Farmland Values Reexplored

By George Iden

The selling price of agricultural land has shown an unprecedented rise over the last 25 years, due to a number of factors. Economists and real estate men have attempted to appraise the role of (1) land purchases as a hedge against inflation, (2) higher returns per acre, (3) the need for farm enlargement, (4) urban expansion, and (5) the equity position of farmers. Examples of such appraisals include those by Regan and Clarenbach *(10)*, Scofield *(11)*, and Miller *(8)*.[1] This paper tries to answer in a meaningful way the question of what has happened to the value of agricultural land on typical commercial farms and why it has happened.
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THE FIRST PART of this paper utilizes the extensive historical data on typical commercial farms collected by the Economic Research Service of the U.S. Department of Agriculture (*13*).[2] The data for the various types of farms are generally comparable cross sectionally and over time.

The use of these data enables us to be specific with respect to the type of farmland and its location (fig. 1). Use of an average selling price for a State or region may cover up divergent price trends associated with distinctly different types of land.

The statistical analysis in the second part of this paper proposes a more quantitative technique than is often employed. Cash grain farms are used as an illustrative example. The procedure uses multiple regression to test the historical relationship between land values and the explanatory variables, expected return per acre and real per capita income of the farm population.

Land Values and Returns per Acre

The Value of Land

In a stationary state, where knowledge and the mobility of factors are perfect and economic activity is continuous in its present form, we would expect land value to be determined by the present value of its future earnings. And we would expect its equilibrium value to be such that the yield on investments in farmland would be the same as on alternative forms of investment.

For many reasons, the yield on capital invested in land differs from that on other investments. Variations in weather and in commodity prices cause erratic changes in the output of land. In addition, long-run trends in the economy cause some industries and some segments within each industry to grow in relative size and earnings. The value of land becomes a function of individuals' best estimates of the discounted future earnings from land relative to those from alternative investments.

The value of land is affected by many noneconomic factors as well. For example, in some regions prestige attaches to landownership as tangible evidence of position and wealth.

Nevertheless, it might be expected that the yield from capital invested in farmland would have some stability over long periods of time and that there would be a semblance of uniformity in the rates of return on capital invested in various types of farming enterprises. With these initial expectations the data on costs and returns for typical farms were examined.

Estimating the Return to Land

No completely satisfactory method for determining the earnings from farmland is available. The return to the owner-entrepreneur is for a composite of unpaid labor, land, and capital resources. The difficulties in allocating a return to each of the unpaid factors are well known (*6*, pp. 23–26, and *4*).

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[1] Italic numbers in parentheses refer to items in the Literature Cited, p. 49.

[2] The concept of the typical commercial farm is analogous to Marshall's concept of the representative firm (7, pp. 317–318).

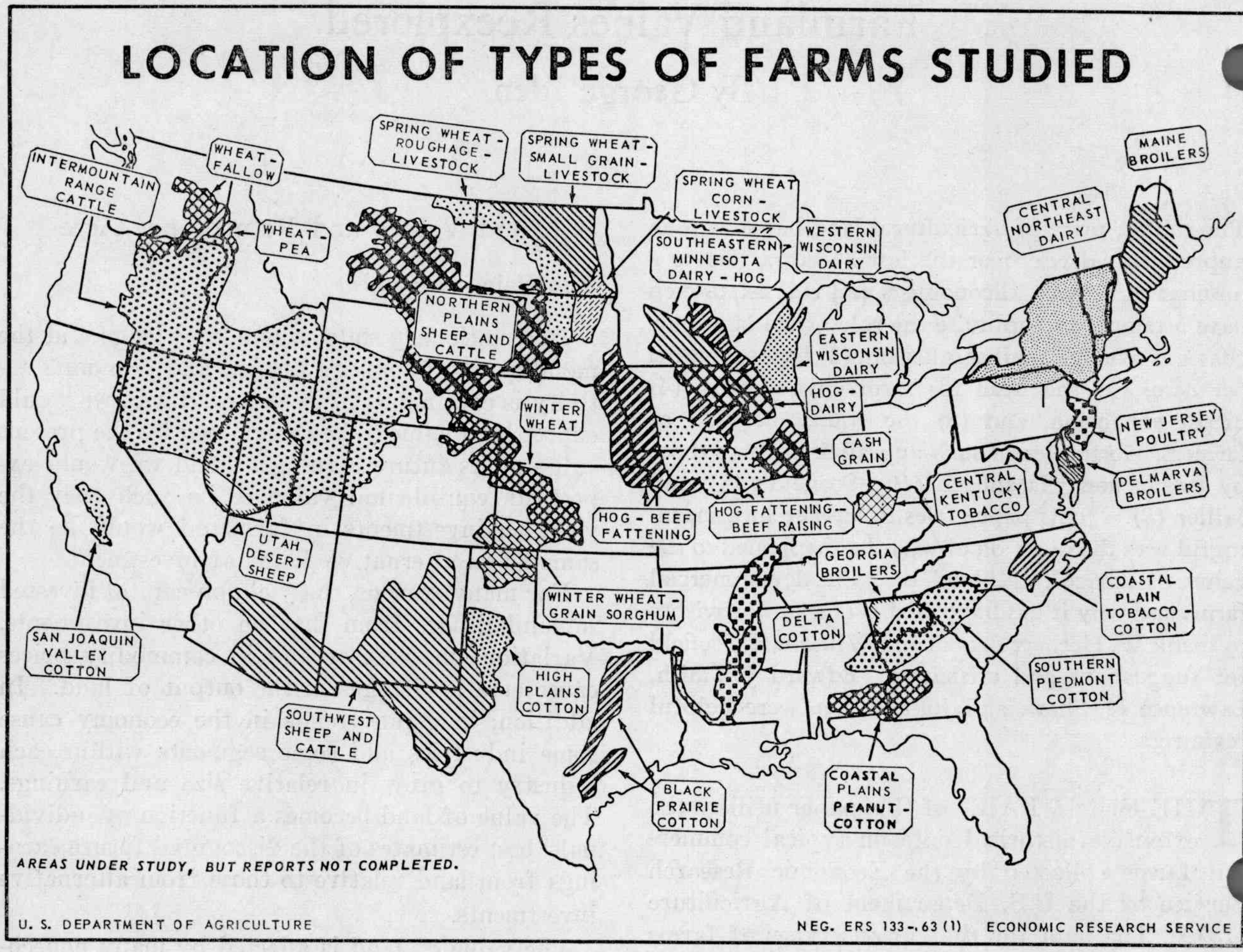

FIGURE 1

Three methods of estimating a return to land were considered. The residual method values operator and family labor at hired wage rates and non-real estate capital charges at the prevailing mortgage interest rate, with the residual imputed as a return to land. The interest rate on land was used rather than the rate charged on short-term production credit because it provided a better measure of opportunity cost.

The pro rata share method values all unpaid factors, *including* land, at hired rates. The total of these values may be more or less than net income. However, the net income is allocated to each unpaid factor in the same proportion that the imputed value of that input bears to the total imputed value of these inputs. A more detailed explanation of the pro rata share method has been presented by Hurd (*3*). Hurd uses the proportions obtained in some base period, whereas this analysis uses the proportions for each year.

The "landlord method" estimates what the land would earn if the owner rented his land on a customary rental arrangement, rather than operating it himself. The chief drawback of this method is that rental arrangements differ greatly, and data on rental practices are not very widely available.

Figure 2 compares the results obtained from each of these methods. The residual method shows returns fluctuating widely over time. Share rents show less variability, and pro rata share allocations show still less.

Because information on rental practices was available on only three types of farms, a choice had to be made between the other two methods of allocation for the analysis which follows. The residual method was selected over the pro rata

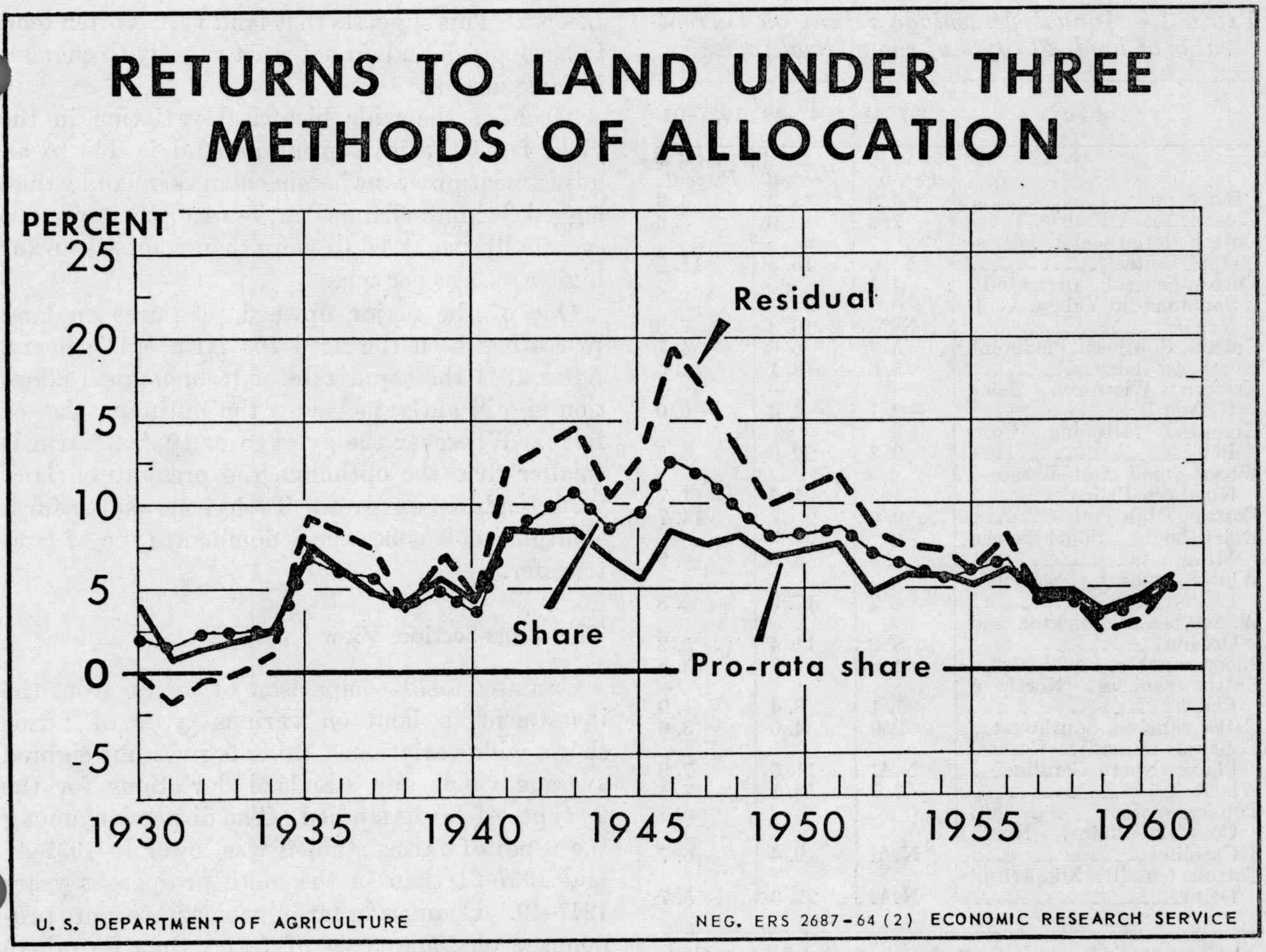

FIGURE 2

share method for two reasons. First, it corresponds more nearly to the way farmers estimate a return to land. Second, economic rent is price determined rather than price determining, and it is the difference between the supply price of a factor and its actual returns (*1*, p. 230). To the extent that nonland factors are mobile and it is possible to estimate the alternative earning capacities for nonland resources, the residual is a return to land.

The use of the residual method implies that the analysis over time for one type of farm is more valid than inference from a cross-sectional comparison of different types of farms. For example, a bias due to the use of a particular wage rate for operator and family labor is likely to be about the same over time. Thus, we may say with some assurance that the return to land for a particular type of farm was increased or decreased and that the dispersion of the return to capital invested in various types of farms was more or less in one period than in another.

The Historical View

In the 5-year period, 1937–41, most of the farms in table 1 yielded a 5 to 10 percent return on current value of the investment in land. Cash returns per acre rose during and after the Second World War and tended to reach a peak in the period 1947–49. Tables 2 and 3 show that changes in land values lagged behind changes in income so that returns of more than 20 percent on current value were realized on farms in the corn and cotton producing areas. Since the early 1950's farm income has declined; yet, values have continued to climb, driving the yield to less than 3 percent on cash grain land in the Midwest and on cotton farms in the Black Prairie of Texas.

Table 1.—*Annual percentage return on current value of land, 20 types of commercial farms* [1]

Type of farm	1937–41	1947–49	1957–61
	Percent	*Percent*	*Percent*
Cash grain	6.9	13.2	3.9
Cotton, Black Prairie, Texas	7.4	12.0	3.6
Cotton (large scale), Mississippi Delta	[2] N.A.	16.3	11.0
Cotton-general (irrigated), San Joaquin Valley, California	N.A.	16.3	7.3
Cotton, Southern Piedmont	5.7	6.6	4.7
Northeast dairy	5.3	16.1	4.6
Eastern Wisconsin dairy (Grade B)	−2.7	−4.4	−6.0
Hog–beef fattening, Corn Belt	9.3	22.6	4.5
Wheat–small-grain–livestock, Northern Plains	1.5	21.5	1.7
Cotton, High Plains	9.6	20.7	14.7
Dairy–hog, Southeastern Minnesota	.7	3.9	−.9
Winter wheat, Southern Plains	4.2	17.9	8.8
Wheat–pea, Washington and Oregon	8.0	11.4	5.2
Sheep ranches, Southwest	4.9	2.9	3.8
Cattle ranches, Northern Plains	1.1	8.4	1.9
Cattle ranches, Southwest	2.9	4.6	3.6
Tobacco (small), Coastal Plains, North Carolina	N.A.	11.6	7.6
Wheat–fallow	3.7	18.1	7.5
Tobacco–cotton (large), Coastal Plains, North Carolina	N.A.	9.4	6.7
Cotton (small), Mississippi Delta	N.A.	22.3	5.7

[1] Computations made from data supplied by the Cost, Income and Efficiency Branch of the Farm Production Economics Division, USDA.

[2] Not available.

Table 2 shows that value per acre on each of 20 types of farms increased substantially between 1947–49 and 1957–61. The largest increases in value have occurred on cotton–general farms in the San Joaquin Valley of California, on dairy–hog farms in southeastern Minnesota, and on small cotton farms in the Mississippi Delta. The smallest increases occurred on sheep and cattle ranches and on large tobacco–cotton farms of the Coastal Plains of North Carolina. Since 1947–49, cash return per acre (table 3) has risen on the cotton farms and on the sheep and cattle ranches, but it has fallen on the other types of farms studied. The decline has been severe on wheat–small-grain–livestock farms of the Northern Plains, Northeast dairy farms, and small cotton farms of the Mississippi Delta. In recent years, the yield on current value has been lowest on farms with declining income. This suggests that land values often tend to be sluggish and do not react rapidly to changes in farm income.

Much of the wide historical variation in the yield from the investment in land is due to an adjustment process wherein changes in land values lagged behind changes in return per acre, but eventually increased to more than compensate for higher returns per acre.

One of the major upward pressures on land prices has been the need for farm enlargement. After 1941 the rapid rate of technological adoption significantly increased the optimum size of farm. Wherever the average or typical farm is smaller than the optimum, the pressure on land value tends to be greater. Table 4 shows that farm enlargement has become a dominant type of land transfer.

The Cross-Section View

Cross-sectional comparison of yields from the investment in land on various types of farms shows wide variation. Table 5 gives unweighted average yields and standard deviations for the 20 types of farms studied. The dispersion among the types of farms studied was lower in 1937–41 and 1957–61 than in the more prosperous years 1947–49. Changes in farm income were more pronounced on some types of farms than on others and values did not rise enough to maintain a uniform yield on current value. Over time, however, values tended to approach an equilibrium so that comparative returns among regions and types of farms became more uniform for 1957–61.

A variety of factors are responsible for dispersion in returns. Urban areas, highways, airports, and reservoirs took an average of about 831,000 acres per year from 1945 to 1954 (*16*, p. 26). In some areas these nonfarm competing uses have taken more farmland than in other areas, and hence have a greater effect on the value of land.

Percentage returns on current value may be lower on some types of farms than on others because of a relative abundance of inputs other than land. Where there are few competing uses for operator and family labor, land becomes a limiting resource for the farm enterprise and the imputed value of land becomes correspondingly higher than in locations where labor and other nonland inputs are more mobile. This may partially ex-

TABLE 2.—*Land value per acre on 20 types of commercial farms* [1]

Type of farm	1937–41	1947–49	1957–61	Percent of 1947–49	
				1937–41	1957–61
	Dollars	*Dollars*	*Dollars*	*Percent*	*Percent*
Cash grain	120.80	219.70	376.00	55	171
Cotton, Black Prairie, Texas	51.90	86.20	146.40	60	170
Cotton (large-scale), Mississippi Delta	N.A.	84.60	162.20	N.A.	192
Cotton—general (irrigated), San Joaquin Valley, California	N.A.	336.00	768.00	N.A.	229
Cotton, Southern Piedmont	22.80	55.20	91.80	41	166
Northeast dairy	30.40	58.00	90.50	52	156
Eastern Wisconsin dairy (Grade B)	79.30	118.70	174.40	67	147
Hog-beef fattening, Corn Belt	79.20	152.70	253.00	52	166
Wheat-small-grain-livestock, Northern Plains	16.60	27.30	46.20	61	169
Cotton, High Plains	37.06	78.01	116.20	48	149
Dairy-hog, Southeastern Minnesota	63.44	98.67	193.80	64	196
Winter wheat, Southern Plains	28.00	64.00	95.00	44	148
Wheat-pea, Washington and Oregon	66.04	174.70	267.62	38	153
Sheep ranches, Southwest	5.77	9.97	12.31	58	124
Cattle ranches, Northern Plains	3.54	8.77	11.07	40	126
Cattle ranches, Southwest	4.20	8.56	10.56	49	123
Tobacco (small), Coastal Plains, North Carolina	N.A.	135.00	200.00	N.A.	148
Wheat-fallow	19.51	43.56	82.92	45	190
Tobacco-cotton (large), Coastal Plains, North Carolina	N.A.	139.66	183.80	N.A.	132
Cotton (small), Mississippi Delta	N.A.	84.03	163.80	N.A.	195

[1] Computations made from data supplied by the Cost, Income and Efficiency Branch of the Farm Production Economics Division, USDA.

TABLE 3.—*Cash returns per acre on 20 types of commercial farms* [1]

Type of farm	1937–41	1947–49	1957–61	Percentage of 1947–49	
				1937–41	1957–61
	Dollars	*Dollars*	*Dollars*	*Percent*	*Percent*
Cash grain	8.33	28.92	14.65	29.0	51.0
Cotton, Black Prairie, Texas	3.85	10.34	5.27	37.2	51.0
Cotton (large-scale), Mississippi Delta	N.A.	13.75	17.79	N.A.	129.4
Cotton—general (irrigated), San Joaquin Valley, California	N.A.	54.92	55.85	N.A.	102.0
Cotton, Southern Piedmont	1.30	3.65	4.32	36.0	118.4
Northeast dairy	1.62	9.35	4.17	17.3	44.6
Eastern Wisconsin dairy (Grade B)	−2.15	−5.18	−10.45	(*)	(*)
Hog—beef fattening, Corn Belt	7.40	34.54	11.34	21.4	32.8
Wheat—small-grain—livestock, Northern Plains	.25	5.88	.79	4.3	13.4
Cotton, High Plains	3.57	16.15	16.97	22.1	105.1
Dairy—hog, Southeastern Minnesota	.41	3.81	−.37	10.8	(*)
Winter wheat, Southern Plains	1.17	11.48	8.32	10.2	72.5
Wheat—pea, Washington and Oregon	5.31	20.01	13.89	26.5	69.4
Sheep ranches, Southwest	.28	.29	.47	97.0	162.1
Cattle ranches, Northern Plains	.04	.74	.21	5.4	28.4
Cattle ranches, Southwest	.12	.39	.38	30.8	97.4
Tobacco (small), Coastal Plains, North Carolina	N.A.	15.60	15.10	N.A.	96.8
Wheat—fallow	.73	7.90	6.19	9.2	78.4
Tobacco—cotton (large), Coastal Plains, North Carolina	N.A.	13.13	12.24	N.A.	93.2
Cotton (small), Mississippi Delta	N.A.	18.72	9.34	N.A.	49.9

[1] Computations made from data supplied by the Cost, Income and Efficiency Branch of the Farm Production Economics Division, USDA.

*The indicated comparison does not apply as it is not meaningful to speak of a reduction in loss in the same manner as an increase in return starting from a positive return.

TABLE 4.—*Percentage of farmland purchases for farm enlargement, United States*

Year	Percent
1950–54	26
1958–59	42
1959–60	45

Source: Farm Real Estate Market (*15*, p. 3).

TABLE 5.—*Mean rate of return on investment and standard deviation for 20 types of farms*

Years	Mean	Standard deviation
	Percent	*Percent*
1937–41	4. 6	3. 4
1947–49	12. 6	7. 2
1957–61	4. 9	4. 1

plain why percentage returns from land are low on Wisconsin dairy farms, and why returns on Southern Piedmont cotton farms are lower than those on cotton farms in the San Joaquin Valley (table 1).

On the other hand, where there are many alternative opportunities and the shift from agricultural to nonagricultural employment is proceeding at a rapid rate, there is a different kind of upward pressure on land values. Capital from off-farm employment is often funneled into farm capital, and higher land prices result. Farms are also valued as rural residences by both farm and nonfarm people. The high cost of housing in towns and cities influences the price of small farms with rural residences and in turn the value of larger farms.

The highest percentages of land transfers for the purpose of farm enlargement have occurred in the Corn Belt and wheat areas, where the trend toward mechanization has been most pronounced in recent years (table 6). The lowest percentages have occurred in the dairy and general farming regions where large-scale mechanization has not been as much in evidence. Pressure on land values due to farm enlargement is likely to be greater and, ceteris paribus, the yield from investment in land would tend to be lower in the corn and wheat areas than in the dairy and general farming areas.

Statistical Test of the Hypothesis

We have assumed that farmland value is determined by individuals' best estimates of the future returns per acre from farming accruing to a landowner, and by the level of per capita personal income, especially of those persons interested in becoming landowners. Since there is no objective measure of what people expect returns from land to be in the future, this analysis takes as an indication a 3-year moving average of returns per acre with income in recent years weighted more heavily.

Farmland may be purchased in hopes of gains in equity. However, expected capital gains cannot keep the price high forever. In a period when the expectation of capital gains has had a pronounced effect on the price of land we may say that a change in structure has occurred between returns per acre and land values.

TABLE 6.—*Percentage of total farmland sales for farm enlargement, selected type-of-farming areas and United States, average 1950–54 and annual 1956–60*

Type of farming area	Average 1950–54	1956	1957	1958	1959	1960
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Northeast dairy	14	14	18	24	22	21
Lake State dairy	16	21	26	22	28	31
General farming	19	20	23	25	26	29
Eastern Corn Belt	29	41	45	46	50	55
Western Corn Belt	28	38	43	46	47	52
Wheat areas	48	57	64	65	66	59
Western cotton	30	34	43	49	59	46
Western range livestock	31	38	39	48	48	49
United States	26	33	38	40	42	45

Source: Farm Real Estate Market (*15*, p. 13).

Farmers' ability to pay may be expected to affect land prices for several reasons. First, a farmer's earnings and equity position are important factors determining his willingness and ability to obtain a loan and buy a farm.

Second, each generation is faced with the necessity of buying or renting a farm, or changing occupations. There are well-known difficulties in renting land. Nearby land may be unavailable. The interests of landlord and tenant may conflict. Uncertainty as to the duration of the tenure arrangement is another disadvantage in renting land. Under these circumstances, landownership becomes an important goal in itself, and a significant part of per capita farm income is likely to be used in achieving this goal.

Third, farm families with investment funds may lack sufficient knowledge of the market to seek higher returns in other industries. L. F. Miller (*9*) found strong preferences among Pennsylvania farmers for holdings in farm and nonfarm real estate and Government bonds. In the assets outside the farm business there was little diversification. Because of the strong preference for land over other forms of investments, investable funds (ability to pay) may be expected to have more impact on land prices than on, say, stock and bond prices.

Per capita farm income from all sources is used as the measure of farmers' ability to pay. No such measure is available for farmers in Illinois or the Corn Belt, so we were forced to use the national average in the hope that it would reflect trends in ability to pay of farmers located in the geographic area. Unfortunately, the national average includes many farmers who could not be considered as part of the market for Illinois farmland. In addition, it does not reflect changes in ability to pay of many nonfarmers in the local area who *are* a part of the market for Illinois farmland.

The Data

Data on cash-grain farms in Illinois were selected for a statistical test of the hypothesis (table 7). In estimating returns attributable to land and buildings the landlord method was used instead of the residual method. The normal renting arrangement for Illinois cash-grain farms is for

TABLE 7.—*Land values and returns to land, Illinois cash grain farms, and income of potential buyers, 1934–50*

Year	Value per acre	Weighted moving average of returns per acre	Per capita personal income of U.S. farm population[1]
	Dollars	*Dollars*	*Dollars*
1934	97	2.38	136
1935	99	4.53	194
1936	106	5.85	183
1937	114	6.50	224
1938	120	5.53	190
1939	118	5.52	200
1940	125	4.85	207
1941	127	7.55	257
1942	141	10.75	325
1943	146	14.02	376
1944	169	17.67	380
1945	176	15.83	385
1946	181	19.45	391
1947	206	22.38	343
1948	222	22.33	384
1949	231	20.16	324
1950	236	19.27	356
1951	278	21.48	389
1952	299	21.66	378
1953	310	20.83	375
1954	304	18.40	370
1955	309	17.94	356
1956	324	19.74	362
1957	352	17.69	378
1958	370	16.72	417
1959	394	14.24	397
1960	394	15.08	433
1961	370	16.57	472

[1] Deflated for changes in the prices of commodities bought for use in family maintenance. See the farm consumers' price index found in *Agricultural Statistics* (*12*).

the landlord to take half of the crops, pay upkeep on the land and buildings, and share equally in seed, fertilizer, and pesticide expenses. In computing the moving average of the landlord's net returns per acre a weight of 3 was given to year t, 2 to year $t-1$, and 1 to year $t-2$. The other independent variable, per capita personal income from all sources, was deflated by a price index composed of items purchased by farm families for family living (*14*, p. 43).

There was no reason to deflate either the historical value or the returns-per-acre figures, as this would remove part of the relationship to be tested, i.e., the response of land values to trends in commodity prices and crop yields. Deflating the per capita income series gave a measure of ability to pay in real terms.

Fitting a Multiple Regression Equation

From 1934 to 1950 all three variables showed strong upward trends; but after 1950 land values continued to climb while returns per acre declined. Per capita income declined in the middle 1950's, to rise again in the latter 1950's and early 1960's.

Several explanations can be offered for the structural change occurring after the break in farm prices in 1951–52. Most important were technological advances which increased the optimum size of farm and created pressures for farm enlargement. Second, many persons probably believed that the Government would continue to support agricultural prices. Third, many believed that urbanization and population growth made agricultural land an excellent long-term holding and hedge against inflation.

Because of the evident structural change occurring after the decline in farm prices, the 17-year period 1934–50 was selected for analysis.

The following linear form was postulated:

$$Y_t = A + B_1X_{1t} + B_2X_{2t} + U_t$$

where Y_t=value per acre

X_t=moving average of cash returns per acre attributed to land

X_{2t}=per capita income (from all sources) for the U.S. farm population

U_t=unexplained influence (assumed to be random).

The data gave the following equation:

$$Y_t = 36.9 + 0.50X_{1t} + 0.39X_{2t}$$

This regression equation had a coefficient of determination of 0.66. However, there was an indication of strong autocorrelation among the residuals.[3] Thus, the estimate might still be unbiased and consistent, but it would not be the most efficient or the most likely estimate. The R^2 and tests of significance would be meaningless (*5*, p. 179).

[3] One of the necessary assumptions for the ordinary least squares estimating procedure is that the residual of one period is independent of the residual in any previous period. The absence of this convenient characteristic is called autocorrelation.

The autoregressive scheme was estimated, and the data were transformed using the following relationship:

$$Y'_t = Y_t - 0.75Y_{t-1}$$

$$X'_{1t} = X_{1t} - 0.75X_{1t-1}$$

$$X'_{2t} = X_{2t} - 0.75X_{2t-1}$$

We then reapplied ordinary least squares and arrived at the equation:

$$Y'_t = 34.19 + \underset{(1.68)}{4.80X'_{1t}} - \underset{(.101)}{0.08X'_{2t}}$$

The Durbin-Watson statistic (*2*), a test for autocorrelation in the disturbances, was significantly improved but was still in the indefinite range. The R^2 was 0.42, which indicated that variations in X_{1t} and X_{2t} about their means "explained" 42 percent of the squared variation of Y'_t about its mean.

Statistical Significance of the Results

The variable X'_{1t} was significantly different from zero at the 95 percent confidence level, indicating that there was a linear relationship between changes in return per acre and value per acre.

Analysis of the X'_{2t} variable gave surprising results. Its influence on Y'_t was insignificant. In the regression equation we expected the sign of this coefficient to be positive instead of negative. The negative value implied that, ceteris paribus, an increase in per capita income is associated with a decline in land value. This suggestion may result from an inability to effectively measure the purchasing ability of the farm people who are potential buyers of land in the area. In addition, the result is partially due to multicollinearity among the explanatory variables.[4] We chose the independent variable with the higher simple correlation coefficient and obtained the equation:

$$Y'_t = \underset{(5.91)}{29.90} + \underset{(1.37)}{4.15X'_{1t}}$$

[4] Multicollinearity is the problem which arises when two or more explanatory variables are highly correlated relative to their respective simple correlations with the dependent variable. When this is the case it is impossible to disentangle the separate influence of the independent variables.

This regression equation has an R^2 of 0.40. These results imply that a change of one dollar in the moving average of return per acre is associated with a change of \$4.15 in land values. This response of land values to a change in returns per acre is highly significant but the magnitude is not as great as anticipated.

A Summing Up

The time series analysis reveals wide variations in yields on investments in farmland. Returns to land rose rapidly in the 1940's, but land values showed little response. More recently, land values have caught up with returns, and yields have declined to former levels.

Similarly, in cross section there was a wide dispersion of yields from the investment in land among types of farms. Though some of this dispersion was due to the method of computing returns per acre, not all of the variation can be explained in this way. In some areas nonland production factors are less mobile than in other areas, causing the value of land to be bid up, and the opportunity cost of nonland resources to be lower. The trend toward increasing size is more in evidence for some types of farms than for others. Next, there are demographic and institutional factors that affect whole regions. Lastly, neither capital nor farm operators appear to be highly mobile in seeking out the types of farming and areas where returns are highest.

The attempt at a quantitative analysis of factors determining land values was only partially successful, but served to point out a lack of association between land values and real per capita personal income of the farm population. However, the association between land values and returns per acre was statistically significant. Relationships were tested on only one type of farm (cash-grain), and over a limited period of time, 1934 to 1950. One criticism of the approach might be that the time period was picked. An answer to this objection is that the same explanatory variables are not applicable in all periods, and it is the job of the researcher to choose the most relevant variables for particular time periods.

It would be helpful if studies of agricultural land values could utilize data with a wider coverage, and go beyond a listing of factors responsible for changes in land value to an attempt to quantify these influences. Finally, the implications of the trend toward larger farms need to be examined. Perhaps data on costs and returns for typical farms might be utilized to compute a synthetic variable, "economic advantage to be gained from farm enlargement."

Literature Cited

(*1*) Boulding, Kenneth E.
1955. economic analysis. Ed. 3, 905 pp., illus, Harper, New York.

(*2*) Durbin, J., and G. S. Watson
1950 and 1951. testing for serial least squares regression. Part I, Biometrika 37: 409; part II, Biometrika 38: 159, illus.

(*3*) Hurd, Edgar B.
1957. allocation of net farm income. Agr. Econ. Res. 9: 10–19, illus.

(*4*) Johnson, D. Gale.
1948. allocation of agricultural income. Jour. Farm Econ. 30(4): 724–729.

(*5*) Johnston, J.
1960. econometric methods. 300 pp., illus. McGraw-Hill, New York.

(*6*) Kuznets, Simon.
1959. distribution of national income by factor shares. Paper IV in a series on Quantitative Aspects of the Economic Growth of Nations. Jour. Econ. Devel. and Cult. Change 7(3-II): 1–100. Univ. Chicago.

(*7*) Marshall, Alfred.
1948. principles of economics. 8th ed., 871 pp., illus. MacMillan, New York.

(*8*) Miller, Frank.
1959. some factors affecting the market value of farm land. Dept. Agr. Econ., Inst. Agr., Univ. Minn., Rpt. 516.

(*9*) Miller, L. F.
1949. farmers' assets outside their business. Jour. Farm Econ. 31(1): 143–153.

(*10*) Regan, M. M. and F. A. Clarenbach.
1943. land market developments and the war. Jour. Farm Econ. 25(1): 190–202, illus.

724–200—64——2

(*11*) Scofield, W. H.
1960. returns to productive capital in agriculture. Farm Real Estate Market. U.S. Dept. Agr., Econ. Res. Serv. CD–54 (Feb.), pp. 20–26.

(*12*) U.S. Department of Agriculture.
1962. agricultural statistics. U.S. Govt. Prtg. Off., 741 pp.

(*13*) U.S. Department of Agriculture.
1961. costs and returns on commercial farms, long-term study, 1930–57. U.S. Dept. Agr., Statis. Bul. 297, 253 pp., illus.

(*14*) U.S. Department of Agriculture.
1962. farm income situation. Econ. Res. Serv., FIS–187, 63 pp., illus.

(*15*) U.S. Department of Agriculture.
1960. farm real estate market. Agr. Res. Serv., CD–56 (Oct.), 30 pp., illus.

(*16*) Wooten, Hugh H., and James R. Anderson.
1957. major uses of land in the united states. U.S. Dept. Agr., Agr. Inf. Bul. 168, 102 pp., illus.