be associated with greater local development and better soil at any given distance from major cities.

FARM COUNTIES STUDIED

To evaluate the relationships among farm real estate values, location, local development, and land quality in Minnesota, all counties with 25 percent or more rural farm population in 1959 were studied. Of Minnesota's 87 counties, 67 were included in the study (see map). Some of the 20 counties excluded contain sizable urban centers and some are located in the nonagricultural areas of northern Minnesota.

The research discussed in this article was part of a larger project that utilized 1959 data. However, the general character of the results probably still applies to farm real estate values in Minnesota.

VARIABLES USED

Besides farm real estate values (including land and buildings) the variables selected for study were location, land quality, and local development.

- ● Location was represented by a population/distance variable.
- ● Land quality was represented in two ways: by a crop value variable and by the proportion of total farmland devoted to crops.
- ● Local development was represented by the percentage of each county's urban and rural nonfarm dwellers.

The population/distance variable was constructed by taking the distance (providing it was 200 miles or less) from the center of each included county to a standard metropolitan statistical area (SMSA) and dividing this distance into the population of the SMSA. Where more than one SMSA fell within 200 miles of a county, the ratios were added to give a total effect. SMSA's that influenced Minnesota counties in 1959 were the Twin Cities; the Fargo-Moorhead area along the Minnesota-North Dakota border; the Duluth-Superior area on the Minnesota-Wisconsin border; Sioux Falls in South Dakota; Sioux City, Waterloo, and Dubuque in Iowa; and Madison and Green Bay in Wisconsin.

The crop index was constructed from data on acres, production, and prices for those crops that were grown on 80 percent or more of a county's acreage in 1959. Production for each crop was multiplied by 1959 prices to give a value figure. Values for all crops were added and the total was divided by the total crop acres, giving the average value of crops produced per acre per county. The crop index was designed to represent the cropping patterns that would yield the highest profits for a given county. Management considerations thus were included implicitly, as were temperature and moisture conditions that influence yields and government farm programs (but not direct government payments), which influence the amounts and kinds of crops grown.

The other two variables, cropland as a percentage of each county's total land in farms and the percentage of each county's population that was urban or rural nonfarm, were obtained directly from available data sources.[1]

GEOGRAPHIC RELATIONSHIPS

To identify possible geographic patterns, 1959 farm real estate values by

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[1] The data used in this study came from several readily available sources. Farm real estate values for 1959 were obtained from *Farm Real Estate Values in the United States by Counties, 1950-1959*, edited by T. J. Pressly and W. H. Scofield, University of Washington Press, Seattle, 1965. Population figures came from *City and County Data Book, 1967*, Bureau of the Census, U.S. Department of Commerce. Minnesota acreage and crop value data came from *U.S. Census of Agriculture, 1959*, Final Report, Vol. I, Part 15, and from *Minnesota Agricultural Statistics, 1960*, State-Federal Crop and Livestock Reporting Service, Minnesota Department of Agriculture.

Continuous Churns Introduced Into Minnesota's Creamery Industry

G. M. Nolte and E. Fred Koller

Minnesota's important creamery industry has experienced many changes in the past 30 years. The number of plants manufacturing butter declined from 874 in 1938 to 221 in 1968. In the mean time, butter output per plant increased from 345,000 pounds a year to about 1,500,000 pounds.

Many factors were responsible for these changes. Improved roads and trucks encouraged the trend. New technology such as bulk milk handling equipment, clean-in-place systems, high-temperature-short-time pasteurization, and generally larger capacity dairy equipment had a significant effect. Plant managers found that as they adopted and fully utilized the larger and improved equipment, per unit output costs could be reduced.

Recently another major technological development has entered the Minnesota creamery industry — the continuous churn. This innovation suggests a number of important implications in the way of increased butter manufacturing efficiency and further changes in creamery industry organization. Plant managers, creamery directors, and dairy producers are interested in how this new equipment may affect costs, returns, and investment in new facilities.

In view of its importance, the University's Department of Agricultural Economics has made a study of the efficiency, costs, and some of the implications of the continuous churn. This article briefly summarizes that study.

The first continuous churn was introduced into Minnesota in 1965. Six creameries in the state presently have this equipment. These plants will manufacture about 47 million pounds of butter this year — nearly 15 percent of the expected butter output in the state. Several other dairy firms in the state are now considering installation of the churns.

The continuous churn process involves the same principle as the traditional batch churn, but it applies on a smaller scale. In this process, a thin film of about 40 percent cream is fed into a small drum containing beaters that revolve at a high rate. The great turbulence of the cream causes almost instantaneous conversion of the cream to kernels of butter and buttermilk. The butter is "worked" by means of two augers that force the butter through a series of sieves. Cream is continually pumped into the beater section and butter continually flows out the end of the worker section. The output rate of these churns varies with types and models from about 3,000 to 4,500 pounds of butter an hour.

There are three makes of continuous churns in use in Minnesota; all are im-

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Churns . . . cont'd from page 1

ported from Europe. They are the Danish Silkaborg, the German Westfalia, and the French Simon.

FOUR CHURN SYSTEMS COMPARED

In this study, the cost of churning butter was compared with the continuous churn with three alternative batch churn systems now used in Minnesota. Costs for each of the four systems were determined assuming various annual volumes of butter output. Each of the churn systems compared was assumed to be part of a butter-powder plant operation having a daily processing capacity of about 600,000 pounds of milk.

The continuous churn was compared with a 600-gallon cream capacity churn operation in which butter was packaged by hand, a 1,300-gallon cream capacity churn with hand packaging, and a 2,000-gallon cream capacity churn with a mechanical butter packer. The 600-gallon churn with hand packaging represents a size and system that could be considered typical in Minnesota. The 2,000-gallon churn represents the highest capacity and most automated batch system available.

DIRECT CHURN COSTS

The direct cost components for the four churn systems are shown in table 1. These cost components were put together from several sources. The equipment and building costs were obtained by consulting dairy equipment sales firms. The labor costs were obtained by visiting a number of plants and timing the various component operations.

The cost of equipment for the various churning systems varies from $18,750 for the 600-gallon batch churn to $46,890 for the continuous churn (table 1). There is little difference between the purchase price of the 2,000-gallon batch churn and the continuous churn, both with mechanical packers. When building costs are added to the equipment costs, the 2,000-gallon churn system is slightly more expensive than the continuous churn. The 2,000-gallon churn with the mechanical packer requires a good deal more space than the continuous churn.

The costs for the use of the building and equipment were converted into an annual cost by taking 9.42 percent and 16.42 percent, respectively, of the new cost (see first two footnotes to table 1).

Labor costs varied from $0.339 per 100 pounds of butter in the 600-gallon batch churn system to $0.178 in the 2,000-gallon churn (table 1). The lowest variable labor cost ($0.172) was achieved with the continuous churn. The main difference in the variable labor cost between the 2,000-gallon and continuous churn was due to packaging. The mechanical packers used with both systems were similar, but the employees using the continuous churn always packed at a higher rate than those using the 2,000-gallon churn. The reason appears to be that the continuous process sets a pace to which the worker adapts. In the batch process, the workers set the pace.

AVERAGE MANUFACTURING COSTS

The direct costs of operating the four types of churns were combined with the cost of other plant operations and general administrative costs to determine the average cost of manufacturing a pound of butter (table 2). The costs cited do not include any milk hauling or butter marketing costs. In the 600-gallon churn operation, average plant costs varied from 7.57 cents a pound at 1.4 million pounds annual volume to 2.28 cents at 7.2 million pounds. In the case of the continuous churn, costs varied from 7.80 to 2.19 cents a pound in this volume range. Per pound costs of operating the continuous churn plant were essentially identical to the costs of the 2,000-gallon batch churn plant at the various volumes. The continuous churn showed a per unit cost advantage over the widely used 600-gallon churn at volumes of 4.3 million pounds a year and over.

Table 2. Average cost of manufacturing butter at various volumes with four churning systems

Annual volume of butter, 1,000 pounds	600-gallon churn	1,300-gallon churn	2,000-gallon churn	Continuous churn
	Average cost of producing butter			
	cents per pound			
1,450	7.57	7.62	7.88	7.80
2,900	4.26	4.24	4.33	4.30
4,350	3.16	3.21	3.15	3.13
5,800	2.61	2.55	2.56	2.55
7,250	2.28	2.22	2.20	2.19

Note that in all four systems per pound costs declined significantly as the annual volume of output increased. This cost saving arose largely from the more intensive use of the high cost equipment and plant as volume was increased.

CONCLUSIONS

This study showed that the continuous churn offers cost savings over the conventional small churns widely used in Minnesota, but only if a large enough volume of cream is available. However, the continuous churn system shows relatively little cost advantage over the large mechanized batch churn systems now available. The new churn system offers other advantages such as establishing pace, setting labor routines in the plant, facilitating continuous packaging and printing of butter, and others.

The introduction of the continuous churn may affect the organization of the state's creamery industry even more, because to make the system economically feasible even larger quantities of cream must be assembled in one plant. This will mean discontinuing a number of smaller plants with each continuous churn installation. This can result in continuance of the trend toward fewer and much larger creameries in Minnesota. If these changes are carefully planned, they can result in greater creamery efficiency and better returns to dairy farmers. ■

Table 1. Summary of direct cost for operating four different butter churns

Item	Batch churn 600-gallon	Batch churn 1,300-gallon	Batch churn 2,000-gallon	Continuous churn
	dollars			
Approximate cost of new churn and accessory equipment	18,750	26,240	45,220	46,890
Annual churn and accessory equipment cost*	3,079	4,424	7,425	7,699
Approximate new cost for building space required for churn at $18 per square foot	7,200	9,000	16,200	9,000
Annual building space cost†	678	848	1,526	849
Daily cost of cleanup and setup labor‡	3.75	4.50	7.50	6.00
Variable labor cost per 100 pounds of butter, including churn operator and labor for bulk packaging butter	0.339	0.252	0.178	0.172§
Approximate electrical cost for churn and accessory equipment per 100 pounds of butter¶	0.0169	0.0096	0.0085	0.0197
Salt cost per 100 pounds of butter	0.0316	0.0316	0.0316	0.0412

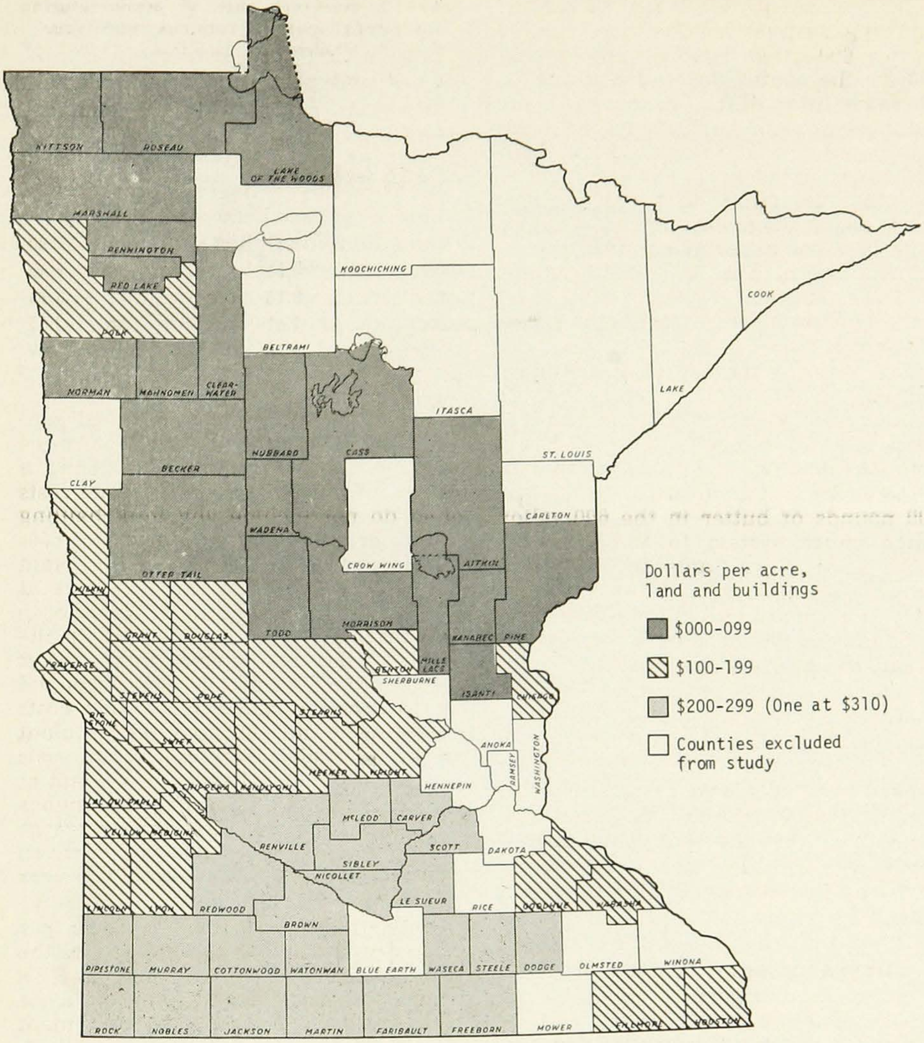
* This allows 10 percent for depreciation, 6 percent interest on mid-life value (or 3 percent of new value), 0.29 percent for insurance, 1.63 percent for taxes, and 1.5 percent for repair and maintenance.

† Similar to churn and equipment cost rates except 3 percent depreciation rather than 10 percent.

‡ All labor was calculated at $3 per hour gross wage.

§ This cost is based on two workers operating at a rate of 3,500 pounds per hour. If a higher rate is used with bulk packaging, a third man is needed, resulting in increased cost.

¶ Based on a charge of $.015 per kilowatt hour.


Dollars per acre, land and buildings
▨ $000-099
▧ $100-199
▨ $200-299 (One at $310)
☐ Counties excluded from study
KITTSON
ROSEAU
LAKE OF THE WOODS
MARSHALL
PENNINGTON
RED LAKE
KOOCHICHING
COOK
POLK
BELTRAMI
NORMAN
MAHNOMEN
CLEARWATER
LAKE
ITASCA
HUBBARD
CASS
ST. LOUIS
BECKER
CLAY
CARLTON
WADENA
CROW WING
AITKIN
OTTER TAIL
WILKIN
GRANT
DOUGLAS
TODD
MORRISON
KANABEC
PINE
TRAVERSE
BENTON
MILLE LACS
SHERBURNE
ISANTI
CHISAGO
STEVENS
POPE
STEARNS
BIG STONE
SWIFT
ANOKA
RAMSEY
WASHINGTON
MEEKER
WRIGHT
CHIPPEWA
KANDIYOHI
HENNEPIN
LAC QUI PARLE
YELLOW MEDICINE
McLEOD
CARVER
RENVILLE
SCOTT
DAKOTA
SIBLEY
NICOLLET
LE SUEUR
RICE
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WATONWAN
BLUE EARTH
WASECA
STEELE
DODGE
OLMSTED
WINONA
ROCK
NOBLES
JACKSON
MARTIN
FARIBAULT
FREEBORN
MOWER
FILLMORE
HOUSTON

Average farm real estate values in Minnesota counties, 1959

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county were divided into three dollar groups ($000-099, $100-199, and $200-299). These groups are plotted on the map. The counties fell into a pattern similar to the spokes of a wheel emanating from the Twin Cities and crossing the state with high values in the south central and southwest areas and median values in the central and northwest areas. This pattern suggests that factors other than location strongly affect farmland estate values.

This, in fact, is what was found in the analysis. The most important variable affecting county farm real estate values was the percentage of farmland in crops. The population/distance variable was next most important, and the crop index was third. The local development variable was of little value in explaining farm real estate values.

The location and land quality variables explained about 70 percent of the differences in real estate values among Minnesota counties. The remaining 30 percent undoubtedly is attributable to the value of farm buildings and to other local factors that differ from one part of the state to another.

Minnesota is a heterogeneous state with respect to types of farms, soils, climate, local development, and other factors. The southeastern counties contain several important medium- and small-sized cities. Few comparable cities exist in other areas of the state.

In the north central section of the state, near the Twin Cities, farmland is being purchased for recreational purposes and summer homes. The southwestern and Red River Valley areas are suited for commercial agriculture, but quite different crops are grown in each area. Hence, the specific characteristics in each area of the state must be considered in explaining the remaining 30 percent of the differences in farm real estate values not accounted for by the studied variables.

EFFECTS OF THE VARIABLES

The population/distance variable was strongly related to 1959 differences in Minnesota farm real estate values. For a given size of a nearby city and for the same relative quality of land for farming, each additional mile away from the city resulted in a drop in average county farm real estate values. On the other hand, for a fixed distance, the larger the nearest city the higher farm real estate values were in 1959.

For instance, imagine that there are two Minnesota counties with farmland of equal quality. One county is 100 miles away from the Twin Cities and the other is 110 miles away (as measured by the previously mentioned method). The results of this study suggest that farm real estate in the county closer to the Twin Cities would have averaged about $3.50 more per acre than in the more distant county in 1959.

Suppose that these two counties of equal farmland quality both were located 100 miles from major cities. One county is 100 miles from the Twin Cities and the other is 100 miles from Duluth-Superior. The study results indicate that in 1959, real estate values in the county 100 miles from the Twin Cities would have averaged about $29 more per acre than in the county 100 miles from Duluth-Superior.

The crop index of land quality also was related to 1959 farmland values. Imagine now that there are two Minnesota counties equally distant from the same urban center. The only difference between them, from the standpoint of this study, is that one county has an average 1959 crop value per acre of $50 (as measured by the previously mentioned method) and the other has an average crop value of $51 per acre. Based on the study results, the average farm real estate value in the second county would have been $1.60 per acre higher than in the first.

Finally, the percentage of a county's farmland in crops was strongly related to farm real estate values in 1959. Consider two counties equally distant from the same city and with exactly equal crop index values. One county had 70 percent of its farmland in crops in 1959 and the other had 71 percent. Based on the study results, land values in the second county would have averaged about $2.75 per acre higher.

Although the factors influencing farm real estate values are complex and interrelated, this study indicates that significant and simple relationships can be found. Two land quality variables and one location variable explained 70 percent of the variation in 1959 Minnesota real estate values. The remaining 30 percent could be attributed to local factors. Because these local factors differ markedly from one area of the state to another, it is difficult to account for them in an overall study. But by means of the relationships discussed in this article, real estate buyers, sellers, and appraisers can better understand farm real estate values in their respective counties. Although the examples presented in this article are only illustrative, they indicate some of the forces at work in the Minnesota land market. ■

In Review

Trends In U.S. Farmland Prices Since 1950

Philip M. Raup

Farmland prices in the United States and in Minnesota have risen almost continuously for over 30 years. This is one of the longest periods of sustained land price increases in U.S. history. Nationally, and also in Minnesota, land prices weakened slightly in 1953-54 (and again in 1960-61 in Minnesota). With these exceptions, the increases have been unbroken. But they have not been uniform.

The biggest increases since 1950 have been in the southeastern and Mississippi Delta States. On a regional basis, the smallest increases were in the Northern Plains States of Kansas, Nebraska, and the Dakotas, and in the three Great Lake States of Michigan, Wisconsin, and Minnesota. For the 48 states, excluding Alaska and Hawaii, land prices more than doubled, rising from an average of $65 per acre in 1950 to $167 per acre in 1967. Similarly, average Minnesota land prices in the same period rose from $84 to $189 per acre.

In contrast, land prices in the three Delta States of Mississippi, Arkansas, and Louisiana more than tripled, rising from $63 per acre in 1950 to $225 per acre in 1967. In the four southeastern states of South Carolina, Georgia, Florida, and Alabama, land prices quadrupled, rising from $52 to $207 per acre in the same period.

Apart from the Lake States and the Northern Plains States, the other regions with increases below the national 1950-67 average were the northeast and the Corn Belt (see accompanying table).

Percentage increases in average value of farmland and buildings by regions and for the United States, 1950-67*

Region	Percentage increase, 1950-67
Northern Plains	128
Lake States	129
Northeast	154
Corn Belt	154
Mountain	159
Appalachian	170
Southern Plains	170
Pacific	185
Delta States	257
Southeast	398
United States, 48 states	157

* Computed from *Farm Real Estate Market Developments*, USDA, ERS, CD-70, April 1968, pp. 42-43.

What accounts for the large increases in the South? For one thing, this region has lagged behind the rest of the United States in the adoption of modern agricultural technology and in the development of industry.

The increases since 1950 can be regarded primarily as a process of catching up with the rest of the country. It is also significant that these largest increases in farmland prices since 1950 have occurred in regions with large Negro populations. The heavy migration of Negroes out of the South in recent decades has forced increases in mechanization and rapid changes in agricultural practices and land use patterns. These changes apparently have resulted in increased profitability in agriculture and higher land prices.

Another part of the explanation stems from changes in land use. In the past, heavy soils were thought to be desirable and productive, while light or sandy soils were considered undesirable. The introduction of fertilizers, chemical weed and pest controls, supplemental irrigation, and large-scale equipment have brought about a revolution in concepts of what constitutes good land. Light, sandy soils sometimes are the best ones for heavy fertilization and irrigation. In addition, the techniques of drainage and land clearing have led to reductions in the real cost of bringing swampy or wet lands into agricultural use.

Many of the remaining areas of light soils and undrained or uncleared lands in the United States are in the Southern states. Modern agricultural technology has enabled the Southern states to exploit what some have called the last land frontier in our country.

One of the most remarkable nationwide aspects of recent increases in farmland prices is that they have taken place in a period in which interest rates on mortgage credit have risen dramatically. In the mid-fifties it was possible to obtain commercial farm loans at interest rates of 4 percent in most states. In May 1968 the Federal Land Bank raised its base (or contract) rate to 7 percent in all but two farm credit districts. Farm mortgage credit from most life insurance companies and similar commercial lenders also now costs 7 percent or more.

In theory, a rise in interest rates of this magnitude should be accompanied by a decline in land values. But in fact, we have experienced the most dramatic increase in interest rates in more than a century during the past 10 years, and farmland values have risen by over 50 percent during the same time. Clearly, the simple economic theory that derives land values by capitalizing net income at current interest rates is not an adequate procedure for estimating land values in today's farmland market. ■

Minnesota Farm Business Notes

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