APPLICATION OF CROP ENTERPRISE RETURNS TO PREDICT FARMLAND PRICES IN THE CORN BELT

By

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Abstract

Unexpected developments in the 1970s and 1980s disrupted a balance between returns to land from major crops (corn and soybeans) and land ownership costs in the Corn Belt. Both enterprise budgets and a time series analysis indicate a convergence to balance in the near future.

Application of Crop Enterprise Returns to Predict Farmland Prices in the Corn Belt

The task of predicting farmland prices has been formidable in the past 15 years because of volatile and unexpected developments in crop prices and interest rates. Expectations by farmers and other participants in the land market concerning the future income stream from land investments and also concerning future developments in land prices play a predominant role in establishing current land prices. Expectations are difficult to measure, compounding the problem of explaining and predicting land prices.

For many years, land prices increased monotonically and interest rates were relatively stable. In the Corn Belt (Ohio, Indiana, Illinois, Iowa, Missouri and Minnesota), the average value of farmland and buildings increased from $100 per acre in 1946 to about $400 in the early 1970s with only three years in which the value declined from the year before--1954, 1961 and 1971. This is based on data from the Economic Research Service, U.S. Department of Agriculture. Interest rates on farm mortgages, as indicated by rates charged new borrowers by the Federal Land Banks, increased gradually from 4 percent in 1946 to 6 percent in 1967; then ranged between 7 and 9 percent through the 1970s.

Interest rates moved up to a peak over 12 percent in 1982 before dropping back gradually to below 11 percent in 1986. The value of farmland in the Corn Belt reached a peak of $1720 per acre in 1981, then dropped sharply to $878 in early 1986 and to $784 in early 1987. This represents more than a 50 percent retrenchment in just six years.

Obviously, the disruptions caused by the rapid rise and equally rapid fall in land values have been severe and particularly troublesome for many farmers who leveraged themselves in buying land in the late 1970s. Many rural banks and the Farm Credit System have incurred substantial losses. The entire agribusiness sector has been affected by the farmers' loss of equity just as they benefited from the capital gains of the 1970s. This has been particularly true of the farm machinery and other capital goods industries.

As farm incomes rose in the 1970s, producers had both the inclination and the funds to purchase land. The experience of the 1950s and 1960s demonstrated that farmland was a good hedge against inflation. Farmers wanting to expand could afford to pay a premium for land which would allow them to reap gains from economies of scale. Optimism was further buoyed by the rapidly expanding export market and the general expectation that this market would expand indefinitely. Rising land prices fed the prevailing optimism and thus had a snowballing effect.

The major reversal which developed in the land market in the 1980s appears to be the result of: (1) the unrealistic expectations of the 1970s; (2) the severe worldwide recession which forced a cutback in animal protein consumption in many nations; (3) a strong dollar; (4) large debt servicing obligations in developing countries; and (5) unexpectedly high interest rates. Other reasons could be cited.

While the factors affecting land values are complex and difficult to predict, more careful attention to long-term relationships between returns to land from major crops and costs of owning land might have mitigated the excesses of the 1970s. In unpublished research by this author, the conclusion was reached that net returns per acre over non-land costs on representative Corn Belt farms about equaled the cost of owning land--in the long-run. This was a bit surprising in that the presumption was that net returns to land would be below costs reflecting expected real capital gains from land ownership. That is, buyers would bid up prices to levels greater than warranted by current income flow because they anticipated capital gains above general inflation rates. Favorable treatment of capital gains for federal income tax purposes has been an additional incentive.

The close relationship between returns to land and land ownership costs held over the post World War II period prior to the early 1970s. The developments of the 1970s injected a shock into the system and only recently have land prices approached levels

justified by current income flow. To illustrate these developments, a more detailed analysis was made for the period from 1960 to 1986.

Net Returns Over Non-Land Costs Versus Land Costs

Since 1974, the Economic Research Service of the U.S. Department of Agriculture has annually estimated and published costs of production data on major crops for regions and the U.S. as a whole. Non-land costs were obtained from that series on corn and soybeans which are the predominant crops produced in the Corn Belt. Data for 1960 to 1973 were derived from selected enterprise cost studies from the U.S. Department of Agriculture and Land Grant Universities. While actual costs of production vary substantially from farm to farm, these average cost series appear to be representative when checked against independent budget studies.

Returns per acre over non-land costs were calculated by multiplying yields times prices received by farmers and subtracting the estimates of non-land costs. Land costs were calculated on a current basis; that is, farmland prices were multiplied by mortgage interest rates. While the current basis does not reflect the acquisition costs for average farmers, it does reflect the selling opportunity for existing owners and acquisition costs for new buyers.

The net returns versus costs on corn are plotted in Figure 1. Because of the importance of the Feed Grain Programs in this period, returns were calculated for both participants and non-participants. Note the stability and relatively close alignment between returns and costs through the early 1970s and the departures from this balance since. The spike in returns in the 1972-1976 period triggered a rise in land prices that continued long after returns dropped back to a more sustainable level. Rising interest rates also contributed to increasing land costs which peaked near to $200 per acre in 1981-82, a time when returns to land were around $50-70 per acre.

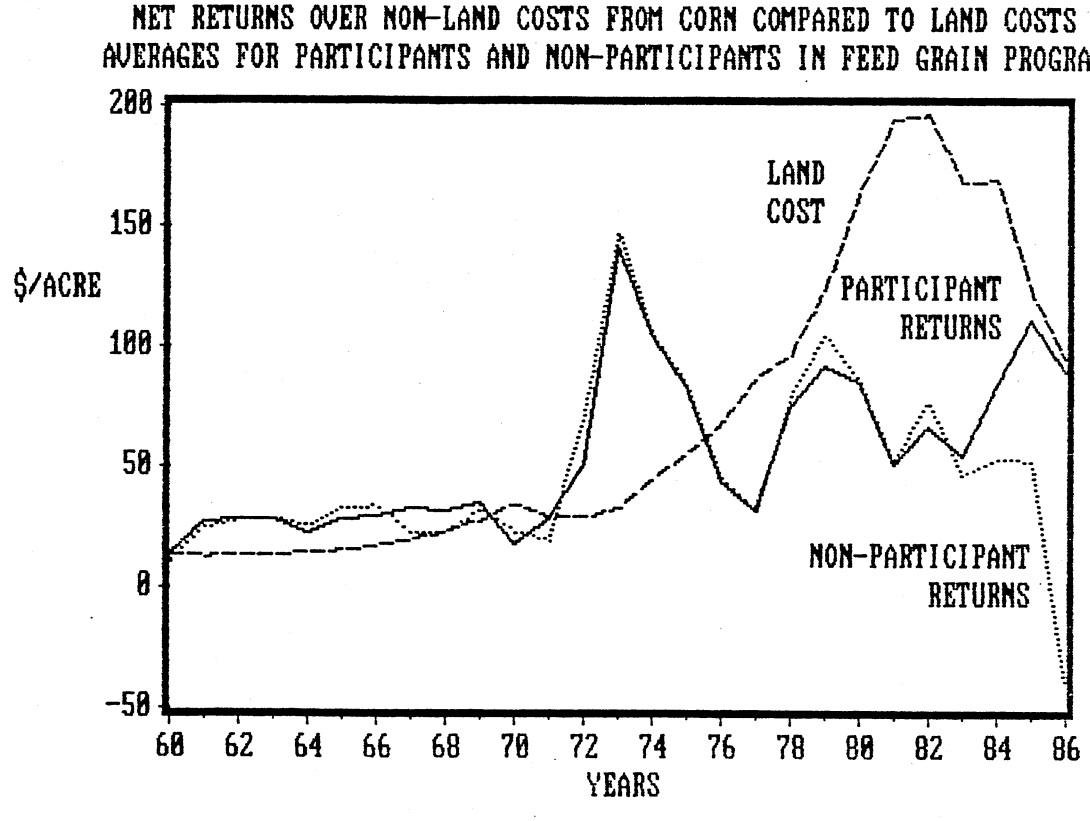

NET RETURNS OVER NON-LAND COSTS FROM CORN COMPARED TO LAND COSTS
AVERAGES FOR PARTICIPANTS AND NON-PARTICIPANTS IN FEED GRAIN PROGRAM
$/ACRE
200
150
100
50
0
-50
60
62
64
66
68
70
72
74
76
78
80
82
84
86
YEARS
LAND COST
PARTICIPANT RETURNS
NON-PARTICIPANT RETURNS

Figure 1

Just as there was a lag in response to higher returns, a lag is noted in response to declining returns. By the 1986 crop year, land costs had declined to a point near to earnings of participants in the Feed Grain Program. Declines in land prices and interest rates estimated for 1987 could result in these two lines intersecting. However, sharply lower market prices on corn have generated losses for non-participants, a fact that may continue to depress land prices. Even so, since over 80 percent of the corn base is in the program in 1986-87 and likely to remain there for the balance of the decade, land prices appear to be close to an equilibrium once again on corn.

A similar pattern is noted on soybeans as illustrated in Figure 2. Because soybean growers participating in the farm program are eligible for non-recourse loans, but not direct payments, net returns over non-land costs have trailed off and are not yet in balance with land costs.

To view the relationship between net returns of both corn and soybean growers and land costs, a weighted average was computed. This average combines corn program participants, corn program non-participants and soybean producers, with weights based on acreage. This is plotted in Figure 3. Since 1980, net returns over non-land costs from these crops have averaged about $65 per acre. Land costs would have to fall another 15 percent from the estimate for early 1987 to be in line with the $65 average returns. This could develop because of lower land prices, lower interest rates, or both.

Time Series Analysis and Projections

From the foregoing analysis, the presumption is that land prices are eventually determined by returns from major crops and interest rates. To establish more precisely what effect net returns (combined corn and soybeans) and interest rates might have on land prices, a least squares analysis was conducted for the period 1965 to 1987.

Several lag structures were explored. The equations which provided the strongest statistical properties consistent with expected signs were as follows:

NET RETURNS OVER NON-LAND COSTS FROM SOYBEANS COMPARED TO LAND COSTS

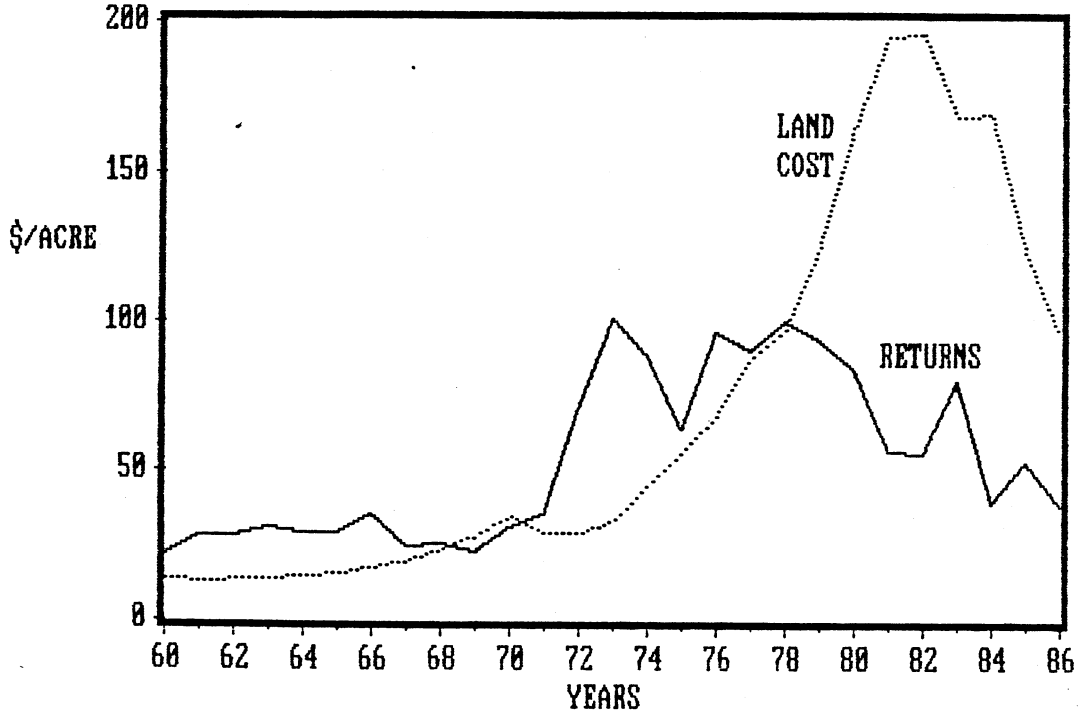


Figure 2

WEIGHTED AVERAGE NET RETURNS OVER NON-LAND COSTS
FROM CORN AND SOYBEANS COMPARED TO LAND COSTS

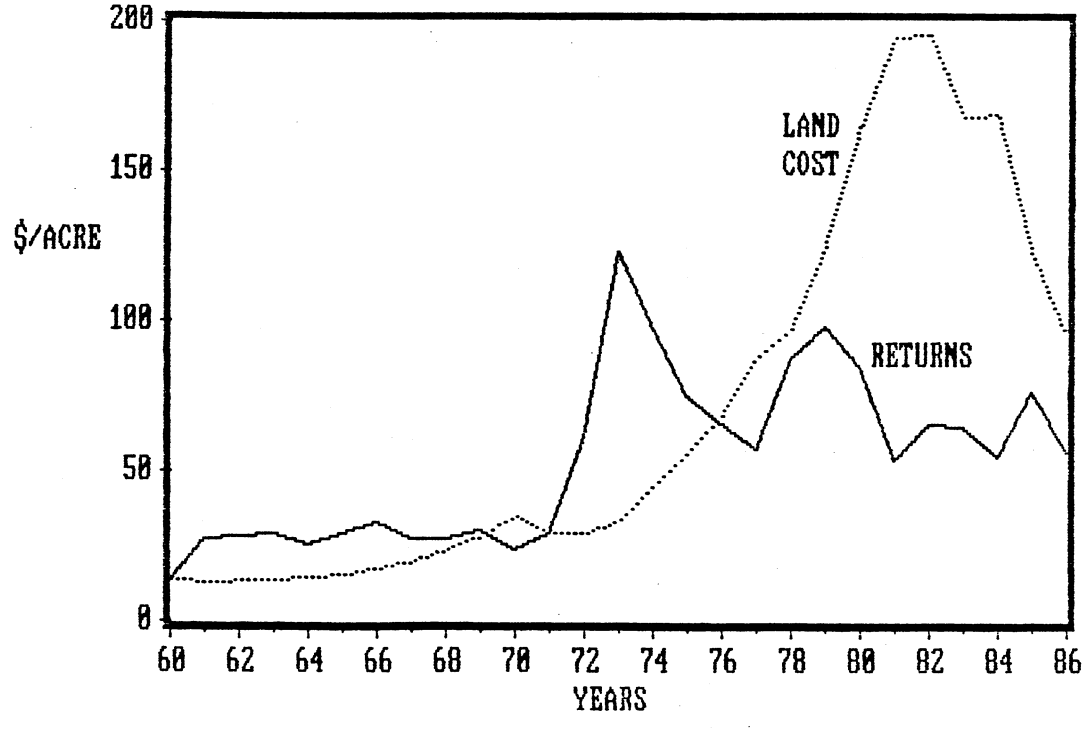


Figure 3

$$PLCBD = 39.42 + .782\ PLCBD\ (-1) - 9.52\ IRLBD$$
$$(24.71) \qquad (-8.85)$$

$$+ .579\ NNLCSD\ (-3) + 1.600\ NNLCSD\ (-4)$$
$$(2.03) \qquad (5.18)$$

$R^2 = .987$ S.D. = 4.1% of mean
d.w. = 2.98 Turning point errors = 3/22

Values in parentheses below the coefficients are in "t-values." The (-1), (-3) and (-4) at the end of the independent variables denote years lagged from the current year.

where:

PLCBD = Price of land in the Corn Belt deflated by the Consumer Price Index (1967 = 1.00). Land price is simple average of Ohio, Indiana, Illinois, Iowa, Missouri and Minnesota in $/acre.

IRLBD = Interest rate charged new borrowers by the Federal Land Bank (Farm Credit System) less the rate of inflation as measured by the Consumer Price Index.

NNLCSD = Weighted average (based on acreages) of net returns over non-land costs for corn producers participating in the Feed Grain Program, those not participating and soybean growers; deflated by the Consumer Price Index; $/acre.

Note the relatively long lag structure of four years measured specifically in this equation (the geometric lag structure implies some effects reaching back even beyond four years). This is not surprising considering that the decision to purchase land requires assumptions about the long-term income stream, land prices, general inflation and interest rates. These expectations are not quickly generated.

The statistical properties of the equation were satisfactory. All the coefficients on the independent variables had correct signs and were significant at the 5 percent confidence level. One weakness was three turning point errors which occurred in the 1969-72 period. The Durbin-Watson statistic (d.w.) indicates no autocorrelation problem with the residuals. The R^2 was .987 with the standard error of the regression at 4.1 percent of the mean.

The fitted values from the equation and actual values are plotted in Figure 4. As can be seen, the fit is reasonably close. One caution in terms of interpreting the relationship and the lag structure is that the period examined includes only one major and one minor cycle in land prices. This limits the confidence one can place on the estimated parameters. Nevertheless, the equation can provide a framework for predicting land prices.

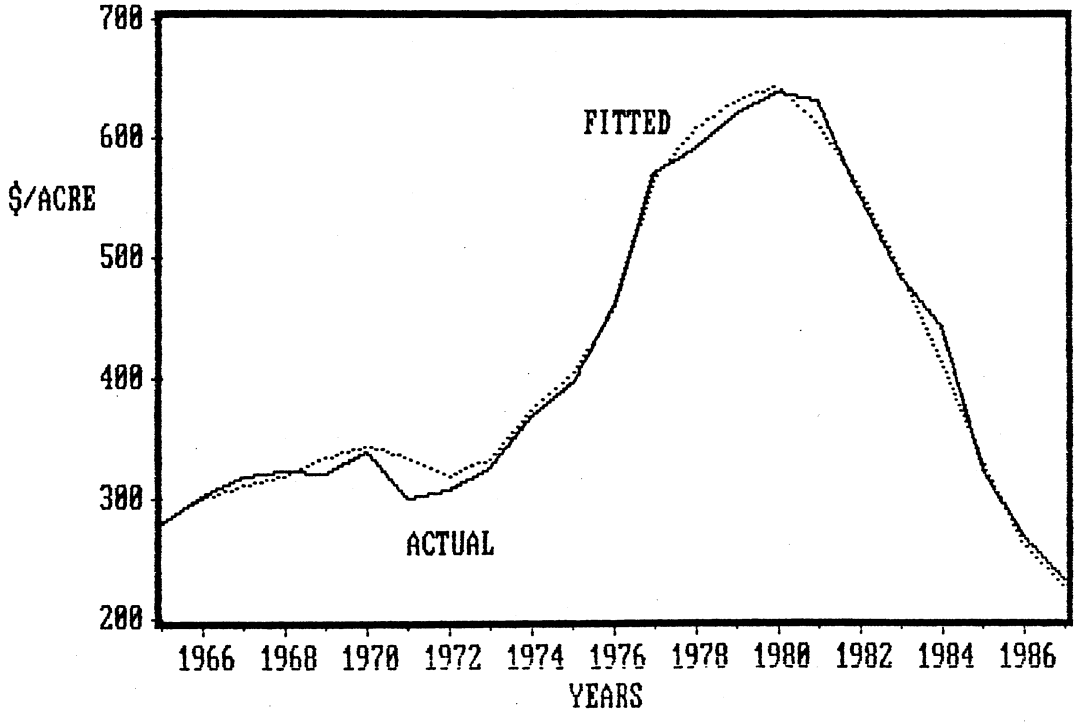
The equation was incorporated in a model of U.S. agriculture with international linkages. With the assumption that the Food Security Act of 1985 continues essentially intact through 1990, returns to participants in the Feed Grain Program should be relatively stable in this period. Modest gains, albeit at relatively low levels, are expected for corn producers not in the program and soybean producers. Interest rates are assumed to decline from 10-11 percent in 1986 to 8-9 percent for 1989-95, equivalent in real terms from 8.8 percent in 1986 to 5 percent in 1989-95.

After 1990, the new farm legislation is assumed to be similar to the Food Security Act of 1985. However, the role of farm programs and direct payments would diminish and would be basically phased out by 1995 as export markets grow more rapidly.

The results from the model as related to land prices are shown in Figure 5. This chart displays land prices from 1955 to 1987 with projections to 1995. Note that land prices continue to move lower reaching a low near $735 per acre in 1990. After that, prices begin to move moderately upward. The leveling off in land prices predicted for the balance of the decade is consistent with Figures 1-3 which show rapidly converging patterns between net returns over non-land costs and land costs.

However, if real interest rates do not decline to 5 percent and remain as high as 7.0 percent, land prices would decline much more than indicated. Under the assumption of continuing high real interest rates, land prices in the Corn Belt would decline to a low near $600 around 1991.

REAL PRICE OF FARM LAND IN THE CORNBELT*
ACTUAL AND FITTED



*DEFLATED BY THE CONSUMER PRICE INDEX (1967=100%)

Figure 4

PRICE OF FARM LAND IN THE CORNBELT
1955 TO 1987 AND PROJECTED TO 1995

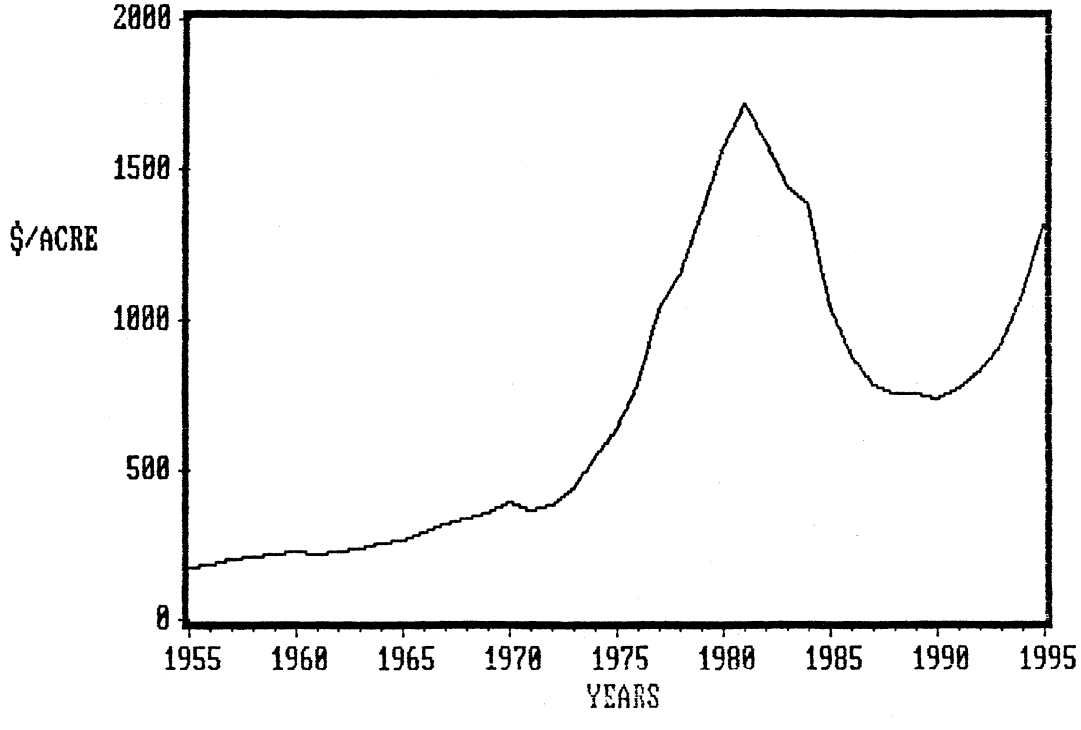


Figure 5

Another major unknown is whether the developments of the 1980s, which demonstrated that farmland prices can fall and fall sharply, may have shaken the confidence of buyers and sellers in the land market. If so, the eventual rise in farmland prices may be somewhat slower than indicated in Figure 5.

References

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